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Project Manual

for

Landmark on Cypress
Historic Rehabilitation Development
Abilene, Texas

October 24, 2025

Project No. 24-3483

LANDMARK ON CYPRESS
HISTORIC REHABILITATION DEVELOPMENT
ABILENE, TEXAS

Project No. 24-3483

DATE OF DRAWINGS AND SPECIFICATIONS	October 24, 2025
OWNER	OPG ROOSEVELT LOFTS PARTNERS, LLC Pat Beatty, Senior Partner Matt Gillam, Managing Partner 254 N. Santa Fe Ave, Suite A, Salina, KS 67401 913 396 6310
ARCHITECT	JONES GILLAM RENZ ARCHITECTS INC Jeffrey Gillam, Project Architect Maggie Gillam, Project Manager 730 N. 9th, Salina KS 67401 785 827 0386
STRUCTURAL ENGINEER	ENGINEERING CONSULTANTS P.A. Brent Engelland, P.E. 1227 N. Main St., Hutchinson, KS 67501 620-665-6394
MECHANICAL/ELECTRICAL	LST CONSULTING ENGINEERS, P.A. John F. Lewis-Smith, P.E. 4809 Vue Du Lac Place, Ste 201, Manhattan KS 66503 785 587 8042 Fax 785 587 8039
CIVIL ENGINEER	EHT (Enprotec Hibbs & Todd) BJ Prichard, P.E. 402 Cedar Street, Abilene Texas 79601 325 698 5560

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General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

Landmark on Cypress
Abilene, TX
JGR Project #24-3483

THE OWNER:
(Name, legal status and address)

OPG Cypress Partners, LLC
Matt Gillam, Managing Partner
250 N. Santa Fe Ave, Suite A, Salina, KS 67401
913-396-6310

THE ARCHITECT:
(Name, legal status and address)

Jones Gillam Renz Architects, Inc.
Maggie Gillam, Principal
730 N. Ninth St, Salina, KS
785-827-0386

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

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G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

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§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

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§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

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§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

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§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 *Superintendent*

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and

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delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely

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upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

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§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

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§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

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ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- **.1** assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

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§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

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.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

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§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

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§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

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.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a Separate Contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

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§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

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§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

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.1 employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will

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promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or

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expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

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§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during

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that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

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§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- **.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

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§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- **.1** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- **.1** that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- **.2** that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- **.1** cease operations as directed by the Owner in the notice;

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.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

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§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

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§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

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§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

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SUPPLEMENTARY CONDITIONS OF AIA DOCUMENT A201-2017

1. DEFINITIONS - Supplement Paragraph 1.1 as follows:
   a. When words such as approved, proper, satisfactory, equal, and as directed are used, they imply such reference to the Architect's specific approval and directions.
   b. Provide means to furnish and install.
   c. The provisions of the Agreement take precedence over all other Contract Documents.

2. WARRANTY - Supplement Paragraph 3.5 as follows:
   a. Contractor warrants to Owner and Architect that on receipt of notice from either of them, within the period of one (1) year following date of Substantial Completion, that defects in materials and/or workmanship have appeared in the Work, Contractor will promptly correct such defects to the state of condition originally required by the Contract Documents at Contractor's expense.

3. SHOP DRAWINGS - Supplement Paragraph 3.12 as follows:
   a. The Contractor is encouraged to submit electronic copies of all Shop or Setting Drawings and Schedules required for the work of the various trades, after same have been checked and compared with the Contract Document Requirements, and after checking with field conditions at the job and so certified on the Drawings by the Contractor. Above Drawings will not be checked by Architect unless same bear certification.
   b. Electronic submittals shall be organized into a single document for each section being submitted and shall be labeled by the specification section number. Submittals that are not organized or that include multiple files may be rejected.
   c. Architect's approval is subject to notations on Drawings, Compliance with Drawings and Specifications, and conditions and measurements at project. Measurements and quantity not checked or approved.

4. SAMPLES - Supplement Subparagraph 3.12.3 as follows:
   a. All samples as called for in the various Sections of this Specification and any other samples, as directed, shall be furnished by the Contractor for approval.
   b. All samples of materials that require approval as to color, texture, finish and type shall be furnished at the same time, so that an intelligent selection of colors and textures may be made by the Architect.

5. COLOR SELECTIONS
   a. The Contractor shall provide for and coordinate into the project construction schedule, a 6-week time frame for the Architect/Designer to make final color selections from Contractor's submittals, obtain approval from the Owner and to submit a color schedule, indicating what colors go where, to the Contractor. Time frame begins when Architect has received 100% of submittals listed below.
   b. Submittals, i.e., actual samples, manufacturers' literature, full color line options, etc., shall include as a minimum, but not limited to:
      Plaster texture/color
      Floor and Wall Tile
      Wood Flooring
      Resilient Flooring
      Carpet
      Cabinet and Countertop

6. CLEAN UP - Supplement Paragraph 3.15 as follows:
   a. Each Contractor shall, at all times, remove any and all of his rubbish from the buildings and grounds and keep the building site clean.
   b. In addition to the general broom cleaning, the General Contractor shall do the following special cleaning for all trades at the completion of the work:
      1) Glass. Remove putty, stains and paint from all glass and wash and polish same. Care shall be taken not to scratch the glass.
      2) Painted, Decorated, and Stained Work. Remove all marks, stains, fingerprints and other soil or dirt from all painted, decorated, and stained work.
      3) Temporary Protection. Remove all temporary protections; clean and polish all floors at completion.
      4) Woodwork. Clean and polish all woodwork upon completion.
      5) Hardware. Clean and polish all hardware for all trades. This shall include removal of all stains, dust, dirt, paint, etc., upon completion.
      6) Tile Work. Remove all spots, soil, and paint from all tile work, wash same upon completion.
      7) Fixtures and Equipment. Clean all fixtures and equipment, removing all stains, paint, dirt, and dust.
   c. All combustible rubbish, and all debris and other rubbish shall be removed entirely from the premises.

7. MUTUAL RESPONSIBILITY OF CONTRACTORS - Supplement Paragraph 6.2 as follows:
   a. General Contractor shall assume general coordination and direction of the project. General Contractor shall cooperate with Mechanical and Electrical Contractors and other subcontractors and/or suppliers on the Work and install their work in sequence to facilitate and not delay the completion of the project. The Architect is not the coordinator or expeditor of the work of the contractors and/or subcontractors referred to hereinbefore.

8. CHANGES IN THE WORK
   Refer to Paragraph 7.2 and insert the following:
   a. Whenever a Change Order involves net cost decrease, the CREDIT to the Owner shall be such net cost decrease. Whenever a Change Order involves a summary net increase, the Contract shall be increased by the amount of such net cost increase plus a percentage of such net cost for overhead and profit as indicated on the Bid Form. The General Contractor will furnish supervision and coordination for a percentage as noted on the Bid Form, of the cost of additional Mechanical and Electrical work ordered by the Owner.
   b. The Contractor shall furnish the Owner an itemized accounting with supporting data used in computing the value of any change that might be ordered.
   c. Change Orders must state a number of added days or days to be deleted from completion time. If no change in days is required by the change order, write NONE. Failure to comply with above voids any later request for extra time.

9. APPLICATION FOR PROGRESS PAYMENTS AND CERTIFICATION FOR PAYMENT
   a. Amend Subparagraph 9.3.1 and insert the following: On or before the 25th day of each month, the Contractor shall submit to the Architect an itemized Application for Payment supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require.
   b. Amend Subparagraph 9.4.1 and insert: If the Contractor has made application for payment as above, the Architect will, with reasonable promptness and within seven (7) days after receipt of the application, issue an application for payment to the Owner, with a copy to the Contractor in the amount of 90% of the value of the Contract the Architect determines has been completed to the date of application, thus a 10% retainage, less any amount paid to the Contractor, or state in writing his reason for withholding an application as provided in Subparagraph 9.5.1.
   c. Date of payment of the Application for Payment by the Owner is hereby defined as the earliest possible date that the Owner can prepare vouchers after receipt of Application for Payment from the Architect and approval of same by any governing body of the Owner and issuance of vouchers to cover Application for Payment.

10. PROPERTY INSURANCE MARINE ALL RISK SPECIAL BUILDERS RISK AND TRANSIT FORM
    Refer to Paragraph 11.3.1 Property Insurance and insert the following:
    a. Until the Work is completed and accepted by the Owner, **the Owner shall effect and maintain total Property Insurance (Marine All Risk Special Builders Risk and Transit Form**) upon the Work at the site to 100% of the insurable value thereof (plus 8% of this insured value for Architect's Fee in connection with any loss covered by this insurance) including items of labor and materials connected therewith in or adjacent to the structure insured, materials in place or to be used as a part of the permanent construction, including surplus materials, shanties, protective fences, bridges or temporary structures, miscellaneous materials and supplies incidental to the Work, and such scaffoldings, stagings, towers, forms and equipment as are not owned or rented by the Contractor, the cost of which is included in the cost of the work. EXCLUSIONS: This insurance does not cover any tools owned by mechanics; any tools, equipment, scaffoldings, stagings, towers and forms owned or rented by the Contractor; the capital value of which is not included in the cost of the work, nor loss of equipment, materials, tools, etc., by theft. **Contractor shall not commence construction prior to receipt of policy copy from Owner.**
    b. This insurance shall include the interest of the Owner, the Contractor, Subcontractor, and Sub-Subcontractor in the Work.

11. CONTRACTOR'S LIABILITY INSURANCE
    a. Workers' Compensation and Employers Liability Insurance - Refer to Subparagraph 11.1.1.
    b. Bodily Injury and Property Damage - Refer to Subparagraph 11.1.2. Limits shall be as follows:
       (1) Limits of liability coverage shall be $2,000,000.00 Combined Single Limit for Bodily Injury and Property Damage.

12. PERFORMANCE AND PAYMENT BONDS - Supplement Subparagraph 11.3.1.1 as follows:
    a. Bond shall be equivalent to AIA Form A312-2010, incorporates two bonds – one covering the contractor's performance, and the other covering the contractor's obligations to pay subcontractors and other for s for material and labor. AIA document A312-2010 obligates the surety to act responsively to the owner's requests for discussion aimed at anticipating or preventing a contractor's default. Performance Bond and Labor and Materials Bond with amount shown on each part equal to 100% of the total amount payable by the terms of the Contract. Surety shall be company licensed to do business at the place of building and shall be acceptable to the Owner.

13. TESTS AND INSPECTIONS – The contractor shall bear all costs associated with testing and inspections where required by the construction documents, the City of Salina, or by standard construction practices.

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PHASE ENGINEERING

Limited Asbestos Inspection Report

Landmark on Cypress

301 Cypress Street

Abilene, Taylor County, Texas 79601

PE Project No.: 202506075
June 25, 2025

Prepared for:
Overland Property Group
5241 West 151st Terrace
Leawood, Kansas 66224

Prepared by:
Phase Engineering, LLC
5524 Cornish Street
Houston, Texas 77007

Overland Property Group
c/o April Engstrom
5241 West 151st Terrace
Leawood, Kansas 66224
Phone: (785) 212-0810 Email: aengstrom@overlandpg.com

RE: 202506075

Dear April Engstrom:

Phase Engineering, LLC (Texas Department of State Health Services [TDSHS] license #10-0224) has conducted an asbestos inspection for renovation purposes of the building materials in the Landmark on Cypress building located at 301 Cypress Street, Abilene, Taylor County, Texas 79601.

PROJECT SUMMARY	
Site Elements	**Comments**
Subject Property Address	301 Cypress Street, Abilene, Taylor County, Texas 79601
Location Contact	Jack Oduro
Date of Inspection	June 17, 2025
Building Plans / Prior Inspection Reports	Prior report provided by EHT, inspection on August 20, 2018
Known Areas Not Available for Access	None
Inspector Name	Ross Doctoroff
Inspector License #	TDSHS Asbestos Inspector License 602189
Company License #	TDSHS Asbestos Consultant Firm #10-0224
Number of Samples Collected	6
Number of Samples Analyzed	6
Number of samples containing or assumed to contain more than 1% asbestos via Polarized Light Microscopy (PLM)	3
Number of samples containing or assumed to contain more than 1% asbestos that were analyzed by Point Counting	0
Number of samples containing asbestos but less than 1% via Point Count analysis	0
Number of samples containing more than 1% asbestos	**3**

Laboratory Conducting Analysis and Method: Micro Analytical Services. (TDSHS License Number 30-0304), Methods - Polarized Light Microscopy with Dispersion Staining EPA Test Method 600/ M4-82-020; (40CFR Part 763 Appendix E to Subpart E) & EPA 600/R-93/116.

Under EPA 600/R-93/116; Interim 40CFR Part 763 Appendix E to Subpart E it is not necessary to separate layers for point counting in the individual components are proportioned equally.

The potential Asbestos Containing Building Material (ACBM) samples collected, their descriptions, and their locations are summarized in the following table. ACBMs that tested positive over 1% for asbestos are shaded in yellow. Material that tested positive over 1% for asbestos via PLM, but tested to be 1% or less via Point Count analysis are shaded in blue.

Sample Number	Sample Description	Unit / Location	Percent Asbestos
See lab results, sample photographs, licenses and certifications and scope of work in the appendices of this report.			
01	12×12 floor tile (mastic)	1st floor north foyer entry	Floor tile - <1% Chrysotile Mastic - 5% Chrysotile
02	12×12 floor tile (mastic)	1st floor north foyer entry	Floor tile - <1% Chrysotile Mastic - 5% Chrysotile
03	12×12 floor tile (mastic)	1st floor north foyer entry	Floor tile - <1% Chrysotile Mastic - 5% Chrysotile
04	Sheetrock ceiling components (textured)	7th floor board room	<1% Chrysotile
05	Sheetrock ceiling components (textured)	7th floor board room	<1% Chrysotile
06	Sheetrock ceiling components (textured)	7th floor board room	<1% Chrysotile

Site Specific Details:

The inspection performed by Phase Engineering, LLC was a suspect asbestos containing building materials (ACBMs) inspection for renovation purposes of the building materials in the Landmark on Cypress building located at 301 Cypress Street, Abilene, Taylor County, Texas 79601 following the Texas Asbestos Health Protection Rules (TAHPR) and the National Emission Standards for Hazardous Air Pollutants (Title 40 CFR, Part 61) for any exterior samples required. **This inspection is not intended to comply with AHERA 40 CFR 763**.

Site Specific Details
Item Description
The inspector was provided no historical documentation of original construction or renovations of the building. No previous asbestos inspection reports or abatement reports were provided to the inspector.

Site Specific Details
Item Description
The sampling protocol followed for this inspection was intended for renovation purposes of the building materials in the Landmark on Cypress building located at 301 Cypress Street, Abilene, Taylor County, Texas 79601.
The building consisted of vinyl tile flooring and sheetrock ceilings.
The first-floor flooring types appear to be installed onto concrete and the upper-floor flooring types appear to be installed onto wood.
Any other suspect material found during renovation that was not sampled during this inspection is to be considered ACBM until tested.
The mirrors within the building inspected appeared to be hung to the sheetrock walls. During the course of renovation, any suspect material observed behind mirrors (black mastic) or behind any observed ceramic tile is to be considered ACBM until tested.
No roof materials were sampled as part of this inspection.
Areas behind walls and above ceilings were observed for suspect ACBMs where possible. Phase Engineering, LLC does not warrant that all suspect ACBMs above ceilings, under flooring, and behind walls have been identified.
The specific square footage of each homogeneous suspect ACBM area is not included as a part of this limited asbestos inspection.

Although Phase Engineering, LLC uses trained and licensed inspectors in attempting to locate and identify materials potentially containing asbestos, Phase Engineering, LLC does not warrant that all materials containing asbestos have been identified. It is possible that there are materials containing asbestos that were not found because they were not visible or accessible to the inspector, or for various other reasons, were not sampled. Moreover, it is possible that the actual quantities of materials will differ from the quantities of materials estimated during this survey.

Samples taken are categorized as either friable or non-friable. The term friable refers to the ease with which the material can be crumbled or made to produce dust using hand pressure alone. For example, ceiling tiles are generally considered friable, while floor tiles are generally considered non-friable. Sheet rock wall materials are considered friable when damaged and non-friable when intact. The condition of the materials sampled is also categorized as good, damaged or significantly damaged.

A construction material is considered to be an ACBM if it is composed of more than 1% asbestiform components.

Findings:

The results found during the asbestos inspection indicate that the following suspect ACBM(s) contain more than 1% asbestos. The material found to be an ACBM is summarized in the following table:

Type of Material	Approximate Location of ACBM	Friable / Non-Friable - Condition	Asbestos % and Type
12×12 Floor tile (Mastic)	1st floor north foyer entry	Non-Friable - Good	Mastic - 5% Chrysotile

Type of Material	Approximate Location of ACBM	Friable / Non-Friable - Condition	Asbestos % and Type
12×12 Resilient floor tile (white with brown streaks)	3rd floor	Non-Friable - Good	Floor tile - 10% Chrysotile Mastic - 10% Chrysotile
1×1 Adhered acoustic tile and mastic (brown)	2nd floor	Non-Friable - Good	Mastic - 2% Chrysotile
1" TPI	5th and 7th floor	Non-Friable - Good	Mastic - 10%
1" TPFI	3rd, 5th and 7th floor	Non-Friable - Good	Mastic - 10%
12×12 Resilient floor tile (white with brown streaks)	3rd and 4th floor	Non-Friable - Good	Floor tile - 3-5% Chrysotile Mastic - 5% Chrysotile
4" TPI	4th and 5th floor	Non-Friable - Good	Mastic - 10% Chrysotile
4" TPFI	3rd, 4th and 5th floor	Non-Friable - Good	Mastic - 10% Chrysotile
Concrete (Red)	2nd and 4th floor	Non-Friable - Good	Red Concrete - 3% Chrysotile Grey Concrete - 3% Chrysotile Mastic - 5% Chrysotile
Composite sheet flooring (Brown)	3rd floor	Non-Friable - Good	Mastic - 5% Chrysotile
12×12 Resilient floor tile (gray with white streaks)	2nd, 3rd and 4th floor	Non-Friable - Good	Floor tile - 5% Chrysotile
Concrete (Dark brown)	2nd floor	Non-Friable - Good	Black concrete - 3% Chrysotile Gray concrete - 5% Chrysotile

No other suspect ACBMs analyzed were found to contain more than 1% asbestos in the Landmark on Cypress building located at 301 Cypress Street, Abilene, Taylor County, Texas 79601.

Recommendations:

If the buildings are to be demolished or renovated it is recommended that any other ACBMs or assumed ACBMs that will be disturbed be removed by a licensed abatement contractor and if applicable, a licensed asbestos consultant. The TDSHS Demolition/Renovation Notification form combines the requirements of the National Emission Standards for Hazardous Air Pollutants, 40 CFR, Subpart M (NESHAP) and the Texas Asbestos Health Protection Rules (TAHPR). Both of these regulations require that written notification be submitted before beginning renovation projects that include the disturbance of any asbestos-containing material in a facility. A notification form is required before the demolition of a building or facility, even when no asbestos is present. This form must be used to fulfill either of these requirements. Please call either 512-834-6610 or 1-800-572-5548 (within Texas), or your local regional office for assistance in completing this form.

If any ACBM is left in place the TDSHS may require an asbestos Management Plan in accordance with the TAHPR, section 295.34 (h). In the event that maintenance and repair are necessary, it is required by OSHA that anyone in contact with the disruption of these ACBMs be notified through an onsite, up-to-date asbestos Management Plan. This Management Plan should be developed to include emergency procedures for handling leaks, breaks, fire, etc. to ensure minimal release of asbestos fibers into the air. This plan should also ensure that when asbestos fibers are released, either accidentally or intentionally, proper control and cleanup procedures are implemented.

During renovation or demolition activities, care should be exercised in dealing with all construction materials even those shown to be non-asbestos containing (this would include materials technically considered as non-asbestos containing because they are below the one percent limit). If these non-asbestos materials are to be disturbed work practices should be used that will limit exposure to dust and debris. Contractors performing this work should conform to OSHA regulations outlined in 29 CFR 1926.55 (exposure limits can be found in 29 CFR 1910.1000 Table Z-3).

The Texas Asbestos Health Protection Rules (TAHPR) dated March 2003, §295.34 (c) (1) state “During the construction of or renovation in a public building, a person appropriately licensed in accordance with these rules, Texas-registered architect or Texas-licensed professional engineer may compile the information from material safety data sheets (MSDS) of all products used in the construction of the building and, finding no asbestos in any of those products, prepare a signed written certification that he has reviewed the MSDSs for all products used in the construction and that none of those products contain ACBM and: therefore, the building material do not contain asbestos. This certification, together with copies of the MSDSs and copies of any previous asbestos surveys, may be used as an asbestos survey.”

Further TAHPR §295.34 (i) states that “A person may not install building materials or replacement parts as stated in subsection (j) of this section, in a public building unless: (1) the person obtains a required MSDS showing that the materials or replacement parts contain 1.0% or less of asbestos; or (2) the materials or replacement parts, according to the MSDS, contain more than 1.0% asbestos but there is no alternative material or part as demonstrated by the building owner or contractor.” In the event of future renovation and or demolition, further sampling may be required of suspect asbestos containing materials prior to these activities to satisfy the Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and Texas Department of State Health Services (TDSHS) rules and regulations at that time. If suspect asbestos containing building

materials (not noted during this inspection) should be found during any renovation or demolition, these materials should be sampled for asbestos and handled appropriately following all local, state and federal rules and regulations at that time.

If improper renovation or demolition occurs the owner is subject to a $10,000 a day fine, enforced by the Texas Department of State Health Services (TDSHS).

Thank you for the opportunity to work with you on your environmental needs. If you have any questions, feel free to contact us at (832)-485-2241 or 1-800-419-8881.

Sincerely,

Matt White
Asbestos Consultant
TDSHS License #105849

Ross Doctoroff
Asbestos Inspector
TDSHS License #602189

APPENDIX I

PHOTOGRAPHIC DOCUMENTATION



1. 12″x12″ floor tile with black mastic current samples 1-3



2. Former identified floor tile ACM samples (068-070)



3. Former identified FT and floor covering ACMs 015-017 and 059



4. Former sampled area on 3rd floor samples 025-027



5. HA-2 ceiling material in 7th floor board room samples 4-6



6. Mastic remaining from acoustical tiles



7. Prior identified ACM samples 047-049



8. Red concrete (056-058)



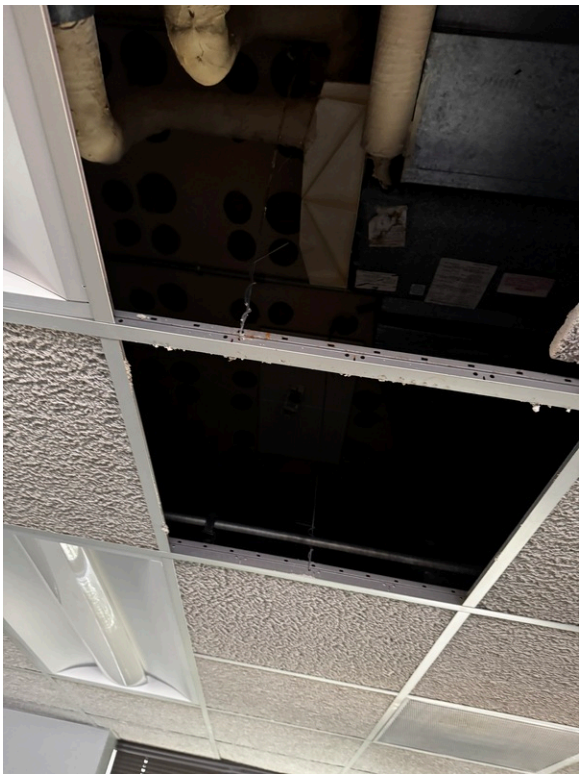
9. Subject property



10. TSI and mastic from acoustical tiles



11. TSI and mastic from acoustical tiles



12. TSI formerly identified as ACM

APPENDIX II

LABORATORY RESULTS

Micro Analytical Services, Inc. 11301 Richmond Ave. Ste. K100B♦Houston♦Texas 77082♦Phone(281) 497-4500♦Fax(281) 497-4517

Asbestos Bulk Sample Chain of Custody

Company: Phase Engineering	Contact: Ross Doctoroff	Project Name: Landmark
Address: 301 Cypress	Bill To: Phase Engineering	
		Project #: 202506075
City: Abilene		
State/Zip: TX		PO#:
Phone:		
Fax:	Date Collected: 6/17/2025	MAS Project #: 19881

Turn around time (circle): Emergency 1-day ~~2-day~~ 3-day ~~4-day~~ 5-day

Field ID	Lab ID	Sample Description	Sample Location	Comments
1	607198	12"x12" Floor tile with mastic	1st floor north foyer entry	
2		12"x12" Floor tile with mastic	1st floor north foyer entry	
3		12"x12" Floor tile with mastic	1st floor north foyer entry	
4		Textured Ceiling Material	7th floor board room	
5		Textured Ceiling Material	7th floor board room	
6	607203	Textured Ceiling Material	7th floor board room	

Relinquished By:_____ Date:_____ Time:_____

Received By: TONY DANG Date: 6/19/25 Time: 1:00 PM

Relinquished By:_____ Date:_____ Time:_____

Received By:_____ Date:_____ Time:_____

Micro Analytical Services, Inc. 11301 Richmond Ave. Ste.K100B♦Houston♦Tx 77082♦Phone(281)497-4500♦Fax(281)497-4517

NVLAP Lab Code: 200618-0 TDSHS License No. 30-0341

PLM BULK ASBESTOS ANALYSIS REPORT

CLIENT: Phase Engineering, Inc. **MAS JOB NO.:** 19881-00

PROJECT: Landmark **REPORT DATE:** June 23, 2025

IDENTIFICATION: Asbestos, Bulk Sample Analysis, Quantitation by Visual Area Estimation

TEST METHOD: Polarized Light Microscopy with Dispersion Staining
EPA - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples
EPA - 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Material

STATEMENT OF LABORATORY ACCREDITATION

These samples were analyzed at Micro Analytical Services, Inc. in the Asbestos Laboratory at 11301 Richmond Ave. Suite K100B, Houston, Texas, 77082. The Laboratory holds accreditation from the National Institute of Standards and Technology under the National Voluntary Laboratory Accreditation Program (NVLAP). This laboratory is also licensed and authorized to perform as an Asbestos Laboratory in the State of Texas within the purview of Texas Civil Statutes, Article 4477-3a, as amended, so long as this license is not suspended or revoked and is renewed according to the rules adopted by the Texas Board of Health.

The samples were analyzed in general accordance with the procedures outlined in the EPA - 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples, EPA - 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Material, under AHERA, for the analysis of asbestos in building materials by polarized light microscopy. The results of each bulk sample relate only to the material tested as submitted to the laboratory and the results shall not be used to claim product endorsement by NVLAP or any agency of the U.S. Government.

Specific questions concerning bulk sample results shall be directed to the Asbestos Bulk Laboratory at Micro Analytical Services, Inc.

Analyst: Tony T. Dang

Approved Signatory: 

Micro Analytical Services, Inc. 11301 Richmond Ave. Ste. K100B♦Houston♦Texas 77082♦Phone(281) 497-4500♦Fax(281) 497-4517

Polarized Light Microscopy Analysis

Phase Engineering, Inc.
5524 Cornish St.
Houston, Texas 77007

MAS Project #: 19881-00
Date Received: 6/19/2025
Date Analyzed: 6/23/2025

Project Name: Landmark

Field ID/ Lab ID	Layer #	Sample Description	Asbestos Detected? (Yes/No)	Asbestos Constituents (%)	Non-Asbestos Constituents (%)
01 MAS607198	1	Tan fibrous floor tile	Yes	<1% Chrysotile	100% Other
01 MAS607198	2	Black fibrous mastic	Yes	5% Chrysotile	95% Mastic
02 MAS607199	1	Tan fibrous floor tile	Yes	<1% Chrysotile	100% Other
02 MAS607199	2	Black fibrous mastic	Yes	5% Chrysotile	95% Mastic
03 MAS607200	1	Tan fibrous floor tile	Yes	<1% Chrysotile	100% Other
03 MAS607200	2	Black fibrous mastic	Yes	5% Chrysotile	95% Mastic
04 MAS607201	1	White fibrous popcorn with white paint	Yes	<1% Chrysotile	20% Foam 80% Other
04 MAS607201	2	White fibrous gypsum with brown paper	No		70% Cellulose 30% Gypsum
05 MAS607202	1	White fibrous popcorn with white paint	Yes	<1% Chrysotile	20% Foam 80% Other
05 MAS607202	2	White fibrous gypsum with brown paper	No		70% Cellulose 30% Gypsum
06 MAS607203	1	White fibrous popcorn with white paint	Yes	<1% Chrysotile	20% Foam 80% Other
06 MAS607203	2	White fibrous gypsum with brown paper	No		70% Cellulose 30% Gypsum

Samples have been analyzed by the EPA Interim Method 600/M4-82-020(40CFR Part 763 Appendix E to Subpart E) & EPA 600/R-93/116. The test results herein relate only to the sample submitted and analyzed. This report may only be reproduced in full with the approval of the Bulk Asbestos Laboratory of Micro Analytical Services (MAS). The above percentages are visual estimates of area percent. MAS is not responsible for any errors resulting from improper or incorrect sampling or shipping procedures. These samples will be retained for a period of 30 days. Accreditation by NVLAP in no way constitutes or implies product certification, approval, or endorsement by NIST. Some materials, especially floor tiles, contain asbestos fibers too thin to be detected by this method.
NVLAP Lab Code: 200618 TDSHS License: 30-0341

Analyzed by: Tony Dang

Approved NVLAP Signatory: Tony Dang

Limited Asbestos Survey

Hendrick Health System
Office Building
301 Cypress Street
Abilene, Texas

Project Number: 5717

August 2018

Prepared for:
Hendrick Health System
1900 Pine Street
Abilene, Texas 79601

Site Inspection:

Mark McHan
Individual Asbestos Consultant
TDSHS License #: 105642
Exp. 07-18-20

Prepared by:

Enprotec / Hibbs & Todd
402 Cedar, Abilene, Texas 79604
Phone: (325) 698-5560 / Fax: (325) 690-3240
Website: e-ht.com
PE Firm Registration No. 1151
PG Firm Registration No. 50103
RPLS Firm Registration Nos. 10011900 & 10007300

Hendrick Health System
Office Building
301 Cypress Street
Abilene, Texas

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EXECUTIVE SUMMARY

Enprotec / Hibbs & Todd, Inc. (eHT) was authorized by Hendrick Health System to perform an asbestos survey of the Office Building, Located at 301 Cypress Street in Abilene, Texas. Based on the assessment results, the following suspect asbestos containing materials were identified:

- Drywall Gypsum Wallboard (DWGB);
- Wall Covering on DWGB;
- Texture on DWGB;
- Joint Compound on DWGB;
- Plaster (Rough Texture);
- Plaster (Smooth Texture);
- 12" x 12" Beige with Green Streaks Resilient Floor Tile (RFT) and Black Mastic;
- 12" x 12" White with Brown Streaks RFT and Black Mastic;
- Brown Sheet Flooring with Fiber Backing and Yellow Mastic;
- 12" x 12" Grey with White Streaks RFT and Yellow Mastic;
- Carpet Mastic (Green);
- Carpet Mastic (Yellow);
- Carpet Mastic (Blue);
- Grey Cove Base and Yellow Mastic;
- Brown Cove Base and Brown Mastic;
- Greenish Grey Cove Base and White Mastic;
- Blue Cove Base and Yellow and Brown Mastic;
- Black Concrete Flooring;
- Grey Concrete Flooring;
- Dark Brown Concrete Flooring;
- Red Concrete Flooring;
- 1' x 1' Adhered Acoustic Tile (AAT) and Brown Mastic;
- 2' x 2' Suspended Acoustic Tile (SAT), Glacier Pattern;
- 2' x 2' SAT, Pinhole Pattern
- Acoustical Texture;

- 4" Ceramic Tile, Grout, Adhesive;
- 1" Ceramic Tile, Grout, Mortar;
- Thermal Pipe Insulation (TPI) and White Mastic;
- Thermal Pipe Fitting Insulation (TPFI) and White Mastic;
- Painted Concrete Masonry Units (CMU); and
- Plaster Crown Molding.

The Asbestos Survey was performed on August 20, 2018 by Mark McHan, Asbestos Consultant, license number 105642, expiration date 07/18/20. One hundred seven (107) bulk samples of suspect asbestos containing building materials (ACBMs) were collected and submitted to the laboratory for analysis.

Based on the laboratory results, the following samples contained greater than one percent (1%) asbestos and the represented material is considered ACBMs:

- **015, 016, 017 – 12" x 12" Beige with Green Streaks RFT and Black Mastic, located on the south Suite on the 3rd Floor;**
- **022 – Brown Mastic adhesive associated with the 1' x 1' Adhered Acoustic Tile, located on the original ceiling in some areas of all floors;**
- **032, 033, 034, 035, 036, 051, 052, 053, 054, 055 – White Mastic on TPI and TPFI, located on air conditioning / heating pipes throughout the facility;**
- **047, 048, 049 – 12" x 12" White with Brown Streaks RFT and Black Mastic, located on the 3rd and 4th Floors of the facility;**
- **056, 057 – Red and Grey Concrete, located on 2, 3, 4, 5, 6 and 7th Floors in the west side stairwells and elevator corridors;**
- **059 – Black Mastic, located on the surface of the Brown Composite Sheet Flooring on the 4th Floor;**
- **068, 069, 070 – 12" x 12" Grey with White Streaks RFT, located on the 2, 3, and 4th Floors; and**
- **080 – Black and Grey Concrete, located on 2, 3, 4, 5, 6, and 7th Floors in the west side stairwells and elevator corridors.**

Material volumes were not calculated for the identified asbestos containing materials (ACMs).

The RFT and Black Mastic are classified as Category I non-friable ACMs in accordance with National Emission Standards for Hazardous Air Pollutant (NESHAP).

The Brown Mastic Adhesive associated with the 1' x 1' AAT is classified as a Category II non-friable ACM in accordance with NESHAP.

The Red, Grey, and Black Concrete is classified as a Category II non-friable ACM in accordance with NESHAP.

The White Mastic on the TPI and TPFI is classified as a Category II non-friable ACM in accordance with NESHAP.

The laboratory reports are presented in Appendix B. A table presenting the laboratory results is presented in the Tables Section. The sample locations are shown on Figures 1, 2, 3, 4, 5, 6 and 7 in the Figures Section.

Enprotec / Hibbs & Todd, Inc. recommends the following actions:

- Prior to demolition or renovation activities, ACBMs in the areas to be disturbed should be abated by a qualified asbestos abatement contractor under monitoring and supervision of a qualified asbestos consultant.
- Tenants, employees, maintenance personnel, contractors, and others that could potentially disturb asbestos during the course of their duties should be notified of the presence and location of asbestos in accordance with Texas Department of Health (TDH) OSHA regulations, 25 TAC295.34 (b) (2) and 29 CFR 1926.1101, respectively.
- Any suspect building materials not sampled in this assessment encountered during demolition and renovation activities should be sampled and tested for possible asbestos content by qualified personnel prior to continuation of activities.

1.0 INTRODUCTION:

1.1 Client/Facility Location

eHT was authorized by Hendrick Health System to perform an asbestos survey of the Office Building, located at 301 Cypress Street in Abilene, Texas. The asbestos survey was limited in scope to the interior of the facility.

1.2 Scope of Work:

In general, the scope of work included the performance of an asbestos survey on accessible suspect ACBMs throughout the interior of the facility.

The facility was a seven (7) story building constructed of steel and concrete with two (2) separate basement areas. The original walls were plaster. The original ceilings were plaster or concrete covered with adhered acoustic tile. Original floors were concrete, terrazzo or wood. Subsequent remodeling of the facility added sheetrock wall coverings and partitions. Also added was a chilled water cooling / heating system incorporated between the original ceiling and a suspended acoustic tile ceiling. Floor coverings added included carpet, vinyl sheet flooring, vinyl floor tile and ceramic tile.

1.3 Regulatory Standards:

This study was conducted based on the Final Rules for Asbestos Exposure in General Industry and Construction, issued August 10, 1994. An employer or owner may demonstrate that Presumed Asbestos Containing Material (PACM) (includes thermal system insulation, sprayed-on or troweled-on surfacing material and debris in work areas where such material is present) does not contain asbestos by having an inspection conducted pursuant to the requirements of Asbestos Hazard Emergency Response Act (AHERA) (40 CFR 763, Subpart E). Such tests shall include analysis of a minimum of three (3) bulk samples of each homogenous area of PACM collected in a randomly distributed manner. The tests, evaluation, and sample collection shall be performed by an accredited inspector or by a Certified Industrial Hygienist (CIH). The employer/building owner may demonstrate that flooring material, including associated mastic and backing, does not contain asbestos, based upon recognized analytical techniques showing that the material is asbestos free (contains 1% or less of asbestos).

State and Federal regulations require an asbestos survey be performed prior to renovation or demolition of a public or commercial building. Renovation and demolition will disturb building materials and the asbestos materials likely to be disturbed must be removed by a qualified (i.e. certified and licensed) asbestos abatement contractor under monitoring and supervision of a qualified asbestos consultant.

Federal and State regulations only allow asbestos material to remain in-place during demolition activities under certain circumstances. The circumstances are: 1) a building is declared to be structurally unsound and in danger of collapse, or 2) regulated materials are removed, leaving only certain non-friable materials in-place. Regulated asbestos-containing materials (RACMs) are ACMs that are friable or may become friable during demolition. Materials that may remain in-place include gaskets, packings, and asphalt roofing materials that are not friable and are not in poor condition (Category 1 Non-Friable ACM), as well as other non-friable materials (Category II Non-Friable ACM) that do not have a high probability of becoming or have not already become crumbled, pulverized or reduced to powder by forces expected to act on the Material in the course of demolition activities.

According to NESHAP [40CFR61.145(A)(3)], a building may be demolished with friable and non-friable ACMs in-place "if the facility is being demolished under an order of a State or Local government agency, issued because the facility is structurally unsound and in danger of imminent collapse". Texas Asbestos Health Protection Rules (TAHPR) similarly stated in 25 TAC 295.61(i), "The judgement that a structure is in danger of imminent collapse or that it is unsafe for anyone to enter shall be made by a professional engineer, registered architect, or government official" and as such the building would no longer meet the requirements of a public building [25 TAC 295.32(7A)(F)]. Leaving the ACMs requires the use of wet demolition techniques and proper disposal of all the resulting debris as asbestos waste.

1.4 Field Methods:

Prior to collecting bulk samples of suspect ACBM, distinct homogeneous sampling areas and specific sampling sites were defined. A homogeneous sample area can be defined as a material that is similar in appearance, color, and generally having the same episode of installation as surrounding "like" material. Attempts were made in all cases to obtain

representative samples of like materials, as this is the most cost-effective method for determination of ACBM. It should be assumed by the building owner, contractor, and the abatement contractors that the compositions of like materials in a single homogeneous area are the same.

As the suspect ACBM was located and identified, bulk samples were obtained and placed in labeled individual containers. The sample identification number on the containers directly corresponds with the numbers listed on the Chain-of-Custody (COC) and laboratory reports presented in Appendix A. **In the event that during any renovation or demolition, any suspect material is encountered behind any walls or other areas that were not accessible at the time this survey was conducted, samples of these suspect materials should be collected and analyzed by qualified asbestos inspectors and laboratories, respectively.**

1.5 Assessment of Suspect ACBM:

In accordance with AHERA (October 30, 1986), verified or assumed ACBM discovered in an inspection or reinspection of a facility shall be assessed in view of past, present, or future likelihood of disturbance and may include the following:

- Location of material present;
- Condition of material: type of damage, severity of damage, and the extent or spread of damage;
- Accessibility of the materials;
- Potential for disturbance of the material;
- Known or suspected causes of damage (i.e., air erosion, vandalism, service or repair, vibration, and water);
- Preventative measures which might eliminate the possibility of undamaged ACBM from being significantly damaged; and
- Actions to be taken to protect human health.

1.5.1 Classification of ACBM: Verified ACBM are classified into one of the following categories:

- Damaged ACBM thermal system insulation;
- Significantly damaged ACBM thermal system insulation;
- Damaged friable surfacing ACBM;
- Significantly damaged friable surfacing ACBM;
- Damaged friable miscellaneous ACBM;
- Significantly damaged friable miscellaneous ACBM;
- ACBM with potential for damage;
- ACBM with potential for significant damage; and
- Remaining ACBM not fitting into categories above.

ACBM is defined as friable if the material contains more than one-percent asbestos that, when dry, can be crumbled, pulverized or reduced to powder by hand pressure. ACBM is defined as non-friable if the material contains more than one-percent asbestos that when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure. Friable materials are more likely to become airborne, thereby increasing the potential for health hazards.

1.5.2 Prioritization: The ACBM is usually examined and prioritized according to condition, location, potential for damage and potential or fiber release. The priorities are usually divided into the following categories:

- Low Hazard - those non-friable materials in good condition with low potential for disturbance **(L)**.
- Moderate Hazard - Those currently non-friable or friable materials in good physical condition that have a moderate potential for disturbance or damage to make them friable and release asbestos fibers to the air **(M)**.
- High Hazard - Those friable or non-friable materials that have become friable in poor physical condition and/or likely to be disturbed by air currents, water damage, construction or other activities which could distribute airborne asbestos fibers **(H)**.
- Immediate Hazard - Those friable or non-friable materials that have become friable, that are significantly damaged, have released material and/or are

very likely to expose unprotected persons **(I)**.

1.6 Laboratory Methods:

A total of one hundred seven (107) bulk samples were collected from the building areas accessed. Polarized Light Microscopy (PLM) methods were utilized with dispersion-staining techniques according to US Environmental Protection Agency (EPA) Method EPA 600/R-93/116. This type of analysis requires the microscopist to take a portion of the bulk sample and treat it with a special light-refractive oil emulsion stain. This prepared slide is then subjected to a variety of tests while being viewed under varying polarization of light.

Each type of asbestos is determined by visual estimation. Even though this is an estimation, any material that contains more than one percent of any type of asbestos using the PLM method is considered an ACBM and must be handled according to Occupational Safety and Health Agency (OSHA) and EPA regulations, if disturbed.

Friable materials may be reanalyzed using the objective point counting method. (Asbestos NESHAP Revision Final Rule to CFR 61.141). The point counting method shall take precedent when different to the standard PLM method.

The samples were submitted to Moody Labs in Farmers Branch, Texas for analysis. This laboratory is a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory and licensed by the Texas Department of State Health Services (TDSHS).

1.7 Response Actions:

The following four (4) basic response actions are options for each type of ACBM:

- Operations and Maintenance - requires maintenance of the material in an undamaged condition. This includes the repair or removal of damaged materials, record keeping, worker training, re-inspection, prevalent level air monitoring and documentation in a comprehensive Operations and Maintenance Program (O&M) specific to the building.
- Encapsulation - requires sealing of the exposed surface of the ACBM with a bridging-type encapsulant or conversion from a friable to non-friable status with penetrating type encapsulant. Encapsulation work must be conducted under conditions which control the

release of asbestos fibers into the building areas.

- Enclosure - requires isolation of the ACBM behind or within air-tight barriers of gypsum wallboard, plyboard, etc. Enclosure work must be conducted under conditions which control the release of asbestos fibers into the building areas.
- Removal - requires removal and disposal of the asbestos-containing building material (ACBM) under full asbestos abatement conditions by licensed asbestos abatement contractors.

2.0 Survey Findings:

The following findings are based on site investigations performed on August 20, 2018. This asbestos survey was performed in accordance with the Texas Asbestos Health Protection Rules, 25 TAC 295.34).

The following materials were identified as suspect ACBM or Presumed Asbestos Containing Building Materials (PACM):

- Drywall Gypsum Wallboard (DWGB);
- Wall Covering on DWGB;
- Texture on DWGB;
- Joint Compound on DWGB;
- Plaster (Rough Texture);
- Plaster (Smooth Texture);
- 12" x 12" Beige with Green Streaks Resilient Floor Tile (RFT) and Black Mastic;
- 12" x 12" White with Brown Streaks RFT and Black Mastic;
- Brown Sheet Flooring with Fiber Backing and Yellow Mastic;
- 12" x 12" Grey with White Streaks RFT and Yellow Mastic;
- Carpet Mastic (Green);
- Carpet Mastic (Yellow);
- Carpet Mastic (Blue);
- Grey Cove Base and Yellow Mastic;
- Brown Cove Base and Brown Mastic;
- Greenish Grey Cove Base and White Mastic;

- Blue Cove Base and Yellow and Brown Mastic;
- Black Concrete Flooring;
- Grey Concrete Flooring;
- Dark Brown Concrete Flooring;
- Red Concrete Flooring;
- 1' x 1' Adhered Acoustic Tile (AAT) and Brown Mastic;
- 2' x 2' Suspended Acoustic Tile (SAT), Glacier Pattern;
- 2' x 2' SAT, Pinhole Pattern
- Acoustical Texture;
- 4" Ceramic Tile, Grout, Adhesive;
- 1" Ceramic Tile, Grout, Mortar;
- Thermal Pipe Insulation (TPI) and White Mastic;
- Thermal Pipe Fitting Insulation (TPFI) and White Mastic;
- Painted Concrete Masonry Units (CMU); and
- Plaster Crown Molding.

Materials observed but not suspected of containing asbestos were not sampled. The non-sampled materials included fiberglass insulation, metal products, glass materials, plastic products and wood materials. A table presenting a summary of the ACMs is presented as Table 1 in the Tables Section.

The facility was viewed at 301 Cypress Street, Abilene, Texas on August 20, 2018. The survey was limited in scope to the interior of the facility. A total of 107 bulk samples of suspect ACBM materials were collected at this location. The laboratory reports are presented in Appendix B.

2.1 Laboratory Results:

Based on the laboratory results, the following samples contained greater than one percent (1%) asbestos and the represented material is considered ACBMs:

- **015, 016, 017 – 12" x 12" Beige with Green Streaks RFT and Black Mastic, located on the south Suite on the 3rd Floor;**
- **022 – Brown Mastic adhesive associated with the 1' x 1' Adhered Acoustic Tile, located on the original ceiling in some areas of all floors;**

- **032, 033, 034, 035, 036, 051, 052, 053, 054, 055 – White Mastic on TPI and TPFI, located on air conditioning / heating pipes throughout the facility;**
- **047, 048, 049 – 12" x 12" White with Brown Streaks RFT and Black Mastic, located on the 3rd and 4th Floors of the facility;**
- **056, 057 – Red and Grey Concrete, located on 2, 3, 4, 5, 6 and 7th Floors in the west side stairwells and elevator corridors;**
- **059 – Black Mastic, located on the surface of the Brown Composite Sheet Flooring on the 4th Floor;**
- **068, 069, 070 – 12" x 12" Grey with White Streaks RFT, located on the 2, 3, and 4th Floors; and**
- **080 – Black and Grey Concrete, located on 2, 3, 4, 5, 6, and 7th Floors in the west side stairwells and elevator corridors.**

Material volumes were not calculated for the identified asbestos containing materials (ACMs).

The RFT and Black Mastic are classified as Category I non-friable ACMs in accordance with National Emission Standards for Hazardous Air Pollutant (NESHAP).

The Brown Mastic Adhesive associated with the 1' x 1' AAT is classified as a Category II non-friable ACM in accordance with NESHAP.

The Red, Grey, and Black Concrete is classified as a Category II non-friable ACM in accordance with NESHAP.

The White Mastic on the TPI and TPFI is classified as a Category II non-friable ACM in accordance with NESHAP.

3.0 RECOMMENDATIONS:

- Prior to demolition or renovation activities, ACBMs in the areas to be disturbed should be abated by a qualified asbestos abatement contractor under monitoring and supervision of a qualified asbestos consultant.
- Tenants, employees, maintenance personnel, contractors, and others that could potentially disturb asbestos during the course of their duties should be notified of the presence and location of

asbestos in accordance with Texas Department of Health (TDH) OSHA regulations, 25 TAC295.34 (b) (2) and 29 CFR 1926.1101, respectively.

- Any suspect building materials not sampled in this assessment encountered during demolition and renovation activities should be sampled and tested for possible asbestos content by qualified personnel prior to continuation of activities.

4.0 STANDARDS/LIMITATIONS:

The work performed in conjunction with the data developed are intended as a description of available information at the dates and locations given. This report does not warrant against future operations or conditions, nor does it warrant against operations or conditions present of a type or at a location not investigated.

Opinions and recommendations presented herein apply to site conditions existing at the time of our investigation and those reasonably foreseeable; they cannot necessarily apply to site changes of which eHT is not aware and has not had the opportunity to evaluate.

This report is designed to aid the building owner, architect, construction manager, general contractor, and potential abatement contractor in locating ACBM. Under no circumstances is this report to be used as a bidding document or a project specification document.

Reasonable efforts were made to obtain representative samples of building materials and have those materials analyzed for asbestos content. Materials or conditions which were not observed due to the survey conditions stated herein may differ from those documented in this report. Should suspect materials be discovered during building renovation/demolition that have not been addressed, bulk samples of the material should be collected and analyzed for asbestos content prior to renovation and/or demolition.

Our professional services have been performed, our findings obtained, and recommendations prepared in accordance with customary principles and practices in the fields of environmental science and engineering. This warranty is in lieu of all other warranties either expressed or implied. eHT is not responsible for the independent conclusions, opinions or recommendations made by others based on the field exploration and laboratory test data presented in this report.

Tables:
Table 1, Suspect ACM Summary

TABLE 1
SUSPECT ACBM SUMMARY

Hendrick Health System
Office Building
301 Cypress
Abilene, Texas

Sample No:	Material	Location	Type (S,TSI,M)	Friable/Nonfriable (F/NF)	Category Class. (1 - 9)	Priority (1 - 4)	Response Action (1 - 4)	Asbestos Content (ND=Non Detect)
001	DWGB & Wall Covering	3rd Floor						ND
002	DWGB & Wall Covering	2nd Floor						ND
003	DWGB & Wall Covering	5th Floor						ND
004	DWGB & Wall Covering	6th Floor						ND
005	DWGB & Wall Covering	7th Floor						ND
006	DWGB & Wall Covering	1st Floor						ND
007	DWGB & Wall Covering	3rd Floor						ND
008	Joint Compound	3rd Floor						ND
009	Joint Compound	2nd Floor						ND
010	Joint Compound	4th Floor						ND
011	Joint Compound	5th Floor						ND
012	Joint Compound	6th Floor						ND
013	Joint Compound	7th Floor						ND
014	Joint Compound	1st Floor						ND
015	12" x 12" Beige with Green Streaks RFT & Mastic	3rd Floor	M	NF	7	1	1	10% Chrysotile - RFT 10% Chrysotile - Black Mastic
016	12" x 12" Beige with Green Streaks RFT & Mastic	3rd Floor	M	NF	7	1	1	10% Chrysotile - RFT 10% Chrysotile - Black Mastic
017	12" x 12" Beige with Green Streaks RFT & Mastic	3rd Floor	M	NF	7	1	1	10% Chrysotile - RFT 10% Chrysotile - Black Mastic

Type

S	Surfacing Material
TSI	Thermal System Insulation
M	Miscellaneous Material

Category Classification:

1. Damaged ACBM thermal System Insulation
2. Significantly Damaged ACBM Thermal System Insulation
3. Damaged Friable Surfacing ACBM
4. Significantly Damaged Friable Surfacing ACBM
5. Damaged Friable Miscellaneous ACBM
6. Significantly Damaged Friable Miscellaneous ACBM
7. ACBM With Potential For Damage
8. ACBM With Potential For Significant Damage
9. Remaining ACBM Not Fitting Into Categories Above

Response Aciton:

1. Operations and Maintenance
2. Encapsulation
3. Enclosure
4. Removal

Priority:

1. Low Hazard
2. Moderate Hazard
3. High Hazard
4. Immediate Hazard

Note:

Asbestos Type, Category Classification, Priority and Response Action are not given for Non ACBMs listed on the table.

TABLE 1
SUSPECT ACBM SUMMARY

Hendrick Health System
Office Building
301 Cypress
Abilene, Texas

Sample No:	Material	Location	Type (S,TSI,M)	Friable/Nonfriable (F/NF)	Category Class. (1 - 9)	Priority (1 - 4)	Response Action (1 - 4)	Asbestos Content (ND=Non Detect)
018	2' x 2' SAT (Glacial)	3rd Floor						ND
019	2' x 2' SAT (Glacial)	2nd Floor						ND
020	2' x 2' SAT (Glacial)	4th Floor						ND
021	1' x 1' Adhered Acoustic Tile	3rd Floor						ND
022	1' x 1' Adhered Acoustic Tile	2nd Floor	M	NF	7	1	1	ND - Acoustic Tile 2% Chrysotile - Brown Mastic
023	1' x 1' Adhered Acoustic Tile	4th Floor						ND
024	1' x 1' Adhered Acoustic Tile	1st Floor						ND
025	Carpet Mastic (Green)	3rd Floor						ND
026	Carpet Mastic (Green)	3rd Floor						ND
027	Carpet Mastic (Green)	3rd Floor						ND
028	Grey Cove Base & Mastic	3rd Floor						ND
029	Grey Cove Base & Mastic	3rd Floor						ND
030	Grey Cove Base & Mastic	3rd Floor						ND
031	Thermal Pipe Insulation, 1"	3rd Floor						ND
032	Thermal Pipe Insulation, 1"	5th Floor	M	NF	7	1	1	ND - Thermal Insulation ND - Paper/Foil Wrap 10% Chrysotile - White Mastic
033	Thermal Pipe Insulation, 1"	7th Floor	M	NF	7	1	1	ND - Thermal Insulation ND - Paper/Foil Wrap 10% Chrysotile - White Mastic

Type		Category Classification:	Response Aciton:	Priority:
S	Surfacing Material	1. Damaged ACBM thermal System Insulation	1. Operations and Maintenance	1. Low Hazard
TSI	Thermal System Insulation	2. Significantly Damaged ACBM Thermal System Insulation	2. Encapsulation	2. Moderate Hazard
M	Miscellaneous Material	3. Damaged Friable Surfacing ACBM	3. Enclosure	3. High Hazard
		4. Significantly Damaged Friable Surfacing ACBM	4. Removal	4. Immediate Hazard
		5. Damaged Friable Miscellaneous ACBM		
		6. Significantly Damaged Friable Miscellaneous ACBM		
		7. ACBM With Potential For Damage		
		8. ACBM With Potential For Significant Damage		
		9. Remaining ACBM Not Fitting Into Categories Above		

Note:

Asbestos Type, Category Classification, Priority and Response Action are not given for Non ACBMs listed on the table.

TABLE 1
SUSPECT ACBM SUMMARY

Hendrick Health System
Office Building
301 Cypress
Abilene, Texas

Sample No:	Material	Location	Type (S,TSI,M)	Friable/Nonfriable (F/NF)	Category Class. (1 - 9)	Priority (1 - 4)	Response Action (1 - 4)	Asbestos Content (ND=Non Detect)
034	Thermal Pipe Fitting Insulation, 1"	3rd Floor	M	NF	7	1	1	ND - Thermal Insulation ND - Glass Fiber Mesh 10% Chrysotile - White Mastic
035	Thermal Pipe Fitting Insulation, 1"	5th Floor	M	NF	7	1	1	ND - Thermal Insulation ND - Glass Fiber Mesh 10% Chrysotile - White Mastic
036	Thermal Pipe Fitting Insulation, 1"	7th Floor	M	NF	7	1	1	ND - Thermal Insulation ND - Glass Fiber Mesh 10% Chrysotile - White Mastic
037	Plaster (Rough Texture)	3rd Floor						ND
038	Plaster (Rough Texture)	2nd Floor						ND
039	Plaster (Rough Texture)	4th Floor						ND
040	Plaster (Rough Texture)	5th Floor						ND
041	Plaster (Rough Texture)	6th Floor						ND
042	Plaster (Rough Texture)	7th Floor						ND
043	Plaster (Rough Texture)	1st Floor						ND
044	Brown Cove Base & Mastic	3rd Floor						ND
045	Brown Cove Base & Mastic	2nd Floor						ND
046	Brown Cove Base & Mastic	6th Floor						ND
047	12" x 12" White with Brown Streaks RFT & Mastic	3rd Floor	M	NF	7	1	1	ND - Green Mastic 5% Chrysotile - RFT 10% Chrysotile - Black Mastic
048	12" x 12" White with Brown Streaks RFT & Mastic	4th Floor	M	NF	7	1	1	ND - Yellow Mastic 3% Chrysotile - RFT ND - Yellow Mastic
049	12" x 12" White with Brown Streaks RFT & Mastic	3rd Floor	M	NF	7	1	1	ND - Blue Mastic ND - Yellow Mastic 3% Chrysotile - RFT 5% Chrysotile - Black Mastic

Type		Category Classification:	Response Aciton:	Priority:
S	Surfacing Material	1. Damaged ACBM thermal System Insulation	1. Operations and Maintenance	1. Low Hazard
TSI	Thermal System Insulation	2. Significantly Damaged ACBM Thermal System Insulation	2. Encapsulation	2. Moderate Hazard
M	Miscellaneous Material	3. Damaged Friable Surfacing ACBM	3. Enclosure	3. High Hazard
		4. Significantly Damaged Friable Surfacing ACBM	4. Removal	4. Immediate Hazard
		5. Damaged Friable Miscellaneous ACBM		
		6. Significantly Damaged Friable Miscellaneous ACBM		
		7. ACBM With Potential For Damage		
		8. ACBM With Potential For Significant Damage		
		9. Remaining ACBM Not Fitting Into Categories Above		

Note:

Asbestos Type, Category Classification, Priority and Response Action are not given for Non ACBMs listed on the table.

TABLE 1
SUSPECT ACBM SUMMARY

Hendrick Health System
Office Building
301 Cypress
Abilene, Texas

Sample No:	Material	Location	Type (S,TSI,M)	Friable/Nonfriable (F/NF)	Category Class. (1 - 9)	Priority (1 - 4)	Response Action (1 - 4)	Asbestos Content (ND=Non Detect)
050	Thermal Pipe Insulation, 4"	3rd Floor						ND
051	Thermal Pipe Insulation, 4"	4th Floor	M	NF	7	1	1	ND - Thermal Insulation ND - Foil/Paper Wrap 10% Chrysotile - White Mastic
052	Thermal Pipe Insulation, 4"	5th Floor	M	NF	7	1	1	ND - Thermal Insulation ND - Foil/Paper Wrap 10% Chrysotile - White Mastic
053	Thermal Pipe Fitting Insulation, 4"	3rd Floor	M	NF	7	1	1	ND - Thermal Insulation ND - Glass Fiber Mesh 10% Chrysotile - White Mastic
054	Thermal Pipe Fitting Insulation, 4"	4th Floor	M	NF	7	1	1	ND - Thermal Insulation 10% Chrysotile - White Mastic
055	Thermal Pipe Fitting Insulation, 4"	5th Floor	M	NF	7	1	1	ND - Thermal Insulation ND - Glass Fiber Mesh 10% Chrysotile - White Mastic
056	Red Concrete	3rd Floor	M	NF	7	1	1	3% Chrysotile - Red Concrete 3% Chrysotile - Grey Concrete 5% Chrysotile - Black Mastic
057	Red Concrete	2nd Floor	M	NF	7	1	1	3% Chrysotile - Concrete ND - Yellow Mastic
058	Red Concrete	4th Floor						ND
059	Brown Composite Sheet Flooring	3rd Floor	M	NF	7	1	1	5% Chrysotile - Black Mastic ND - Sheet Flooring ND - Fiber Backing ND - Yellow Mastic ND - Felt
060	Brown Composite Sheet Flooring	4th Floor						ND - Sheet Flooring ND - Fiber Backing ND - Yellow Mastic ND - Felt
061	Brown Composite Sheet Flooring	6th Floor						ND - Sheet Flooring ND - Fiber Backing ND - Yellow Mastic ND - Felt
062	4" Ceramic Tile, Grout, Adhesive	3rd Floor						ND
063	4" Ceramic Tile, Grout, Adhesive	2nd Floor						ND
064	4" Ceramic Tile, Grout, Adhesive	7th Floor						ND
065	1" Ceramic Tile, Grout, Mortar	3rd Floor						ND
066	1" Ceramic Tile, Grout, Mortar	2nd Floor						ND
067	1" Ceramic Tile, Grout, Mortar	7th Floor						ND

Type		Category Classification:	Response Aciton:	Priority:
S	Surfacing Material	1. Damaged ACBM thermal System Insulation	1. Operations and Maintenance	1. Low Hazard
TSI	Thermal System Insulation	2. Significantly Damaged ACBM Thermal System Insulation	2. Encapsulation	2. Moderate Hazard
M	Miscellaneous Material	3. Damaged Friable Surfacing ACBM	3. Enclosure	3. High Hazard
		4. Significantly Damaged Friable Surfacing ACBM	4. Removal	4. Immediate Hazard
		5. Damaged Friable Miscellaneous ACBM		
		6. Significantly Damaged Friable Miscellaneous ACBM		
		7. ACBM With Potential For Damage		
		8. ACBM With Potential For Significant Damage		
		9. Remaining ACBM Not Fitting Into Categories Above		

Note:

Asbestos Type, Category Classification, Priority and Response Action are not given for Non ACBMs listed on the table.

TABLE 1
SUSPECT ACBM SUMMARY

Hendrick Health System
Office Building
301 Cypress
Abilene, Texas

Sample No:	Material	Location	Type (S,TSI,M)	Friable/Nonfriable (F/NF)	Category Class. (1 - 9)	Priority (1 - 4)	Response Action (1 - 4)	Asbestos Content (ND=Non Detect)
068	12" x 12" Grey with White Streaks RFT & Mastic	3rd Floor	M	NF	7	1	1	5% Chrysotile - RFT ND - Yellow Mastic
069	12" x 12" Grey with White Streaks RFT & Mastic	2nd Floor	M	NF	7	1	1	5% Chrysotile - RFT ND - Yellow Mastic
070	12" x 12" Grey with White Streaks RFT & Mastic	4th Floor	M	NF	7	1	1	5% Chrysotile - RFT No Mastic
071	Painted CMU	3rd Floor						ND
072	Painted CMU	2nd Floor						ND
073	Painted CMU	4th Floor						ND
074	Plaster Crown Molding	2nd Floor						ND
075	Plaster Crown Molding	2nd Floor						ND
076	Plaster Crown Molding	2nd Floor						ND
077	Carpet Mastic (Brown)	2nd Floor						ND
078	Carpet Mastic (Brown)	2nd Floor						ND
079	Carpet Mastic (Brown)	2nd Floor						ND
080	Dark Brown Concrete	2nd Floor	M	NF	7	1	1	3% Chrysotile - Black Concrete 5% Chrysotile - Grey Concrete
081	Dark Brown Concrete	4th Floor						ND
082	Dark Brown Concrete	5th Floor						ND
083	Greenish Grey Cove Base & Mastic	2nd Floor						ND
084	Greenish Grey Cove Base & Mastic	2nd Floor						ND
085	Greenish Grey Cove Base & Mastic	2nd Floor						ND

Type

S Surfacing Material

TSI Thermal System Insulation

M Miscellaneous Material

Category Classification:

1. Damaged ACBM thermal System Insulation
2. Significantly Damaged ACBM Thermal System Insulation
3. Damaged Friable Surfacing ACBM
4. Significantly Damaged Friable Surfacing ACBM
5. Damaged Friable Miscellaneous ACBM
6. Significantly Damaged Friable Miscellaneous ACBM
7. ACBM With Potential For Damage
8. ACBM With Potential For Significant Damage
9. Remaining ACBM Not Fitting Into Categories Above

Response Aciton:

1. Operations and Maintenance
2. Encapsulation
3. Enclosure
4. Removal

Priority:

1. Low Hazard
2. Moderate Hazard
3. High Hazard
4. Immediate Hazard

Note:

Asbestos Type, Category Classification, Priority and Response Action are not given for Non ACBMs listed on the table.

TABLE 1
SUSPECT ACBM SUMMARY

Hendrick Health System
Office Building
301 Cypress
Abilene, Texas

Sample No:	Material	Location	Type (S,TSI,M)	Friable/Nonfriable (F/NF)	Category Class. (1 - 9)	Priority (1 - 4)	Response Action (1 - 4)	Asbestos Content (ND=Non Detect)
086	Plaster (White, Smooth)	2nd Floor						ND
087	Plaster (White, Smooth)	5th Floor						ND
088	Plaster (White, Smooth)	6th Floor						ND
089	Plaster (White, Smooth)	7th Floor						ND
090	Plaster (White, Smooth)	2nd Floor						ND
091	Plaster (White, Smooth)	2nd Floor						ND
092	Plaster (White, Smooth)	2nd Floor						ND
093	DWGB & Texture	2nd Floor						ND
094	DWGB & Texture	4th Floor						ND
095	DWGB & Texture	1st Floor						ND
096	Blue Cove Base & Mastic	5th Floor						ND
097	Blue Cove Base & Mastic	6th Floor						ND
098	Blue Cove Base & Mastic	5th Floor						ND
099	2' x 2' SAT (Pin Holes)	5th Floor						ND
100	2' x 2' SAT (Pin Holes)	6th Floor						ND
101	2' x 2' SAT (Pin Holes)	5th Floor						ND
102	Acoustic Texture	6th Floor						ND
103	Acoustic Texture	7th Floor						ND
104	Acoustic Texture	5th Floor						ND

Type

S Surfacing Material

TSI Thermal System Insulation

M Miscellaneous Material

Category Classification:

1. Damaged ACBM thermal System Insulation
2. Significantly Damaged ACBM Thermal System Insulation
3. Damaged Friable Surfacing ACBM
4. Significantly Damaged Friable Surfacing ACBM
5. Damaged Friable Miscellaneous ACBM
6. Significantly Damaged Friable Miscellaneous ACBM
7. ACBM With Potential For Damage
8. ACBM With Potential For Significant Damage
9. Remaining ACBM Not Fitting Into Categories Above

Response Aciton:

1. Operations and Maintenance
2. Encapsulation
3. Enclosure
4. Removal

Priority:

1. Low Hazard
2. Moderate Hazard
3. High Hazard
4. Immediate Hazard

Note:

Asbestos Type, Category Classification, Priority and Response Action are not given for Non ACBMs listed on the table.

TABLE 1
SUSPECT ACBM SUMMARY

Hendrick Health System
Office Building
301 Cypress
Abilene, Texas

Sample No:	Material	Location	Type (S,TSI,M)	Friable/Nonfriable (F/NF)	Category Class. (1 - 9)	Priority (1 - 4)	Response Action (1 - 4)	Asbestos Content (ND=Non Detect)
105	Carpet Mastic (Yellow)	6th Floor						ND
106	Carpet Mastic (Yellow)	7th Floor						ND
107	Carpet Mastic (Yellow)	1st Floor						ND

Type		Category Classification:	Response Aciton:	Priority:
S	Surfacing Material	1. Damaged ACBM thermal System Insulation	1. Operations and Maintenance	1. Low Hazard
TSI	Thermal System Insulation	2. Significantly Damaged ACBM Thermal System Insulation	2. Encapsulation	2. Moderate Hazard
M	Miscellaneous Material	3. Damaged Friable Surfacing ACBM	3. Enclosure	3. High Hazard
		4. Significantly Damaged Friable Surfacing ACBM	4. Removal	4. Immediate Hazard
		5. Damaged Friable Miscellaneous ACBM		
		6. Significantly Damaged Friable Miscellaneous ACBM		
		7. ACBM With Potential For Damage		
		8. ACBM With Potential For Significant Damage		
		9. Remaining ACBM Not Fitting Into Categories Above		

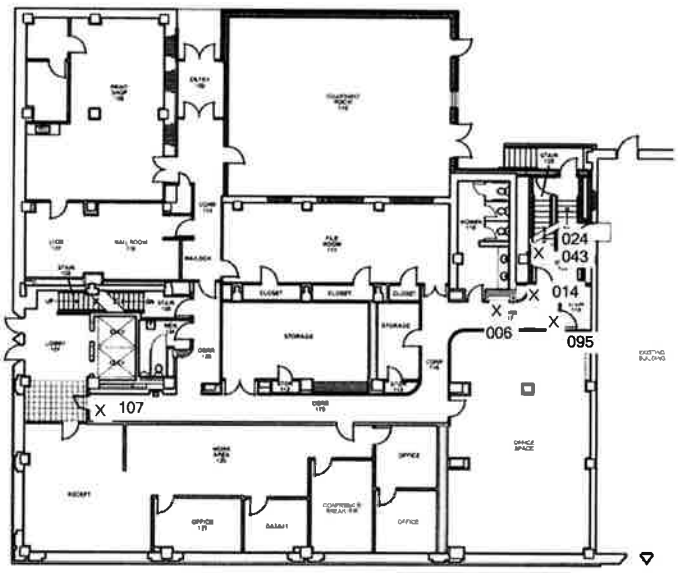
Note:

Asbestos Type, Category Classification, Priority and Response Action are not given for Non ACBMs listed on the table.

Figures:

Figure 1, Sample Location Layout, First Floor
Figure 2, Sample Location Layout, Second Floor
Figure 3, Sample Location Layout, Third Floor
Figure 4, Sample Location Layout, Fourth Floor
Figure 5, Sample Location Layout, Fifth Floor
Figure 6, Sample Location Layout, Sixth Floor
Figure 7, Sample Location Layout, Seventh Floor

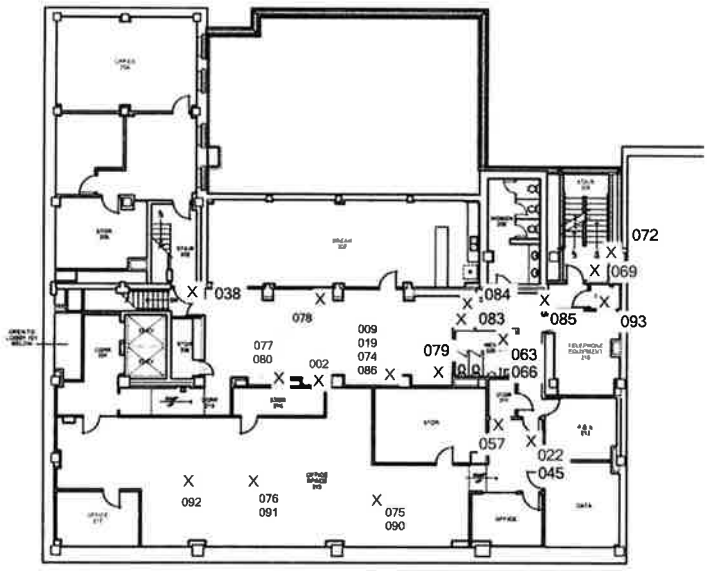
FIGURE 1
SAMPLE LOCATION LAYOUT
HENDRICK HEALTH SYSTEM
301 CYPRESS
ABILENE, TEXAS



FIRST FLOOR PLAN
SCALE : 1/16" = 1'-0"

LEGEND:
X = SAMPLE LOCATION
001 = SAMPLE ID
001 = SAMPLE IDENTIFIED AS ACM

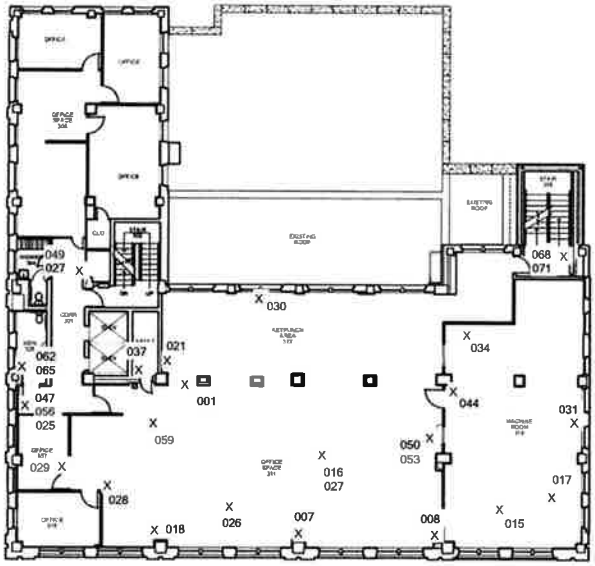
FIGURE 2
SAMPLE LOCATION LAYOUT
HENDRICK HEALTH SYSTEM
301 CYPRESS
ABILENE, TEXAS



LEGEND:
X = SAMPLE LOCATION
001 = SAMPLE ID
001 = SAMPLE IDENTIFIED AS ACM

SECOND FLOOR PLAN
SCALE: 1/8" = 1'-0"

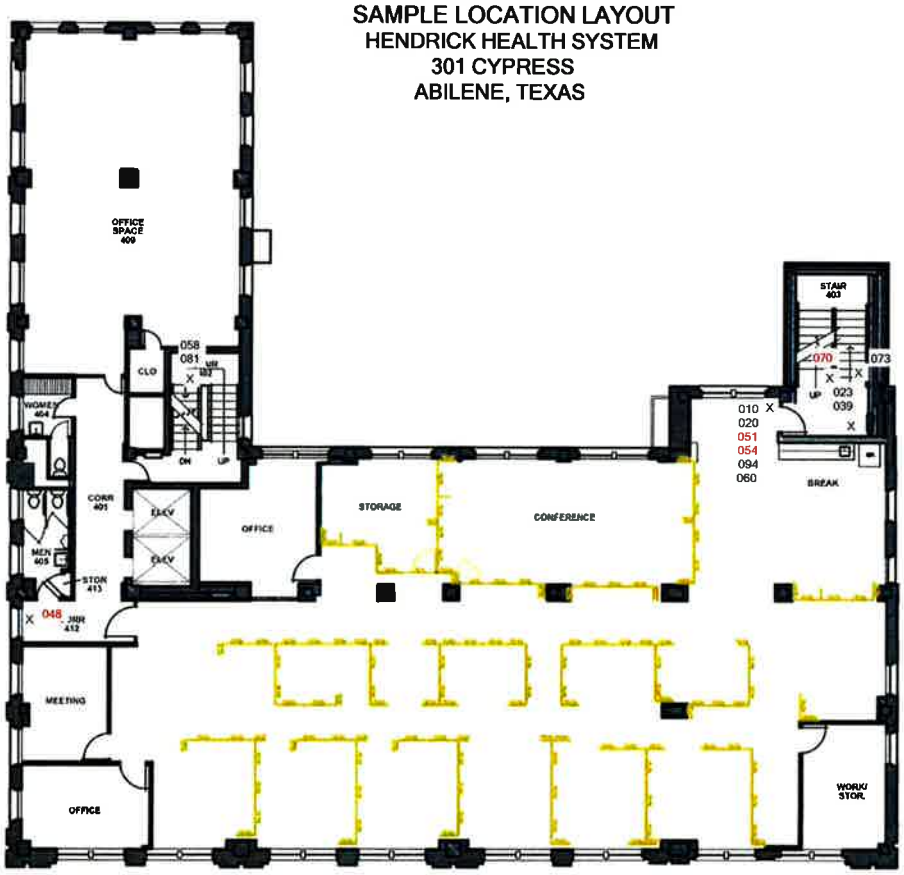
FIGURE 3
SAMPLE LOCATION LAYOUT
HENDRICK HEALTH SYSTEM
301 CYPRESS
ABILENE, TEXAS



THIRD FLOOR PLAN
SCALE: 1/8" = 1'-0"

LEGEND:
X = SAMPLE LOCATION
001 = SAMPLE ID
001 = SAMPLE IDENTIFIED AS ACM

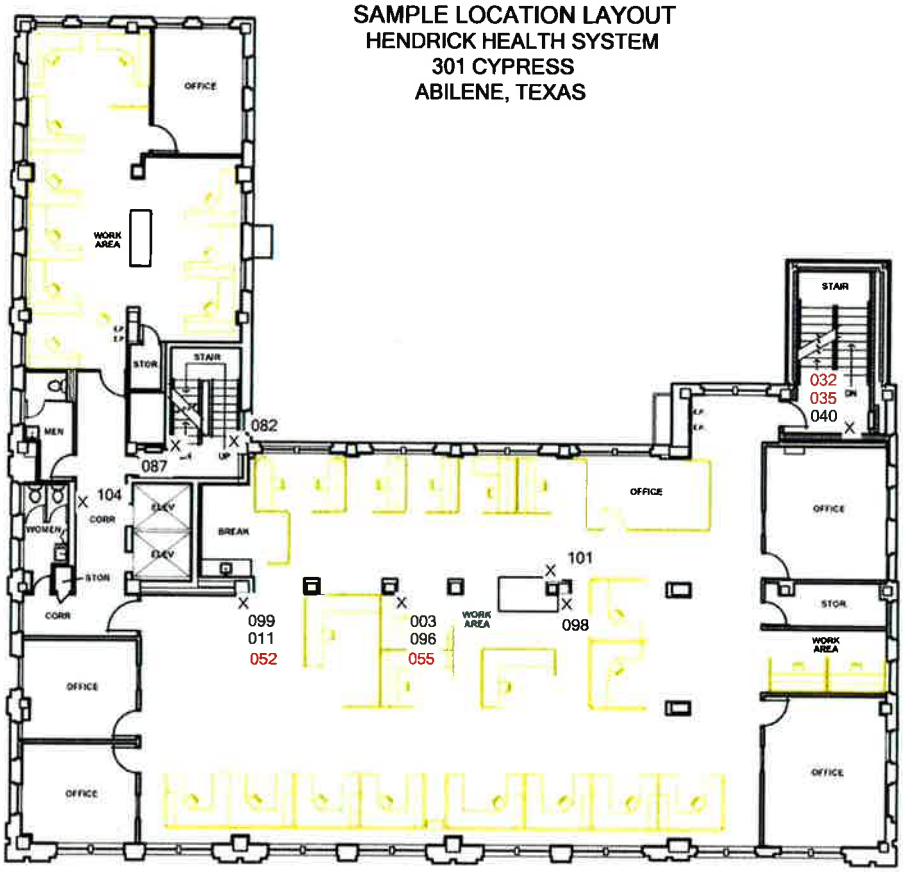
FIGURE 4
SAMPLE LOCATION LAYOUT
HENDRICK HEALTH SYSTEM
301 CYPRESS
ABILENE, TEXAS



FLOOR PLAN – LEVEL 4
SCALE: 1/16" = 1'-0"

LEGEND:
X = SAMPLE LOCATION
001 = SAMPLE ID
001 = SAMPLE IDENTIFIED AS ACM

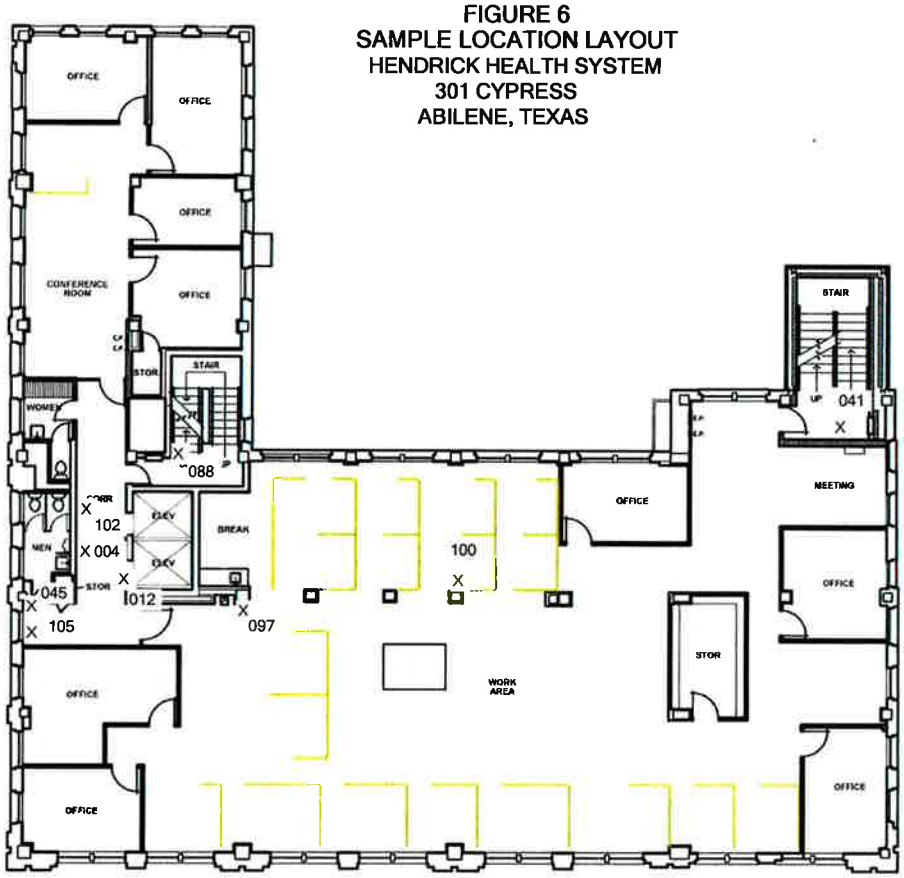
FIGURE 5
SAMPLE LOCATION LAYOUT
HENDRICK HEALTH SYSTEM
301 CYPRESS
ABILENE, TEXAS



FIFTH FLOOR PLAN
SCALE : 1/16" = 1'-0"

LEGEND:
X = SAMPLE LOCATION
001 = SAMPLE ID
001 = SAMPLE IDENTIFIED AS ACM

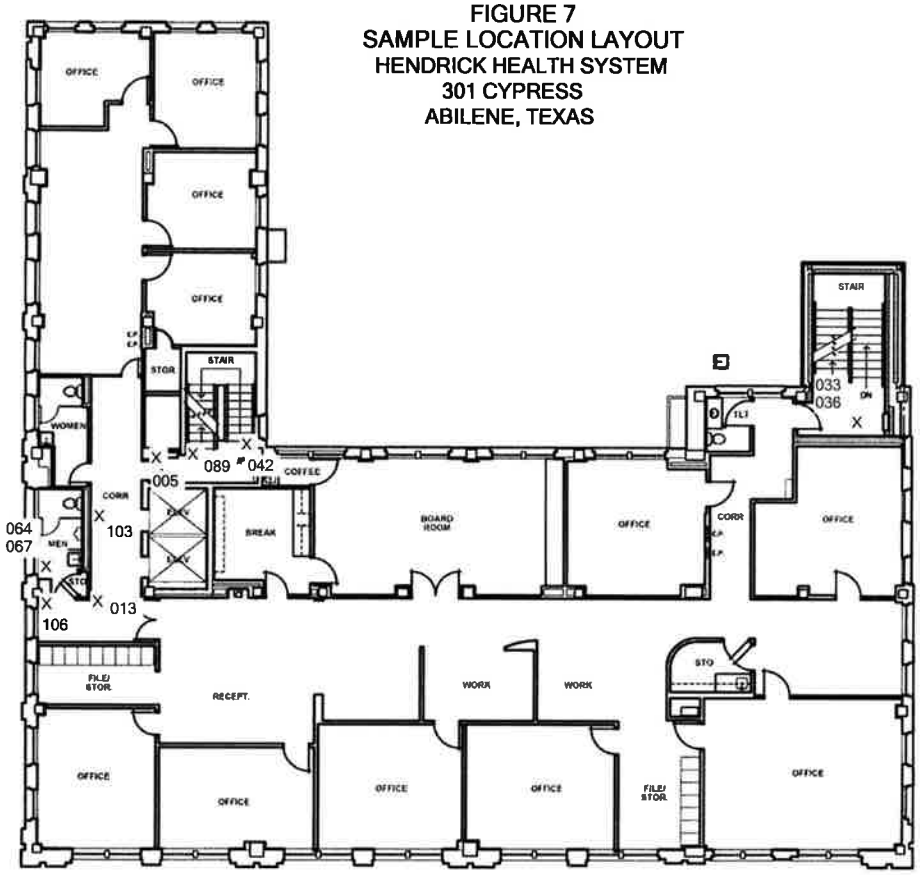
FIGURE 6
SAMPLE LOCATION LAYOUT
HENDRICK HEALTH SYSTEM
301 CYPRESS
ABILENE, TEXAS



SIXTH FLOOR PLAN
SCALE : 1/16" = 1'-0"

LEGEND:
X = SAMPLE LOCATION
001 = SAMPLE ID
001 = SAMPLE IDENTIFIED AS ACM

FIGURE 7
SAMPLE LOCATION LAYOUT
HENDRICK HEALTH SYSTEM
301 CYPRESS
ABILENE, TEXAS



SEVENTH FLOOR PLAN

SCALE : 1/16" = 1'-0"

LEGEND:
X = SAMPLE LOCATION
001 = SAMPLE ID
001 = SAMPLE IDENTIFIED AS ACM

Appendix A - Terminology
Abbreviations/Definitions

CWP .....Chilled water pipe insulation (straight run)
CWF .....Chilled water fitting insulation
CWSP.....Chilled water supply pipe insulation (straight run)
CWSF.....Chilled water supply fitting insulation
CWRP.....Chilled water return pipe insulation (straight run)
CWRF.....Chilled water return fitting insulation
HWP .....Heating water pipe insulation (straight run)
HWF .....Heating water fitting insulation
HWSP.....Heating water supply pipe insulation (straight run)
HWSF.....Heating water supply fitting insulation
HWRP.....Heating water return pipe insulation (straight run)
HWRF.....Heating water return fitting insulation
HCP .....Heating/chilled water pipe insulation (straight run)
HCF .....Heating/chilled water fitting insulation
HCSP.....Heating/chilled water supply pipe insulation (straight run)
HCSF.....Heating/chilled water supply fitting insulation
HCRP.....Heating/chilled water return pipe insulation (straight run)
HCRF.....Heating/chilled water return fitting insulation
SP .....Steam pipe insulation (straight run)
SF .....Steam fitting insulation
LPSP.....Low pressure steam pipe insulation (straight run)
LPSF.....Low pressure steam fitting insulation
HPSP.....High pressure steam pipe insulation (straight run)
HPSF.....High pressure steam fitting insulation
SCP .....Steam condensate pipe insulation (straight run)
SCF .....Steam condensate fitting insulation
DWP .....Domestic water pipe insulation (straight run)
DWF .....Domestic water fitting insulation
DCWP.....Domestic cold water pipe insulation (straight run)
DCWF.....Domestic cold water fitting insulation
DHWP.....Domestic hot water pipe insulation (straight run)
DHWF.....Domestic hot water fitting insulation
RDP .....Roof drain pipe insulation (straight run)
RDF .....Roof drain fitting insulation
MP .....Miscellaneous pipe insulation (straight run)
MF .....Miscellaneous fitting insulation

M I S C E L L A N E O U S M A T E R I A L S

FRBK.....Fibrous backing material
MS .....Mastic (miscellaneous or unidentified source)
SOIL.....Soil, dirt, fill
ELEC.....Electrical components (fixture backing, breaker insulators)
MISC.....Miscellaneous material (not fitting into other categories)

FP .....Structural fireproofing (sprayed-on, trowelled)
AP .....Acoustical plaster (sprayed or trowelled on plaster base)
AT .....Acoustical texture (on gypsum board, concrete base, etc)
HP .....Hard finish plaster or stucco
SAT .....Suspended acoustical tiles (lay-in, concealed spline)
AAT .....Adhered acoustical tiles (ceilings, walls)
ATMS.....Mastic on acoustical tiles
DW .....Drywall construction
DWGB.....Drywall gypsum wallboard
DWTX.....Drywall texture (rolled or brushed)
DWJC.....Drywall joint compound (tape and bed mud)
PFBD.....Pre-formed fiberboard (Tectum, Celotex, Masonite)
MTX .....Miscellaneous texture material (heavy coatings)
CFB .....Cement fiber board (roof, soffit, ceiling, wall panels)
CFP .....Cement fiber pipe (flues, pipes)
RFT .....Resilient floor tiles
FTMS.....Mastic on resilient floor tiles
RSF .....Resilient sheet flooring
SFMS.....Mastic on resilient sheet flooring
RB .....Resilient base, nosings, trim
RBMS.....Mastic on resilient base, nosings, trim
TBI .....Thermal building insulation (sprayed-on,blown,batts,sheets)
BUR .....Built-up roofing (felts, mastic and gravel typical)
RFLS.....Roof flashing (felts or mastic)
RSHG.....Roof shingles
DB .....Debris (on floor, equipment, fixture surfaces)
FAB .....Fabric material (curtains, wall fabrics, etc)

M E C H A N I C A L E Q U I P M E N T

AH .....Air handler unit insulation
AHMB.....Air handler main body insulation
AHND.....Air handler end insulation
AHFL.....Air handler flue insulation
DT .....Duct insulation
DTMS.....Mastic on duct insulation
DTIS.....Duct vibration isolator (flexible connection)
BL .....Boiler unit insulation
BLMB.....Boiler main body insulation
BLND.....Boiler end insulation
BLFL.....Boiler flue insulation
CH .....Chiller unit insulation
CHMB.....Chiller main body insulation
CHND.....Chiller end insulation
FL .....Flue insulation (unidentified source)
FLMS.....Mastic on flue insulation
HX .....Heat exchanger unit insulation
HXMB.....Heat exchanger main body insulation
HXND.....Heat exchanger end insulation
ST .....Storage tank unit insulation
STMB.....Storage tank main body insulation
STND.....Storage tank end insulation
GSKT.....Gasket material

Appendix B - Survey Documentation
Laboratory Reports

PLM Summary Report

Moody Labs
2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

NVLAP Lab Code 102056-0
TDSHS License No. 30-0084

Client : Enprotec / Hibbs & Todd, Inc. - Abilene
Project : HHS, 301 Cypress
Project # : 5717
Identification : Asbestos, Bulk Sample Analysis
Test Method : Polarized Light Microscopy / Dispersion Staining (PLM/DS)
EPA Method 600 / R-93 / 116

Lab Job No. : 18B-10838
Report Date : 08/24/2018
Sample Date :08/20/2018

On 8/22/2018, one hundred seven (107) bulk material samples were submitted by Mark McHan of Enprotec / Hibbs & Todd, Inc. - Abilene for asbestos analysis by PLM/DS. The PLM Detail Report is attached; additional information may be found therein. The results are summarized below:

Sample Number	Client Sample Description / Location	Asbestos Content
001	Drywall Gypsum Board and Wall Covering, 3rd Floor	None Detected - Drywall Material None Detected - Joint Compound None Detected - Wall Covering
002	Drywall Gypsum Board and Wall Covering, 2nd Floor	None Detected - Drywall Material None Detected - Wall Covering No Joint Compound
003	Drywall Gypsum Board and Wall Covering, 5th Floor	None Detected - Drywall Material None Detected - Joint Compound None Detected - Wall Covering
004	Drywall Gypsum Board and Wall Covering, 6th Floor	None Detected - Drywall Material None Detected - Joint Compound None Detected - Wall Covering
005	Drywall Gypsum Board and Wall Covering, 7th Floor	None Detected - Drywall Material None Detected - Wall Covering No Joint Compound
006	Drywall Gypsum Board and Wall Covering, 1st Floor	None Detected - Drywall Material None Detected - Wall Covering No Joint Compound
007	Drywall Gypsum Board and Wall Covering, 3rd Floor	None Detected - Drywall Material None Detected - Wall Covering No Joint Compound
008	Joint Compound, 3rd Floor	None Detected - Joint Compound
009	Joint Compound, 2nd Floor	None Detected - Joint Compound
010	Joint Compound, 4th Floor	None Detected - Joint Compound
011	Joint Compound, 5th Floor	None Detected - Joint Compound
012	Joint Compound, 6th Floor	None Detected - Joint Compound
013	Joint Compound, 7th Floor	None Detected - Joint Compound
014	Joint Compound, 1st Floor	None Detected - Joint Compound

PLM Summary Report

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Sample Number	Client Sample Description / Location	Asbestos Content
015	12" x 12" Resilient Floor Tile (Beige with Green Streaks), 3rd Floor	10% Chrysotile - Floor Tile 10% Chrysotile - Black Mastic
016	12" x 12" Resilient Floor Tile (Beige with Green Streaks), 3rd Floor	10% Chrysotile - Floor Tile 10% Chrysotile - Black Mastic
017	12" x 12" Resilient Floor Tile (Beige with Green Streaks), 3rd Floor	10% Chrysotile - Floor Tile 10% Chrysotile - Black Mastic
018	2' x 2' Suspended Acoustic Tile (Glacier), 3rd Floor	None Detected - Acoustic Tile
019	2' x 2' Suspended Acoustic Tile (Glacier), 2nd Floor	None Detected - Acoustic Tile
020	2' x 2' Suspended Acoustic Tile (Glacier), 4th Floor	None Detected - Acoustic Tile
021	1' x 1' Adhered Acoustic Tile and Mastic (Brown), 3rd Floor	None Detected - Acoustic Tile None Detected - Brown Mastic
022	1' x 1' Adhered Acoustic Tile and Mastic (Brown), 2nd Floor	None Detected - Acoustic Tile 2% Chrysotile - Brown Mastic
023	1' x 1' Adhered Acoustic Tile and Mastic (Brown), 4th Floor	None Detected - Acoustic Tile None Detected - Brown Mastic
024	1' x 1' Adhered Acoustic Tile and Mastic (Brown), 1st Floor	None Detected - Acoustic Tile None Detected - Brown Mastic
025	Carpet Mastic (Green), 3rd Floor	None Detected - Yellow Mastic None Detected - Green Mastic
026	Carpet Mastic (Green), 3rd Floor	None Detected - Green Mastic
027	Carpet Mastic (Green), 3rd Floor	None Detected - Green Mastic
028	Cove Base (Grey) and Mastic, 3rd Floor	None Detected - Cove Base None Detected - Yellow Mastic None Detected - Brown Mastic
029	Cove Base (Grey) and Mastic, 3rd Floor	None Detected - Cove Base None Detected - Yellow Mastic

PLM Summary Report

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Identification : Asbestos, Bulk Sample Analysis
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Sample Number	Client Sample Description / Location	Asbestos Content
030	Cove Base (Grey) and Mastic, 3rd Floor	None Detected - Cove Base None Detected - Yellow Mastic None Detected - Brown Mastic
031	1" TPI, 3rd Floor	None Detected - Thermal Insulation None Detected - Paper / Foil Wrap
032	1" TPI, 5th Floor	None Detected - Thermal Insulation None Detected - Paper / Foil Wrap 10% Chrysotile - White Mastic
033	1" TPI, 7th Floor	None Detected - Thermal Insulation None Detected - Paper / Foil Wrap 10% Chrysotile - White Mastic
034	1" TPFI, 3rd Floor	None Detected - Thermal Insulation None Detected - Glass Fiber Mesh 10% Chrysotile - White Mastic
035	1" TPFI, 5th Floor	None Detected - Thermal Insulation None Detected - Glass Fiber Mesh 10% Chrysotile - White Mastic
036	1" TPFI, 7th Floor	None Detected - Thermal Insulation None Detected - Glass Fiber Mesh 10% Chrysotile - White Mastic
037	Plaster (Rough Texture), 3rd Floor	None Detected - Plaster
038	Plaster (Rough Texture), 2nd Floor	None Detected - Plaster
039	Plaster (Rough Texture), 4th Floor	None Detected - Plaster
040	Plaster (Rough Texture), 5th Floor	None Detected - Plaster
041	Plaster (Rough Texture), 6th Floor	None Detected - Plaster
042	Plaster (Rough Texture), 7th Floor	None Detected - Plaster
043	Plaster (Rough Texture), 1st Floor	None Detected - Plaster

Moody Labs

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PLM Summary Report

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TDSHS License No. 30-0084

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Project # : 5717
Identification : Asbestos, Bulk Sample Analysis
Test Method : Polarized Light Microscopy / Dispersion Staining (PLM/DS)
EPA Method 600 / R-93 / 116

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Sample Number	Client Sample Description / Location	Asbestos Content
044	Cove Base (Brown) and Mastic, 3rd Floor	None Detected - Cove Base None Detected - Brown Mastic
045	Cove Base (Brown) and Mastic, 2nd Floor	None Detected - Cove Base None Detected - Brown Mastic
046	Cove Base (Brown) and Mastic, 6th Floor	None Detected - Cove Base None Detected - Yellow Mastic
047	12" x 12" Resilient Floor Tile (White with Brown Streaks), 3rd Floor	None Detected - Green Mastic 5% Chrysotile - Floor Tile 10% Chrysotile - Black Mastic
048	12" x 12" Resilient Floor Tile (White with Brown Streaks), 4th Floor	None Detected - Yellow Mastic 3% Chrysotile - Floor Tile None Detected - Yellow Mastic
049	12" x 12" Resilient Floor Tile (White with Brown Streaks), 3rd Floor	None Detected - Blue Mastic None Detected - Yellow Mastic 3% Chrysotile - Floor Tile 5% Chrysotile - Black Mastic
050	4" TPI, 3rd Floor	None Detected - Thermal Insulation None Detected - Paper / Foil Wrap
051	4" TPI, 4th Floor	None Detected - Thermal Insulation None Detected - Paper / Foil Wrap 10% Chrysotile - White Mastic
052	4" TPI, 5th Floor	None Detected - Thermal Insulation None Detected - Paper / Foil Wrap 10% Chrysotile - White Mastic
053	4" TPFI (Soft), 3rd Floor	None Detected - Thermal Insulation None Detected - Glass Fiber Mesh 10% Chrysotile - White Mastic
054	4" TPFI (Hard), 4th Floor	None Detected - Thermal Insulation 10% Chrysotile - White Mastic

PLM Summary Report

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TDSHS License No. 30-0084

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Project : HHS, 301 Cypress
Project # : 5717
Identification : Asbestos, Bulk Sample Analysis
Test Method : Polarized Light Microscopy / Dispersion Staining (PLM/DS)
EPA Method 600 / R-93 / 116

Lab Job No. : 18B-10838
Report Date : 08/24/2018
Sample Date :08/20/2018

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Sample Number	Client Sample Description / Location	Asbestos Content
055	4" TPFI (Soft), 5th Floor	None Detected - Thermal Insulation None Detected - Glass Fiber Mesh 10% Chrysotile - White Mastic
056	Concrete (Red), 3rd Floor	3% Chrysotile - Red Concrete 3% Chrysotile - Grey Concrete 5% Chrysotile - Black Mastic
057	Concrete (Red), 2nd Floor	3% Chrysotile - Concrete None Detected - Yellow Mastic
058	Concrete (Red), 4th Floor	None Detected - Concrete
059	Composite Sheet Flooring (Brown), 3rd Floor	5% Chrysotile - Black Mastic None Detected - Sheet Flooring None Detected - Fiber Backing None Detected - Yellow Mastic None Detected - Felt
060	Composite Sheet Flooring (Brown), 4th Floor	None Detected - Sheet Flooring None Detected - Fiber Backing None Detected - Yellow Mastic None Detected - Felt
061	Composite Sheet Flooring (Brown), 6th Floor	None Detected - Yellow Mastic None Detected - Sheet Flooring None Detected - Fiber Backing None Detected - Yellow Mastic None Detected - Felt
062	4" Ceramic Tile, Grout and Adhesive, 3rd Floor	None Detected - Ceramic Tile None Detected - Grout None Detected - Adhesive
063	4" Ceramic Tile, Grout and Adhesive, 2nd Floor	None Detected - Ceramic Tile None Detected - Grout None Detected - Adhesive
064	4" Ceramic Tile, Grout and Adhesive, 7th Floor	None Detected - Ceramic Tile None Detected - Grout None Detected - Adhesive

PLM Summary Report

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Sample Date :08/20/2018

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Sample Number	Client Sample Description / Location	Asbestos Content
065	1" Ceramic Tile, Grout and Mortar, 3rd Floor	None Detected - Ceramic Tile None Detected - Grout None Detected - Mortar
066	1" Ceramic Tile, Grout and Mortar, 2nd Floor	None Detected - Ceramic Tile None Detected - Grout None Detected - Mortar
067	1" Ceramic Tile, Grout and Mortar, 7th Floor	None Detected - Ceramic Tile None Detected - Grout None Detected - Mortar
068	12" x 12" Resilient Floor Tile (Grey with White Streaks), 3rd Floor	5% Chrysotile - Floor Tile None Detected - Yellow Mastic
069	12" x 12" Resilient Floor Tile (Grey with White Streaks), 2nd Floor	5% Chrysotile - Floor Tile None Detected - Yellow Mastic
070	12" x 12" Resilient Floor Tile (Grey with White Streaks), 4th Floor	5% Chrysotile - Floor Tile No Mastic
071	Painted CMU, 3rd Floor	None Detected - CMU None Detected - Paint
072	Painted CMU, 2nd Floor	None Detected - CMU None Detected - Paint
073	Painted CMU, 4th Floor	None Detected - CMU None Detected - Texture None Detected - Paint
074	Plaster Crown Molding, 2nd Floor	None Detected - Plaster
075	Plaster Crown Molding, 2nd Floor	None Detected - White Plaster None Detected - Beige Plaster
076	Plaster Crown Molding, 2nd Floor	None Detected - Plaster
077	Carpet Mastic (Brown), 2nd Floor	None Detected - Yellow Mastic
078	Carpet Mastic (Brown), 2nd Floor	None Detected - Yellow Mastic

Moody Labs
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PLM Summary Report

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Project # : 5717
Identification : Asbestos, Bulk Sample Analysis
Test Method : Polarized Light Microscopy / Dispersion Staining (PLM/DS)
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Report Date : 08/24/2018
Sample Date :08/20/2018

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Sample Number	Client Sample Description / Location	Asbestos Content
079	Carpet Mastic (Brown), 2nd Floor	None Detected - Yellow Mastic
080	Concrete (Dark Brown), 2nd Floor	3% Chrysotile - Black Concrete 5% Chrysotile - Grey Concrete
081	Concrete (Dark Brown), 4th Floor	None Detected - Concrete
082	Concrete (Dark Brown), 5th Floor	None Detected - Concrete
083	Cove Base (Greenish Grey) and Mastic, 2nd Floor	None Detected - Cove Base None Detected - Clear Mastic None Detected - Brown Mastic None Detected - White Mastic
084	Cove Base (Greenish Grey) and Mastic, 2nd Floor	None Detected - Cove Base None Detected - Brown Mastic None Detected - White Mastic
085	Cove Base (Greenish Grey) and Mastic, 2nd Floor	None Detected - Cove Base None Detected - Clear Mastic None Detected - Brown Mastic None Detected - White Mastic
086	Plaster (White, Smooth), 2nd Floor	None Detected - Plaster
087	Plaster (White, Smooth), 5th Floor	None Detected - White Plaster None Detected - Beige Plaster
088	Plaster (White, Smooth), 6th Floor	None Detected - White Plaster None Detected - Beige Plaster
089	Plaster (White, Smooth), 7th Floor	None Detected - White Plaster None Detected - Beige Plaster
090	Plaster (White, Smooth), 2nd Floor	None Detected - White Plaster None Detected - Beige Plaster
091	Plaster (White, Smooth), 2nd Floor	None Detected - White Plaster
092	Plaster (White, Smooth), 2nd Floor	None Detected - White Plaster

PLM Summary Report

Moody Labs
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Sample Number	Client Sample Description / Location	Asbestos Content
093	Drywall Gypsum Board and Texture, 2nd Floor	None Detected - Drywall Material None Detected - Joint Compound None Detected - Texture
094	Drywall Gypsum Board and Texture, 4th Floor	None Detected - Drywall Material None Detected - Texture / Joint Cmpd
095	Drywall Gypsum Board and Texture, 1st Floor	None Detected - Drywall Material None Detected - Joint Compound None Detected - Texture
096	Cove Base (Blue) and Mastic, 5th Floor	None Detected - Cove Base None Detected - Yellow Mastic None Detected - Brown Mastic
097	Cove Base (Blue) and Mastic, 6th Floor	None Detected - Cove Base None Detected - Yellow Mastic None Detected - Brown Mastic
098	Cove Base (Blue) and Mastic, 5th Floor	None Detected - Cove Base None Detected - Yellow Mastic
099	2' x 2' Suspended Acoustic Tile (Pinholes), 5th Floor	None Detected - Acoustic Tile
100	2' x 2' Suspended Acoustic Tile (Pinholes), 6th Floor	None Detected - Acoustic Tile
101	2' x 2' Suspended Acoustic Tile (Pinholes), 5th Floor	None Detected - Acoustic Tile
102	Acoustic Texture, 6th Floor Foyer	None Detected - Acoustic Texture
103	Acoustic Texture, 7th Floor Foyer	None Detected - Acoustic Texture
104	Acoustic Texture, 5th Floor	None Detected - Acoustic Texture
105	Carpet Mastic (Yellow), 6th Floor Foyer	None Detected - Yellow Mastic
106	Carpet Mastic (Yellow), 7th Floor Foyer	None Detected - Yellow Mastic
107	Carpet Mastic (Yellow), 1st Floor Hall	None Detected - Yellow Mastic

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Client :	Enprotec / Hibbs & Todd, Inc. - Abilene	Lab Job No. :	18B-10838
Project :	HHS, 301 Cypress	Report Date :	08/24/2018
Project # :	5717	Sample Date :	08/20/2018
Identification :	Asbestos, Bulk Sample Analysis		
Test Method :	Polarized Light Microscopy / Dispersion Staining (PLM/DS) EPA Method 600 / R-93 / 116		

On 8/22/2018, one hundred seven (107) bulk material samples were submitted by Mark McHan of Enprotec / Hibbs & Todd, Inc. - Abilene for asbestos analysis by PLM/DS. The PLM Detail Report is attached; additional information may be found therein. The results are summarized below:

Sample Number	Client Sample Description / Location	Asbestos Content

These samples were analyzed by layers. Quantification, unless otherwise noted, is performed by calibrated visual estimate. The test report shall not be reproduced, except in full, without written approval of the laboratory. The results relate only to the items tested. These test results do not imply endorsement by NVLAP or any agency of the U.S. Government. Accredited by the National Voluntary Laboratory Accreditation Program for Bulk Asbestos Fiber Analysis under Lab Code 102056-0.

NVLAP® LAB #102056-0

Analyst(s): Daniel Farley

Lab Manager : Heather Lopez — Approved Signatory : Heather Lopez

Lab Director : Bruce Crabb — Approved Signatory : Bruce Crabb

Thank you for choosing Moody Labs

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PLM Detail Report

Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
TDSHS License No. 30-0084

Client : Enprotec / Hibbs & Todd, Inc. - Abilene
Project : HHS, 301 Cypress
Project # : 5717

Lab Job No. : 18B-10838
Report Date : 08/24/2018

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
001	Drywall Material (Light Pink)	35%	Glass Wool Fibers	2%	08/23	DF
			Mica	1%		
			Gypsum / Binders	97%		
	DW Paper Facing (Tan)	20%	Cellulose Fibers	100%		
	Joint Compound (White)	35%	Calcite / Talc / Binders	100%		
	Wall Covering (White)	10%	Synthetic Fibers	15%		
			Cotton Fibers	15%		
			Vinyl Binders	70%		
002	Drywall Material (Light Pink)	55%	Glass Wool Fibers	2%	08/23	DF
			Mica	1%		
			Gypsum / Binders	97%		
	DW Paper Facing (Tan)	20%	Cellulose Fibers	100%		
	Wall Covering (Red)	25%	Synthetic Fibers	15%		
			Cotton Fibers	15%		
			Vinyl Binders	70%		
	No Joint Compound					
003	Drywall Material (Light Pink)	35%	Glass Wool Fibers	2%	08/23	DF
			Mica	1%		
			Gypsum / Binders	97%		
	DW Paper Facing (Tan)	20%	Cellulose Fibers	100%		
	Joint Compound (White)	25%	Calcite / Talc / Binders	100%		
	Wall Covering (White)	20%	Synthetic Fibers	15%		
			Cotton Fibers	15%		
			Vinyl Binders	70%		

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Project : HHS, 301 Cypress
Project # : 5717

Lab Job No. : 18B-10838
Report Date : 08/24/2018

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
004	Drywall Material (Light Pink)	50%	Glass Wool Fibers	2%	08/23	DF
			Mica	1%		
			Gypsum / Binders	97%		
	DW Paper Facing (Tan)	20%	Cellulose Fibers	100%		
	Joint Compound (White)	10%	Calcite / Talc / Binders	100%		
	Wall Covering (White)	20%	Synthetic Fibers	15%		
			Cotton Fibers	15%		
			Vinyl Binders	70%		
005	Drywall Material (Light Pink)	60%	Glass Wool Fibers	2%	08/23	DF
			Mica	1%		
			Gypsum / Binders	97%		
	DW Paper Facing (Tan)	10%	Cellulose Fibers	100%		
	Wall Covering (White)	30%	Synthetic Fibers	15%		
			Cotton Fibers	15%		
			Vinyl Binders	70%		
	No Joint Compound					
006	Drywall Material (Off-White)	60%	Glass Wool Fibers	2%	08/23	DF
			Mica	1%		
			Gypsum / Binders	97%		
	DW Paper Facing (Tan)	10%	Cellulose Fibers	100%		
	Wall Covering (White)	30%	Synthetic Fibers	15%		
			Cotton Fibers	15%		
			Vinyl Binders	70%		
	No Joint Compound					

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Project : HHS, 301 Cypress
Project # : 5717

Lab Job No. : 18B-10838
Report Date : 08/24/2018

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
007	Drywall Material (Light Pink)	60%	Glass Wool Fibers	2%	08/23	DF
			Mica	1%		
			Gypsum / Binders	97%		
	DW Paper Facing (Tan)	10%	Cellulose Fibers	100%		
	Wall Covering (White)	30%	Synthetic Fibers	15%		
			Cotton Fibers	15%		
			Vinyl Binders	70%		
	No Joint Compound					
008	Joint Compound (White)	100%	Calcite / Talc / Binders	100%	08/23	DF
009	Joint Compound (White)	65%	Calcite / Talc / Binders	100%	08/23	DF
	DW Tape (White)	35%	Cellulose Fibers	100%		
010	Joint Compound (White)	100%	Calcite / Talc / Binders	100%	08/23	DF
011	Joint Compound (White)	100%	Calcite / Talc / Binders	100%	08/23	DF
012	Drywall Material (Light Pink)	35%	Glass Wool Fibers	2%	08/23	DF
			Gypsum / Binders	98%		
	DW Paper / Tape (Tan / White)	15%	Cellulose Fibers	100%		
	Joint Compound (White)	50%	Calcite / Talc / Binders	100%		
013	Joint Compound (White)	50%	Calcite / Talc / Binders	100%	08/23	DF
	Yellow Mastic (Yellow)	10%	Glue Binders	100%		
	Brown Mastic (Brown)	40%	Glue Binders	100%		
014	Joint Compound (White)	100%	Calcite / Talc / Binders	100%	08/23	DF
015	Floor Tile (Light Tan)	95%	Chrysotile	10%	08/23	DF
			Calcite / Vinyl Binders	90%		
	Black Mastic (Black)	5%	Chrysotile	10%		
			Tar Binders	90%		
016	Floor Tile (Light Tan)	95%	Chrysotile	10%	08/23	DF
			Calcite / Vinyl Binders	90%		
	Black Mastic (Black)	5%	Chrysotile	10%		
			Tar Binders	90%		

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Project : HHS, 301 Cypress
Project # : 5717

Lab Job No. : 18B-10838
Report Date : 08/24/2018

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
017	Floor Tile (Light Tan)	95%	Chrysotile	10%	08/23	DF
			Calcite / Vinyl Binders	90%		
	Black Mastic (Black)	5%	Chrysotile	10%		
			Tar Binders	90%		
018	Acoustic Tile (Off-White)	100%	Mineral Wool Fibers	95%	08/23	DF
			Binders / Fillers	5%		
019	Acoustic Tile (Off-White)	100%	Mineral Wool Fibers	95%	08/23	DF
			Binders / Fillers	5%		
020	Acoustic Tile (Off-White)	100%	Mineral Wool Fibers	95%	08/23	DF
			Binders / Fillers	5%		
021	Acoustic Tile (Tan)	80%	Wood Fibers	100%	08/23	DF
	Brown Mastic (Brown)	20%	Glue Binders	100%		
022	Acoustic Tile (Tan)	80%	Wood Fibers	100%	08/23	DF
	Brown Mastic (Brown)	20%	Chrysotile	2%		
			Glue Binders	98%		
023	Acoustic Tile (Tan)	80%	Wood Fibers	100%	08/23	DF
	Brown Mastic (Brown)	20%	Glue Binders	100%		
024	Acoustic Tile (Tan)	80%	Wood Fibers	100%	08/23	DF
	Brown Mastic (Brown)	20%	Glue Binders	100%		
025	Yellow Mastic (Yellow)	15%	Glue Binders	100%	08/23	DF
	Green Mastic (Green)	85%	Glue Binders	100%		
026	Green Mastic (Green)	100%	Glue Binders	100%	08/23	DF
027	Green Mastic (Green)	100%	Glue Binders	100%	08/23	DF
028	Cove Base (Grey)	97%	Calcite / Vinyl Binders	100%	08/23	DF
	Yellow Mastic (Yellow)	3%	Glue Binders	100%		
	Brown Mastic (Brown)	<1%	Glue Binders	100%		
029	Cove Base (Grey)	95%	Calcite / Vinyl Binders	100%	08/23	DF
	Yellow Mastic (Yellow)	5%	Glue Binders	100%		

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Lab Job No. : 18B-10838
Report Date : 08/24/2018

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
030	Cove Base (Grey)	96%	Calcite / Vinyl Binders	100%	08/23	DF
	Yellow Mastic (Yellow)	2%	Glue Binders	100%		
	Brown Mastic (Brown)	2%	Glue Binders	100%		
031	Thermal Insulation (Yellow)	95%	Mineral Wool Fibers	95%	08/23	DF
			Resin Binders	5%		
	Paper / Foil Wrap (Tan / Silver)	5%	Cellulose Fibers	60%		
			Glass Wool Fibers	20%		
			Metal Foil	20%		
032	Thermal Insulation (Yellow)	80%	Mineral Wool Fibers	95%	08/23	DF
			Resin Binders	5%		
	Paper / Foil Wrap (Tan / Silver)	15%	Cellulose Fibers	60%		
			Glass Wool Fibers	20%		
			Metal Foil	20%		
	White Mastic (White)	5%	Chrysotile	10%		
			Binders / Fillers	90%		
033	Thermal Insulation (Yellow)	80%	Mineral Wool Fibers	95%	08/23	DF
			Resin Binders	5%		
	Paper / Foil Wrap (Tan / Silver)	15%	Cellulose Fibers	60%		
			Glass Wool Fibers	20%		
			Metal Foil	20%		
	White Mastic (White)	5%	Chrysotile	10%		
			Binders / Fillers	90%		
034	Thermal Insulation (Yellow)	60%	Mineral Wool Fibers	95%	08/23	DF
			Resin Binders	5%		
	Glass Fiber Mesh (White)	35%	Glass Wool Fibers	100%		
	White Mastic (White)	5%	Chrysotile	10%		
			Binders / Fillers	90%		

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Project : HHS, 301 Cypress
Project # : 5717

Lab Job No. : 18B-10838
Report Date : 08/24/2018

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
035	Thermal Insulation (Yellow)	60%	Mineral Wool Fibers	95%	08/23	DF
			Resin Binders	5%		
	Glass Fiber Mesh (White)	35%	Glass Wool Fibers	100%		
	White Mastic (White)	5%	Chrysotile	10%		
			Binders / Fillers	90%		
036	Thermal Insulation (Yellow)	40%	Mineral Wool Fibers	95%	08/23	DF
			Resin Binders	5%		
	Glass Fiber Mesh (White)	55%	Glass Wool Fibers	100%		
	White Mastic (White)	5%	Chrysotile	10%		
			Binders / Fillers	90%		
037	Plaster (Beige)	100%	Aggregate	65%	08/23	DF
			Calcite / Binders	35%		
038	Plaster (Beige)	100%	Aggregate	65%	08/23	DF
			Calcite / Binders	35%		
039	Plaster (Beige)	100%	Aggregate	65%	08/23	DF
			Calcite / Binders	35%		
040	Plaster (Beige)	100%	Aggregate	65%	08/23	DF
			Calcite / Binders	35%		
041	Plaster (Beige)	100%	Aggregate	65%	08/23	DF
			Calcite / Binders	35%		
042	Plaster (Beige)	100%	Aggregate	65%	08/23	DF
			Calcite / Binders	35%		
043	Plaster (Beige)	100%	Aggregate	65%	08/23	DF
			Calcite / Binders	35%		
044	Cove Base (Blue)	95%	Calcite / Vinyl Binders	100%	08/23	DF
	Brown Mastic (Brown)	5%	Glue Binders	100%		
045	Cove Base (Brown)	95%	Calcite / Vinyl Binders	100%	08/23	DF
	Brown Mastic (Brown)	5%	Glue Binders	100%		

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Project : HHS, 301 Cypress
Project # : 5717

Lab Job No. : 18B-10838
Report Date : 08/24/2018

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
046	Cove Base (Black)	98%	Calcite / Vinyl Binders	100%	08/23	DF
	Yellow Mastic (Yellow)	2%	Calcite	40%		
			Glue Binders	60%		
047	Green Mastic (Green)	4%	Glue Binders	100%	08/23	DF
	Floor Tile (Light Tan)	91%	Chrysotile	5%		
			Calcite / Vinyl Binders	95%		
	Black Mastic (Black)	5%	Chrysotile	10%		
			Tar Binders	90%		
048	Yellow Mastic (Yellow)	4%	Glue Binders	100%	08/23	DF
	Floor Tile (Light Tan)	94%	Chrysotile	3%		
			Calcite / Vinyl Binders	97%		
	Yellow Mastic (Yellow)	2%	Glue Binders	100%		
049	Blue Mastic (Blue)	3%	Quartz	5%	08/23	DF
			Glue Binders	95%		
	Yellow Mastic (Yellow)	3%	Glue Binders	100%		
	Floor Tile (Light Tan)	93%	Chrysotile	3%		
			Calcite / Vinyl Binders	97%		
	Black Mastic (Black)	1%	Chrysotile	5%		
			Tar Binders	95%		
050	Thermal Insulation (Yellow)	40%	Mineral Wool Fibers	95%	08/23	DF
			Resin Binders	5%		
	Paper / Foil Wrap (White / Silver)	60%	Cellulose Fibers	60%		
			Glass Wool Fibers	20%		
			Metal Foil	20%		

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Project : HHS, 301 Cypress
Project # : 5717

Lab Job No. : 18B-10838
Report Date : 08/24/2018

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
051	Thermal Insulation (Yellow)	55%	Mineral Wool Fibers	95%	08/23	DF
			Resin Binders	5%		
	Paper / Foil Wrap (White / Silver)	40%	Cellulose Fibers	60%		
			Glass Wool Fibers	20%		
			Metal Foil	20%		
	White Mastic (Off-White)	5%	Chrysotile	10%		
			Binders / Fillers	90%		
052	Thermal Insulation (Yellow)	55%	Mineral Wool Fibers	95%	08/23	DF
			Resin Binders	5%		
	Paper / Foil Wrap (White / Silver)	40%	Cellulose Fibers	60%		
			Glass Wool Fibers	20%		
			Metal Foil	20%		
	White Mastic (Off-White)	5%	Chrysotile	10%		
			Binders / Fillers	90%		
053	Thermal Insulation (Yellow)	55%	Mineral Wool Fibers	95%	08/23	DF
			Resin Binders	5%		
	Glass Fiber Mesh (White)	40%	Glass Wool Fibers	100%		
	White Mastic (Off-White)	5%	Chrysotile	10%		
			Binders / Fillers	90%		
054	Thermal Insulation (Light Grey)	70%	Cellulose Fibers	15%	08/23	DF
			Glass Wool Fibers	5%		
			Binders / Fillers	80%		
	White Mastic (Off-White)	30%	Chrysotile	10%		
			Binders / Fillers	90%		
055	Thermal Insulation (Yellow)	55%	Mineral Wool Fibers	95%	08/23	DF
			Resin Binders	5%		
	Glass Fiber Mesh (White)	40%	Glass Wool Fibers	100%		
	White Mastic (Off-White)	5%	Chrysotile	10%		
			Binders / Fillers	90%		

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Lab Job No. : 18B-10838
Report Date : 08/24/2018

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
056	Red Concrete (Red)	35%	Chrysotile	3%	08/23	DF
			Aggregate	62%		
			Cement Binders	35%		
	Grey Concrete (Grey)	62%	Chrysotile	3%		
			Aggregate	62%		
			Cement Binders	35%		
	Black Mastic (Black)	3%	Chrysotile	5%		
			Tar Binders	95%		
057	Concrete (Red)	97%	Chrysotile	3%	08/23	DF
			Aggregate	62%		
			Cement Binders	35%		
	Yellow Mastic (Yellow)	3%	Calcite	20%		
			Glue Binders	80%		
058	Concrete (Red)	100%	Cellulose Fibers	3%	08/23	DF
			Aggregate	62%		
			Cement Binders	35%		
059	Black Mastic (Black)	1%	Chrysotile	5%	08/23	DF
			Tar Binders	95%		
	Sheet Flooring (Brown)	89%	Cellulose Fibers	15%		
			Calcite / Vinyl Binders	85%		
	Fiber Backing (Tan)	4%	Jute Fibers	100%		
	Yellow Mastic (Yellow)	1%	Glue Binders	100%		
	Felt (Grey)	5%	Cellulose Fibers	100%		
060	Sheet Flooring (Brown)	89%	Cellulose Fibers	15%	08/23	DF
			Calcite / Vinyl Binders	85%		
	Fiber Backing (Tan)	4%	Jute Fibers	100%		
	Yellow Mastic (Yellow)	2%	Glue Binders	100%		
	Felt (Black)	5%	Cellulose Fibers	85%		
			Tar Binders	15%		

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Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
061	Yellow Mastic (Yellow)	3%	Glue Binders	100%	08/23	DF
	Sheet Flooring (Brown)	87%	Cellulose Fibers	15%		
			Calcite / Vinyl Binders	85%		
	Fiber Backing (Tan)	4%	Jute Fibers	100%		
	Yellow Mastic (Yellow)	1%	Glue Binders	100%		
	Felt (Grey)	5%	Cellulose Fibers	100%		
062	Ceramic Tile (White)	96%	Sintered Clays	100%	08/23	DF
	Grout (White)	2%	Calcite / Binders	100%		
	Adhesive (Yellow)	2%	Glue Binders	100%		
063	Ceramic Tile (White)	96%	Sintered Clays	100%	08/23	DF
	Grout (White)	2%	Calcite / Binders	100%		
	Adhesive (Yellow)	2%	Glue Binders	100%		
064	Ceramic Tile (White)	97%	Sintered Clays	100%	08/23	DF
	Grout (White)	2%	Calcite / Binders	100%		
	Adhesive (Yellow)	1%	Glue Binders	100%		
065	Ceramic Tile (White)	80%	Sintered Clays	100%	08/23	DF
	Grout (Grey)	10%	Aggregate	65%		
			Cement Binders	35%		
	Mortar (Grey)	10%	Aggregate	65%		
			Cement Binders	35%		
066	Ceramic Tile (White)	80%	Sintered Clays	100%	08/23	DF
	Grout (Grey)	10%	Aggregate	65%		
			Cement Binders	35%		
	Mortar (Grey)	10%	Aggregate	65%		
			Cement Binders	35%		
067	Ceramic Tile (White)	85%	Sintered Clays	100%	08/23	DF
	Grout (Grey)	5%	Aggregate	65%		
			Cement Binders	35%		
	Mortar (Grey)	10%	Aggregate	65%		
			Cement Binders	35%		

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Report Date : 08/24/2018

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
068	Floor Tile (Grey)	97%	Chrysotile	5%	08/23	DF
			Calcite / Vinyl Binders	95%		
	Yellow Mastic (Yellow)	3%	Glue Binders	100%		
069	Floor Tile (Grey)	99%	Chrysotile	5%	08/23	DF
			Calcite / Vinyl Binders	95%		
	Yellow Mastic (Yellow)	1%	Glue Binders	100%		
070	Floor Tile (Grey)	100%	Chrysotile	5%	08/23	DF
			Calcite / Vinyl Binders	95%		
	No Mastic					
071	CMU (Grey)	98%	Aggregate	65%	08/23	DF
			Cement Binders	35%		
	Paint (Off-White)	2%	Pigment / Binders	100%		
072	CMU (Grey)	98%	Aggregate	65%	08/23	DF
			Cement Binders	35%		
	Paint (Off-White)	2%	Pigment / Binders	100%		
073	CMU (Grey)	97%	Aggregate	65%	08/23	DF
			Cement Binders	35%		
	Texture (White)	2%	Calcite / Talc / Binders	100%		
	Paint (Off-White)	1%	Pigment / Binders	100%		
074	Plaster (White)	100%	Calcite / Binders	100%	08/23	DF
075	White Plaster (White)	85%	Calcite / Binders	100%	08/23	DF
	Beige Plaster (Beige)	15%	Aggregate	65%		
			Calcite / Binders	35%		
076	Plaster (White)	100%	Calcite / Binders	100%	08/23	DF
077	Yellow Mastic (Yellow)	100%	Glue Binders	100%	08/23	DF
078	Yellow Mastic (Yellow)	100%	Glue Binders	100%	08/23	DF
079	Yellow Mastic (Yellow)	100%	Glue Binders	100%	08/23	DF

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NVLAP Lab Code 102056-0
TDSHS License No. 30-0084

Client : Enprotec / Hibbs & Todd, Inc. - Abilene
Project : HHS, 301 Cypress
Project # : 5717

Lab Job No. : 18B-10838
Report Date : 08/24/2018

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
080	Black Concrete (Black)	80%	Chrysotile	3%	08/23	DF
			Aggregate	62%		
			Cement Binders	35%		
	Grey Concrete (Grey)	20%	Chrysotile	5%		
			Aggregate	60%		
			Cement Binders	35%		
081	Concrete (Black)	100%	Cellulose Fibers	3%	08/23	DF
			Aggregate	62%		
			Cement Binders	35%		
082	Concrete (Black)	100%	Cellulose Fibers	3%	08/23	DF
			Aggregate	62%		
			Cement Binders	35%		
083	Cove Base (Grey)	96%	Calcite / Vinyl Binders	100%	08/23	DF
	Clear Mastic (Clear)	1%	Glue Binders	100%		
	Brown Mastic (Brown)	1%	Glue Binders	100%		
	White Mastic (White)	2%	Calcite	50%		
			Binders / Fillers	50%		
084	Cove Base (Grey)	96%	Calcite / Vinyl Binders	100%	08/23	DF
	Brown Mastic (Brown)	2%	Glue Binders	100%		
	White Mastic (White)	2%	Calcite	50%		
			Binders / Fillers	50%		
085	Cove Base (Grey)	95%	Calcite / Vinyl Binders	100%	08/23	DF
	Clear Mastic (Clear)	1%	Glue Binders	100%		
	Brown Mastic (Brown)	2%	Glue Binders	100%		
	White Mastic (White)	2%	Calcite	50%		
			Binders / Fillers	50%		
086	Plaster (White)	100%	Calcite / Binders	100%	08/23	DF

Moody Labs
2051 Valley View Lane
Farmers Branch, TX 75234 Phone: (972) 241-8460

PLM Detail Report

Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
TDSHS License No. 30-0084

Client : Enprotec / Hibbs & Todd, Inc. - Abilene
Project : HHS, 301 Cypress
Project # : 5717

Lab Job No. : 18B-10838
Report Date : 08/24/2018

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
087	White Plaster (White)	85%	Calcite / Binders	100%	08/23	DF
	Beige Plaster (Beige)	15%	Aggregate	65%		
			Calcite / Binders	35%		
088	White Plaster (White)	97%	Calcite / Binders	100%	08/23	DF
	Beige Plaster (Beige)	3%	Aggregate	65%		
			Calcite / Binders	35%		
089	White Plaster (White)	15%	Calcite / Binders	100%	08/23	DF
	Beige Plaster (Beige)	85%	Aggregate	65%		
			Calcite / Binders	35%		
090	White Plaster (White)	98%	Calcite / Binders	100%	08/23	DF
	Beige Plaster (Beige)	2%	Aggregate	65%		
			Calcite / Binders	35%		
091	White Plaster (White)	100%	Calcite / Binders	100%	08/23	DF
092	White Plaster (White)	100%	Calcite / Binders	100%	08/23	DF
093	Drywall Material (Light Pink)	40%	Cellulose Fibers	5%	08/23	DF
			Gypsum / Binders	95%		
	DW Paper / Tape (Tan / White)	15%	Cellulose Fibers	100%		
	Joint Compound (White)	25%	Calcite / Talc / Binders	100%		
	Texture (White)	20%	Calcite / Talc / Binders	100%		
094	Drywall Material (Off-White)	25%	Glass Wool Fibers	2%	08/23	DF
			Mica	1%		
			Gypsum / Binders	97%		
	DW Paper Facing (Tan)	15%	Cellulose Fibers	100%		
	Texture / Joint Cmpd (White)	60%	Calcite / Talc / Binders	100%		

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PLM Detail Report

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NVLAP Lab Code 102056-0
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Client : Enprotec / Hibbs & Todd, Inc. - Abilene
Project : HHS, 301 Cypress
Project # : 5717

Lab Job No. : 18B-10838
Report Date : 08/24/2018

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
095	Drywall Material (Light Pink)	65%	Glass Wool Fibers	2%	08/23	DF
			Mica	1%		
			Gypsum / Binders	97%		
	DW Paper / Tape (Tan / White)	15%	Cellulose Fibers	100%		
	Joint Compound (White)	10%	Calcite / Talc / Binders	100%		
	Texture (White)	10%	Calcite / Talc / Binders	100%		
096	Cove Base (Blue)	92%	Calcite / Vinyl Binders	100%	08/23	DF
	Yellow Mastic (Yellow)	4%	Calcite	40%		
			Glue Binders	60%		
	Brown Mastic (Brown)	4%	Glue Binders	100%		
097	Cove Base (Grey)	10%	Calcite / Vinyl Binders	100%	08/23	DF
	Yellow Mastic (Yellow)	45%	Calcite	40%		
			Glue Binders	60%		
	Brown Mastic (Brown)	45%	Glue Binders	100%		
098	Cove Base (Blue)	98%	Calcite / Vinyl Binders	100%	08/23	DF
	Yellow Mastic (Yellow)	2%	Glue Binders	100%		
099	Acoustic Tile (Light Grey)	100%	Cellulose Fibers	70%	08/23	DF
			Mineral Wool Fibers	5%		
			Perlite	25%		
100	Acoustic Tile (Light Grey)	100%	Cellulose Fibers	70%	08/23	DF
			Mineral Wool Fibers	5%		
			Perlite	25%		
101	Acoustic Tile (Light Grey)	100%	Cellulose Fibers	70%	08/23	DF
			Mineral Wool Fibers	5%		
			Perlite	25%		
102	Acoustic Texture (White)	100%	Synthetic Foam	30%	08/23	DF
			Calcite / Talc / Binders	70%		
103	Acoustic Texture (White)	100%	Synthetic Foam	30%	08/24	DF
			Calcite / Talc / Binders	70%		

Moody Labs
2051 Valley View Lane
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PLM Detail Report

Supplement to PLM Summary Report

NVLAP Lab Code 102056-0
TDSHS License No. 30-0084

Client : Enprotec / Hibbs & Todd, Inc. - Abilene
Project : HHS, 301 Cypress
Project # : 5717

Lab Job No. : 18B-10838
Report Date : 08/24/2018

Sample Number	Layer	% Of Sample	Components	% of Layer	Analysis Date	Analyst
104	Acoustic Texture (White)	100%	Synthetic Foam	30%	08/24	DF
			Calcite / Talc / Binders	70%		
105	Yellow Mastic (Yellow)	100%	Glue Binders	100%	08/24	DF
106	Yellow Mastic (Yellow)	100%	Glue Binders	100%	08/24	DF
107	Yellow Mastic (Yellow)	100%	Glue Binders	100%	08/24	DF

Moody Labs

Chain of Custody

Lab Job #
Lab Job # 18B-10880 PCM 107
Lab Job #

Please call in advance for immediate, after-hour, & weekend pricing & availability. Page 1 of 4

ASBESTOS PLM
Bulk ☐ Immediate ☐ 1 day ☒ 2 day ☐ 3 day ☐ 5 day
☒ **Analyze All** ☐ **Positive Stop**

PCM Air (7400)
☐ Immediate ☐ 1 day ☐ 2 day ☐ 3 day ☐ 5 day
Analyze Blanks ☐ **Yes** ☐ **No**

TOTAL DUST(0500/0600)
☐ 1 day ☐ 2 day

ASBESTOS TEM
Air AHERA Method ☐ Late Night* ☐ 6 hr ☐ 12 hr ☐ 24 hr
Air 7402 (Modified) ☐ 1 day ☐ 2 day ☐ 3 day
Bulk ☐ 1 day ☐ 2 day ☐ 3 day ☐ 5 day
Water/Wipe/Micro Vac ☐ 1 day ☐ 2 day ☐ 3 day
Analyze Blanks ☐ **Yes** ☐ **No**
*Late night analysis surcharges apply

MOLD
Direct Exam ☐ Immed ☐ 1 day ☐ 2 day ☐ 5 day
Standard Air ☐ Immed ☐ 1 day ☐ 2 day ☐ 5 day
Expanded Air ☐ Immed ☐ 1 day ☐ 2 day ☐ 5 day
Culture** ☐ 10-14 days
Analyze Blanks ☐ **Yes** ☐ **No**
****Turnaround of Culture Samples subject to Culture Growth****

BACTERIA**
Colony Counts (CC) ☐ 3 day ☐ 5 day
CC + Gram Stain ☐ 3 day ☐ 5 day
Coliform & E. coli (P/A) ☐ 2-3 day
Legionella ☐ 14 days

OTHER:

Billing Company / City: ENPROTEC / HIBBS & TODD, INC. / ABILENE
Submitter's Company: ENPROTEC / HIBBS & TODD, INC.
Submitter's Name: MARK MCHAN
Project: HHS, 301 Cypress
Contact Information: Name: MARK MCHAN
E-mail Results to: mark.mchan@e-ht.com
Invoice Address: 402 CEDAR, ABILENE, TEXAS 79601

# of Samples: 107
Sample Date: 8-20-18
Project #: 5717
Phone #: 325.698.5560
Mobile #: 325.665.7112
Fax #: 325.690.3240
P.O. #: 3097

Please review paperwork and samples before submitting to lab. Unsealed / improperly packaged / damaged / expired samples or excessive administrative requests may incur additional fees

Notes:

Sample #	Sample Description	Vol. / Area (if applicable)	Location / Notes
001	DWGB & Wall Covering		3rd Floor
002			2nd Floor
003			5th Floor
004			6th Floor
005			7th Floor
006			1st Floor
007			3rd Floor
008	Joint Compound		3rd Floor
009			2nd Floor
010			4th Floor
011			5th Floor
012			6th Floor
013			7th Floor
014			1st Floor
015	12"x12" Beige with Green Streaks RFT		3rd Floor

Released By:	Date / Time:	Received By:	Date / Time:
	8-21-18 1700		
Released By:	Date / Time:	Received By:	Date / Time:
			8/22/18 9:20a

Moody Labs **Chain of Custody**

Lab Job # 18B-10838
Lab Job #
Lab Job #

Project: HHS, 301 Cypress Project #: 5717

Sample #	Sample Description	Vol. / Area (if applicable)	Location / Notes
016	12"x12" Beige with Green Streaks MFT		3rd Floor
017	↓		↓
018	2'x2' SAT (Glazed)		3rd Floor
019	↓		2nd Floor
020	↓		4th Floor
021	1'x1' AAT & Brown Mastic		3rd Floor
022	↓		2nd Floor
023	↓		4th Floor
024	↓		1st Floor
025	Carpet Mastic (Green)		3rd Floor
026	↓		↓
027	↓		↓
028	Grey Cove Base & Mastic		3rd Floor
029	↓		↓
030	↓		↓
031	TPI, 1"		3rd Floor
032	↓		5th Floor
033	↓		7th Floor
034	TPFI, 1"		3rd Floor
035	↓		5th Floor
036	↓		7th Floor
037	Plaster (Rough Texture)		3rd Floor
038	↓		2nd Floor
039	↓		4th Floor
040	↓		5th Floor
041	↓		6th Floor
042	↓		7th Floor
043	↓		1st Floor
044	Brown Cove Base & Mastic		3rd Floor
045	↓		2nd Floor
046	↓		6th Floor

Moody Labs Chain of Custody

Lab Job #
Lab Job # 18B-10838
Lab Job #

Project: 7Hth, 301 Cypress

Project #: 5717

Sample #	Sample Description	Vol. / Area (if applicable)	Location / Notes
047	12"x12" White with Brown Streaks RFT		3rd Floor
048	↓		4th Floor
049	↓		3rd Floor
050	TPI, 4"		3rd Floor
051	↓		4th Floor
052	↓		5th Floor
053	TPFI, 4", Soft		3rd Floor
054	↓ , Hard		4th Floor
055	↓ , Soft		5th Floor
056	Red Concrete		3rd Floor
057	↓		2nd Floor
058	↓		4th Floor
059	Brown Composite Sheet Flooring		3rd Floor
060	↓		4th Floor
061	↓		6th Floor
062	4" Ceramic Tile, Grout, Adhesive		3rd Floor
063	↓		2nd Floor
064	↓		7th Floor
065	1" Ceramic Tile, Grout, Mortar		3rd Floor
066	↓		2nd Floor
067	↓		7th Floor
068	12"x12" Grey with White Streaks RFT		3rd Floor
069	↓		2nd Floor
070	↓		4th Floor
071	Painted CMU		3rd Floor
072	↓		2nd Floor
073	↓		4th Floor
074	Plaster Crown Molding		2nd Floor
075	↓		↓
076	↓		↓
077	Carpet Matte (Brown)		2nd Floor
078	↓		↓

Chain of Custody

Page 4 of 4

SMMS LABS

Lab Job # 18B-10830
Lab Job #
Lab Job #

Project: 1111 S, 301 Cypress Project #: 5717

Sample #	Sample Description	Vol. / Area if applicable	Location / Notes
079	Carpet Mastic (Brown)		2nd Floor
080	Dark Brown Concrete		2nd Floor
081	↓		4th Floor
082	↓		5th Floor
083	Greenish Grey Cove Base & Mastic		2nd Floor
084	↓		↓
085	↓		↓
086	Plaster (white, smooth)		2nd Floor
087	↓		5th Floor
088	↓		6th Floor
089	↓		7th Floor
090	↓		2nd Floor
091	↓		↓
092	↓		↓
093	DWGB & Texture		2nd Floor
094	↓		4th Floor
095	↓		1st Floor
096	Blue Cove Base & Mastic		5th Floor
097	↓		6th Floor
098	↓		5th Floor
099	2'x2' SAT (Pin Holes)		5th Floor
100	↓		6th Floor
101	↓		5th Floor
102	Acoustic Texture		6th Floor Foyer
103	↓		7th Floor Foyer
104	↓		5th Floor
105	Carpet Mastic (Yellow)		6th Floor Foyer
106	↓		7th Floor Foyer
107	↓		1st Floor Hall
108			
109			

Appendix C - License Documentation
Inspector's License Documents
Laboratory's License Documents

Texas Department of State Health Services

Asbestos Individual Consultant

MARK MCHAN
License No. 105642
Control No. 97407
Expiration Date: 7/18/2020



TEXAS DEPARTMENT OF STATE HEALTH SERVICES

STEVE MOODY MICRO SERVICES LLC

is certified to perform as a

Asbestos Laboratory
PCM, PLM, TEM

in the State of Texas within the purview of Texas Occupations Code, chapter 1954, so long as this license is not suspended or revoked and is renewed according to the rules adopted by the Texas Board of Health.

John Hellerstedt, M.D.
Commissioner of Health

License Number: 300084

Control Number: 96287

Expiration Date: 5/31/2020

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

APPENDIX III

LICENSES AND CERTIFICATIONS

Texas Department of State Health Services

PHASE ENGINEERING INC

is certified to perform as an

Asbestos Consultant Agency

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1954 and Title 12, Texas Administrative Code, Chapter 295 relating to Texas Asbestos Health Protection, as long as this license is not suspended or revoked.

License Number: 100224

Expiration Date: 12/26/2025

Jennifer Shuford, MD, MPH,
Commissioner of Health

Control Number: 97616

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

SEE BACK

TEXAS
Health and Human Services

Texas Department of State Health Services

Asbestos Individual Consultant

MATTHEW T WHITE

License Number: 105849

Control Number: 98494

Expiration Date: 27-Dec-2026



Texas Department of State Health Services

Asbestos Inspector

ROSS I DOCTOROFF

License No. **602189**

Control No. **100840**

Expiration Date: **6-Apr-2026**



Texas Department of State Health Services

MICRO ANALYTICAL SERVICES INC

is certified to perform as an

Asbestos Laboratory

PCM, PLM

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1954 and Title 12, Texas Administrative Code, Chapter 295 relating to Texas Asbestos Health Protection, as long as this license is not suspended or revoked.

License Number: 300341

Expiration Date: 01/25/2026

Jennifer Shuford, MD, MPH,
Commissioner of Health

Control Number: 96774

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

SEE BACK

APPENDIX IV

AGREEMENT FOR SERVICES

AGREEMENT FOR PROFESSIONAL ENVIRONMENTAL CONSULTING SERVICES

Section 1 – General Terms and Conditions

1.1 Definitions

"Agreement" means this Agreement for Professional Environmental Consulting Services.
"Party" (or collectively, "Parties") means Phase and Client, unless expressly stated otherwise in this Agreement.
"Phase" means Phase Engineering, LLC
"Engagement Letter" the instrument delivered by Phase to the Parties
"Services" has the meaning set forth in Section 1.2 below.
Any capitalized terms not otherwise defined in this Agreement have the meanings given to them under the Engagement Letter.

1.2 Services

The professional environmental consulting services to be provided by Phase for the Client are set forth in the Engagement Letter, and such services, including subsequent services, changed, altered or additional services are hereinafter called the "Services".

1.3 Standard of Care

Phase shall perform the services under this agreement with that degree of care, skill and diligence generally accepted as typical of the industry in the performance of such services as contemplated by the Agreement at the time and location such services are rendered. Phase shall employ only competent staff and sub-contractors who will be under the supervision of a senior member of Phase's staff.

1.4 Rights of Entry, Site Information and Utilities

The Client shall provide right of entry for Phase and its subcontractors to carry out the Services, unless specified otherwise in the Engagement Letter. The Client warrants that it has furnished to Phase all information known to, or in possession or control of, the Client relating to the past and existing conditions of the site, including but not limited to soil and geologic data, contaminants, wastes, petroleum products, controlled substances, hazardous materials, and subsurface utilities. The Client shall extend use and reliance of this information to Phase, unless stated otherwise and to the extent permitted by law. Such information shall be and remain confidential as between the Client and Phase and Phase shall not disclose same to any third party unless required by law.

1.5 Safety

1.5.1 Phase maintains a General Health and Safety Plan, a copy of which will be provided to the Client on written request and will fall under Section 1.8 Subsequent Changes of this Agreement unless this service is included in the Engagement Letter.

1.5.2 Phase shall take every precaution reasonable in the circumstances for the protection of the workers providing any of the Services. When required and prior to any field work being carried out, Phase shall provide the Client with a comprehensive site-specific safety plan for providing the Services. Such request must be made in writing by the Client prior to commencement of the Services by Phase and will fall under Section 1.9 Subsequent Changes of this Agreement unless included in the Engagement Letter.

1.6 Investigations and Reports

1.6.1 Findings: The findings of any investigation undertaken as part of the Services will be based upon information generated as a result of the specific scope of the Services as described in the Engagement Letter.

1.6.2 Restoration: The Client accepts that in the normal course of the Services some damage to existing ground or other surface finishes may occur, the restoration of which shall be the responsibility of the client or as specified in the Engagement Letter.

1.6.3 Investigations: The parties acknowledge and accept that unique risks exist whenever engineering or related disciplines are applied to identify environmental conditions and even a comprehensive sampling and testing program may fail to detect certain conditions. Because of the inherent uncertainties in environmental evaluations, changed or unanticipated conditions may occur or become known subsequent to Phase's investigation that could affect conclusions, recommendations, total Project cost and/or execution. Changes in conditions are subject to amendments to the Scope of Services.

1.6.4 Confidentiality and Reliance: Any Final Report or draft reports and the information contained therein shall be treated as confidential and, unless otherwise agreed to by Phase and the Client, the information, sampling data, analysis, findings, conclusions and recommendations (if any), may be used and relied upon only by the Client, its officers, directors and employees and professional advisors in the performance of their obligations for or on behalf of the Client. Any such use and reliance shall be subject to the limitations set forth in this agreement. In addition, the Client may submit any report to a regulatory authority or lender for the purpose of obtaining financing on a property.

1.6.5 Third Party Reliance: This Agreement and the Services provided are for Consultant and Client's sole benefit and exclusive use with no third party beneficiaries intended. Reliance upon the Services and any work product is limited to Client, and is not intended for third parties. In the event Phase agrees, in its sole and absolute discretion, to make the Report available to a third party not mentioned in Paragraph 1.6.4, the Third Party shall be required to obtain the original Clients release, sign Phase's standard Authorized User Agreement (AUA) and pay Phase a fee of not less than $350.00. Any such use shall be subject to the terms, conditions and limitations set forth in this Agreement, the Report and the AUA.

1.7 Ownership of Records/Reports:

All documents or records created or prepared by Phase in the performance of the Services are considered Phase's professional work product and shall remain the copyright property of Phase, subject to any reasonable disclosure request from the Client as may be necessary and for which reasonable reimbursement for copies is provided.

1.8 Disposal and Samples

1.8.1 Disposal of all wastes generated from the subject property shall be the responsibility of the Client.

1.8.2 Phase shall be responsible for appropriate disposal of sample material and sample residuals after 30 days following submission of the FinalReport unless the Client specifically requests otherwise.

1.9 Subsequent Changes
With the consent of Phase, the Client may in writing at any time after the execution of this Agreement or the commencement of the Services delete, extend, increase, vary or otherwise alter the Services. The Parties further agree that such changes shall alter the Services, schedule and/or the costs. Any such changes shall be made in writing with reference to this Agreement, and accepted in writing by both Parties.

1.10 Delays
Neither Party shall be liable or penalized for delays or failure to perform its Services if the same is caused directly or indirectly by circumstances beyond a Party's reasonable control. The Client shall not hold Phase responsible for damages or delays in performance caused by the Client, acts of God, acts and/or omissions of governmental authorities and regulatory agencies or other events which are beyond the reasonable control of the Parties.

1.11 Payment
1.11.1 Phase shall invoice the Client in accordance with the provisions set forth in the Engagement Letter. Except as stated in the Engagement Letter, the Client shall pay to Phase at its corporate office each invoice within 30 days of the date of the invoice without holdback. Interest at a rate of 10% per year or the maximum rate allowed by law, whichever is lower, may be charged on all overdue amounts.
1.11.2 In the event of a disputed billing, only the disputed portion will be withheld from payment, and the undisputed portion will be paid. The Client shall exercise reasonableness in disputing any bill or portion thereof. No interest will accrue on any disputed portion of the billing until mutually resolved.
1.11.3 If the Client fails to make payment of any sum due hereunder within a reasonable time period, Client acknowledges and agrees that the subject Invoice will be referred to legal collections, and any amount in aggregate less than Ten Thousand Dollars U.S. ($10,000) will be referred to small claims court in Harris County, Texas.

1.12 Suspension or Termination
The Client may at any time by notice in writing to Phase, suspend or terminate the Services or any portion thereof at any stage of the Project. Upon receipt of such written notice by the Client, Phase shall perform no further Services other than those reasonably necessary to close out its Services. In such an event, Phase shall invoice the Client for the portion of the Services completed and shall be entitled to payment in accordance with Section 1.9. Once the Services are completed the Client assumes the risk of Frustration of Purpose.

1.13 Insurance
1.13.1 Phase agrees to carry and maintain the following **minimum** insurance coverages for the term of this Agreement:
Worker's Compensation Insurance: Statutory requirement amounts
Commercial General Liability: $1,000,000 per occurrence
Automobile Liability Insurance: $1,000,000 per occurrence for both owned and non-owned vehicles
Umbrella Liability (including Professional Liability and Contractors Professional Insurance): $10,000,000 aggregate

1.13.2 Phase's current Certificate of Insurance is provided with the Engagement Letter. If the Client requests to be a named as a certificate holder,
this request must be made in writing to Phase prior to commencement of the Services.
1.13.3 Phase will renew the Professional Liability Insurance at or above the minimum coverage for period of two (2) years after completion of the Services.
1.13.4 If the Client requests that Phase increase the amount of insurance coverage or obtain other special insurance for the Project, Phase shall endeavor forthwith to obtain such increased or special insurance at the Client's expense.
1.13.5 Each of Phase and Client waive all claims, losses, damages and rights of recovery against the other to extent of the limits of coverage under any commercial general liability or property insurance policy actually obtained by a Party to this Agreement (or, in the case of Phase, to the extent obtained or required to be obtained by Phase under this Agreement). In addition, each Party shall exercise commercially reasonable efforts to cause to waive subrogation under its commercial general liability and property insurance policies and provide any necessary endorsements thereto.

1.14 Indemnity/Statute of Limitations.
EACH OF Phase AND CLIENT SHALL INDEMNIFY AND HOLD HARMLESS THE OTHER AND THEIR RESPECTIVE AGENTS, EMPLOYEES, SUCCESSORS AND ASSIGNS FROM AND AGAINST LEGAL LIABILITY FOR CLAIMS, LOSSES, DAMAGES, AND EXPENSES TO THE EXTENT SUCH CLAIMS, LOSSES, DAMAGES, OR EXPENSES ARE LEGALLY DETERMINED TO BE CAUSED BY THEIR NEGLIGENT ACTS, ERRORS, OR OMISSIONS. IN THE EVENT SUCH CLAIMS, LOSSES, DAMAGES, OR EXPENSES ARE LEGALLY DETERMINED TO BE CAUSED BY THE JOINT OR CONCURRENT NEGLIGENCE OF Phase AND CLIENT, THE PARTIES SHALL BEAR LIABILITY IN PROPORTION TO ITS OWN NEGLIGENCE UNDER COMPARATIVE FAULT PRINCIPLES. NEITHER PARTY SHALL HAVE A DUTY TO DEFEND THE OTHER PARTY, AND NO DUTY TO DEFEND IS HEREBY CREATED BY THIS INDEMNITY PROVISION AND SUCH DUTY IS EXPLICITLY WAIVED UNDER THIS AGREEMENT. CAUSES OF ACTION ARISING OUT OF Phase's SERVICES OR THIS AGREEMENT, REGARDLESS OF CAUSE OR THE THEORY OF LIABILITY, INCLUDING NEGLIGENCE, INDEMNITY OR OTHER RECOVERY, SHALL BE DEEMED TO HAVE ACCRUED AND THE APPLICABLE STATUTE OF LIMITATIONS SHALL COMMENCE TO RUN NO LATER THAN THE DATE OF Phase's SUBSTANTIAL COMPLETION OF SERVICES ON THE PROJECT.

1.15 Limitation of Liability.
1.15.1 Notwithstanding any other provisions contained herein, it is understood and agreed that Phase's liability to the Client for all claims arising out of this Agreement, or in any way relating to the Services, will be limited to direct damages and/or to the specific performance of any Services not meeting the Standard of Care set forth herein and such liability will, in the aggregate, not exceed the sum of the coverages shown on Phase's Certificate of Insurance in effect at the time of the claim.
1.15.2 No claim may be brought against Phase more than Two (2) years after the Services were completed under this Agreement, or as negotiated between Phase and the Client.

1.15.3. **TO THE FULLEST EXTENT PERMITTED BY LAW, THE TOTAL AGGREGATE LIABILITY OF Phase (AND ITS DIRECTORS, EMPLOYEES, AGENTS AND AFFILIATES) TO CLIENT AND THIRD PARTIES GRANTED RELIANCE IS LIMITED TO THE GREATER OF $50,000 OR Phase's FEE FOR ANY AND ALL INJURIES, DAMAGES, CLAIMS, LOSSES, OR EXPENSES (INCLUDING ATTORNEYAND EXPERT FEES) ARISING OUT OF Phase's SERVICES OR THIS AGREEMENT. THIS LIMITATION SHALL APPLY REGARDLESS OF AVAILABLE PROFESSIONAL LIABILITY INSURANCE COVERAGE, CAUSE OR THE THEORY OF LIABILITY, INCLUDING NEGLIGENCE, INDEMNITY, OR OTHER RECOVERY; PROVIDED, HOWEVER, THAT THIS LIMITATION SHALL NOT APPLY TO THE EXTENT OF ANY AVAILABLE COVERAGE UNDER Phase's COMMERCIAL GENERAL LIABILITY POLICY.**

1.16 Consequential Damages.
EXCEPT AS EXPRESSLY PROVIDED IN THIS AGREEMENT, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR LOSS OF PROFITS OR REVENUE, LOSS OF USE OR OPPORTUNITY, LOSS OF GOOD WILL, COST OF SUBSTITUTE FACILITIES, GOODS, OR SERVICES, COST OF CAPITAL, OR FOR ANY SPECIAL, CONSEQUENTIAL, INDIRECT, PUNITIVE, OR EXEMPLARY DAMAGES.

1.17 Regulatory Reporting Requirements
Client recognizes that hazardous substances or contaminates may be discovered at the subject property in the course of provision of the Services by Phase under conditions that may be reportable to Federal or State environmental regulatory agencies. The "duty to report" is ultimately the responsibility of the landowner unless the condition represents an acute threat to human health or the environment. Phase will notify the Client of any such reportable condition. The Client will notify the Landowner, or under mutual agreement, authorize Phase to perform such notification to the landowner.

Section 2 – MISCELLANEOUS PROVISIONS

2.1 Notices:
All notices under this Agreement shall be in writing. It shall be sufficient in all respects if the Notice is delivered by hand, sent by any electronic means, including email or facsimile transmission, with confirmation ("Transmission") during normal business hours, or sent by registered mail, postage prepaid, addressed to the Parties shown on the Engagement Letter or to such other address as either Party shall designate by written notice to the other Party. Any notice so given shall be deemed to have been given and to have been received on the day of delivery, if so delivered, on the third Business Day (excluding each day during which there exists any interruption of postal services due to strike, lockout or other cause) following the mailing thereof, if so mailed, and on the day that notice was sent by Transmission, provided such day is a Business Day (a Business Day being any day of the week save and except for Saturday and Sunday) and if not, on the first Business Day thereafter.

2.2 Entire Agreement, Modifications, Headings, Severability:
The Parties acknowledge that this Agreement and the Engagement Letter constitutes the entire agreement between them and supersedes all prior representations, warranties, agreements, and understandings, oral or written, between the Parties with respect to its subject matter. Unless stated otherwise in this Agreement, this Agreement may not be modified except in writing signed by both Parties. The headings to this Agreement are for convenience and reference purposes only and shall not constitute a part of the Agreement. If any element of this Agreement is later held to violate the law or a regulation, it shall be deemed void, and all remaining provisions shall continue in force.

2.3 Effect:
This Agreement shall be binding upon and inure to the benefit of the Parties hereto and their respective successors and assigns provided that it may not be assigned by either Party without the consent of the other, which consent shall not be unreasonably withheld.

2.4 Survival:
All representations and obligations (including without limitation the mutual obligations of indemnification) shall survive the termination of this Agreement and expire five (5) years from the date of completion of Services.

2.5 Waiver of Rights:
Any waiver of, or consent to depart from, the requirements of any provision of this Agreement shall be effective only if made in writing and signed by the Party granting such waiver or consent, and is valid only in the specific instance and for the specific purpose for which it has been granted. No failure on the part of any Party to exercise, and no delay in exercising, any right under this Agreement shall operate as a waiver of such right. No single or partial exercise of any such right shall preclude any other or further exercise of such right or the exercise of any other right.

2.6 Applicable Law:
This Agreement shall be governed by, and interpreted and enforced in accordance with, the laws in the State of Texas and the laws of The United States of America, as applicable.

2.7 Dispute Resolution:
Excepting Section 1.11 for the purpose of this Agreement, any disagreement arising between the Parties to this Agreement with reference to the interpretation of this Agreement or any matter arising hereunder and upon which the Parties cannot agree shall be referred to mediation. Reference to mediation shall be to a single mediator and in accordance with the laws of mediation in the State of Texas. The costs of the mediator shall be shared equally by the Parties on an interim basis as may be necessary provided however that the mediator shall have the discretion to award costs of the proceeding, including costs of the mediator. The venue for such mediation is agreed to be Harris County, Texas

2.8 Contract Documents:
The Contract Documents consist of the documents listed. If there is a conflict with the Contract Documents, the conflicting terms will be governed in the order of priority set forth as follows: 1. Agreement 2. Engagement Letter

PHASE ENGINEERING

Lead Based Paint Inspection

Vacant Seven-Story Former WTU Office Building

Proposed Repurpose to a Residential Use

301 Cypress Street, Abilene, Taylor County, TX 79601

October 24, 2025

PE Project No.: 202510013

Prepared for:

Overland Property Group
ATTN: April Engstrom
35341 W. 151st Terrace
Leawood, KS 66224

Prepared by:

Phase Engineering, LLC
5524 Cornish Street
Houston, Texas 77007

October 17, 2025

Overland Property Group

ATTN: Ms. April Engstrom
Development Associate

5341 W. 151st Terrace
Leawood, KS 66224

phone: 785-212-0810 email: aengstrom@overlandpg.com

RE: 202510013

Dear Ms. Engstrom:

Phase Engineering, LLC (PELLC) has conducted a lead-based paint (LBP) inspection following HUD guidelines of the vacant seven-story former West Texas Utilities Company (WTU) office building, located at 301 Cypress Street, Abilene, Taylor County, Texas 79601. The lead paint inspection was conducted by using a XRF spectrum analyzer for non-destructive testing (NDT) of accessible painted surfaces that include assays that are representative of the building materials.

The LBP inspection was conducted on October 9 and 10, 2025 by Thomas A. Bazan, Texas Department State Health Services (TDSHS) Licensed Risk Assessor # 2070001. The LBP paint inspection has been conducted on building materials, and does not include potential lead contaminated dust or lead contaminated soil as described in the definition of lead based paint hazard in Title X, CFR Vol. 61 No. 169 Subpart L 745.233 or the Texas Environmental Lead Reduction Rules 295.202. No water or air samples were taken as part of this evaluation. This lead-based paint inspection is in accordance with the updated TDSHS Texas Environmental Lead Reduction Rules (TELRR) and the Residential Lead Based Paint Reduction Act (Title X) because this facility is already or is going to be child occupied or used for private housing, public housing, federally owned housing or housing receiving federal assistance according to the Environmental Protection Agency (EPA), U.S. Department of Housing and Urban Development (HUD) and TDSHS rules and regulations.

The inspector's first step was a visual examination (ASTM E2255M-22) of the property to be tested. The date of construction of the 57,538 square foot building was reported to be in 1923, with the major addition of adding additional floors and the elevators initiated in 1940. There was a partial remodel in 2015. The exterior walls are brick. The construction and painting history of all the rooms was found to be similar; therefore the architectural components of the subject property could be grouped together for sampling purposes. By consulting the second edition of the *HUD Guidelines for the Evaluation and Control of Lead-Based Hazards in Housing (July 2012)*, the inspector determined that the former office structure was older, and had not yet been gutted, although remodeled over the years. The building appears to be listed since 2024 for sale or lease.

The client representative was not present at the start for the field sampling of the facility, and the maintenance supervisor provided the access key.

The building components identified for the LBP inspection are described in the following Summary Report. Floor plans were provided for the seven floors, and after rough sketching a few floor plans for the roof penthouse, the basements, and the retail structure, the inspector conducted an inventory of all potential lead-contaminated paint surfaces on the building exterior as well as within the structure which was tested with an EPA certified and factory calibrated XRF spectrum analyzer and in observance of ASTM E2120-10 (2016) even though it was withdrawn in 2025 with no replacement. The substrates were identified as painted concrete, CMU, brick, ceramic tile, drywall, wood (including hardboard), and metal. The components were identified as 1) interior doors, door jambs, or casings, 2) window frames, sashes, and sills or stools, 3) interior walls, wainscots and ceilings, 4) Cabinets or shelves, 5) exterior doors and jambs, 6) window frames, and trim, 5) exterior walls and decorative entries, 6) metal components, and, 7) miscellaneous.

Prior to inspecting the property, the inspector performed the XRF manufacturer's recommended warm up and quality control procedures successfully. Then the inspector took calibration check readings on a test pad of a N.I.S.T. certified concentration of lead that was provided by the instrument manufacturer. The calibration checks were within the prescribed instrument range, indicating that the XRF instrument was in calibration and that XRF testing could begin. The instrument was checked for calibration prior to being turned off after the morning testing, prior to the afternoon testing, and after completion of each day of testing.

The architectural components inspected were recorded on the Viken (f/k/a Heuresis) Detection Corp. Pb200e, s/n 1013 instrument as to room equivalent, room description, substrate, component, color, condition, and location. Side A was the side first encountered as the room was entered, and Sides B, C, and D were lettered in a clockwise direction. The Viken Detection Pb200e recorded the lead content in mg/cm of each reading (assay) and the calculated result as either Positive (POS), Negative (NEG), or Incomplete (Null). Incomplete readings occur when the instrument is un- intentionally moved prior to completion of a reading.

The XRF measurements contained within are accurate to the best of our knowledge.

Although Phase Engineering, LLC uses trained and competent certified/licensed inspectors in attempting to locate and identify surfaces potentially containing lead based paint, Phase Engineering, LLC does not warrant that all surfaces containing lead based paint will be identified. It is possible that there are surfaces containing lead based paint that were not found because they were not visible or accessible to the inspector, or for various other reasons, were not sampled. The XRF measurements contained within are accurate to the best of our knowledge.

Lead Based Paint Project Summary	
Site Elements	
Subject Property Address	301 Cypress Street, Abilene, TX 79601 / GPS: 33.613222, -95.036639
Number of Buildings & Square Footage	Seven; 57,583 SF (per TCAD PID: 10148)
Date(s) of Construction	2-story building 1923, 5 additional stories 1940 reinforced poured concrete
Site Location Contact & Relationship to Subject Property	Ms. April Engstrom, Overland Property Group, cell: 785-212-0810
Date of Inspection	October 9 & 10, 2025
Purpose of Inspection	Renovation, Repurpose
Instrument Manufacturer	Viken (f/k/a Heuresis) Detection Corp.
Instrument Model	Pb200e Spectrum Analyzer Serial Number: 1013
Mode of Operation	Lead-Based Paint
Radio Active Source	5 mCi Co57
Building Plans and/or Prior Lead Reports Provided	No prior LBP report – building floor plans provided.
Known Areas Not Available for Access	Did not climb onto all roofs
Inspector(s) Names and License #	Thomas Bazan 2070001
Company License Name and #	Phase Engineering, LLC 2110073
Total XRF Readings Including Calibration Readings	642
Total XRF LBP Positive Readings	34-2 (32 on paint films with 2 excluded that were taken on brass handrails)
Total XRF LBP Interior Positive Readings	(3- story School) and 0 (single-story building)
Total XRF LBP Exterior Positive Readings	6 (Roof and Penthouse, parking lot safety paint stripes, wheel stops, bollards)
Total XRF LBP Negative Readings	590
Paint Chip Analysis	A sufficient number of assays were taken on both the interior and exterior of the structural components of the building, therefore, no paint chips were collected for analysis
Total Lead Chip Samples Taken	N/A
Total Lead Chip Positive Samples & Components	N/A
Total Lead Chip Negative Samples	N/A

Site Specific Details:

- The vacant seven-story brick veneered building was used as a single-occupant office building until the late 1970's, and is considered by local leaders as a historic structure but not listed on any state or federal registry. The owners, Hendrick Medical Center are partnering to repurpose the structure into a residential facility.

- The structure initially was a 2-story, brick and block building that is reported to have been constructed in 1923, with the first floor having a high ceiling. There was a two-story addition onto the north side in 1927. Four floors were added in 1940. In 1951 a sixth floor was added, and it is my speculation that it is likely at this time when the existing second floor was sandwiched in, and then the two elevators were installed, making it a total of seven stories. The estimated 2,700 square foot retail bay situated at the east side of the larger structure could have been added in either 1940 or at any time before 1978.

- The demolition and/or renovation contractor must comply with O.S.H.A. rules, and the waste stream should be segregated into separate piles of debris; painted aggregate (plaster, concrete, and CMU), painted drywall, painted metal, and painted wood. Each pile of debris may be required by a landfill operator to be TCLP tested to determine if there is any hazardous level of lead leachate scheduled for waste disposal.

- There will need to be clearance testing completed after the conversion to a residential use.

- The site is not fenced. There is asphalt and concrete paving that is used for off-street parking on the north side of the structure. LBP was detected on paint films covering the concrete wheel stops, a bollard, and the safety paint used for the parking space striping.

- Roof access was by way of the main fire escape stair case. The inspector did not get on the east roofs.

- The plumbing is estimated to be about 85 years old, with some original piping possibly being 102-years-old, and it was reported that lead pipe was used in the Abilene municipal water system. According to the 2024 Water Quality Report for Abilene, the city has tried to cure the service lines, but it is unknown if the underground lines are lead pipe. The owner should plan on a total replacement of all water lines as part of any renovation. Much of the original wiring may be 85 years old. The older copper telephone line cables have lead sheaths. There may be lead roof jacks on the drains.

Findings:

There were 642 readings taken, including calibration readings for the property. Of the 624 suspect lead-based paint surfaces tested for the building, most of the exterior building readings were evaluated as negative (<1.0 mg/cm^2).

There were three (3) positive LBP readings on exterior painted metal and wooden components associated with the roof-mounted elevator penthouse. There were three (3) positive readings on painted parking lot components.

There were twenty-six (26) positive readings taken on interior painted architectural components. There were two (2) readings taken on the brass handrail brackets in the main fire escape stairs, and are excluded from the LBP reading total.

Based on the data collected and evaluated at, or subsequent to, the field inspection: Lead Based Paint exists on the following surfaces:

- Exterior – On the roof of the seven-story building, the painted metal door for roof access from the main fire escape stairs is covered with LBP films. There are also LBP films detected on the painted wood sash of the north facing window of the elevator mechanical penthouse. Also, the painted shut-off valve wheel is covered with LBP films.

- Interior – Lead-Based Paint was detected on various painted metal, concrete and plaster components, mostly associated with the second and third levels. The second level ceiling was originally the first floor ceiling of the initial smaller original building, and the now third floor ceiling was the ceiling of the original 2nd floor. The red paint on the concrete stairs to the main lobby is the same as the floor paint in the elevator penthouse.

Table 1

XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)
		October 9, 2025						
4 / 1	Exterior	Roof Penthouse	Metal	Door	Beige	Poor	North	8.7
5 / 2	Exterior	Roof Valve	Metal	Wheel	Orange	Poor	North	1.2
10 / 7	Exterior	Penthouse - Window	Wood	Sash	Beige	Poor	South	8.2
23 / 20	Penthouse	Office	Concrete	Floor	Red	Fair	Floor - East	3.9
29 / 26	Penthouse	Elevator Motor Room	Concrete	Floor	Beige	Fair	Floor - North	1.8
147/144	11	5th Floor Elevator #1	Metal	Left Door	Brown	Fair	Wall "A" East	1.0
196/190	16	4th Floor Door to Hall/Lobby	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" East	1.1
307/301	24	3rd Floor Large Suite South	Concrete	Beam	Ivory	Fair	Ceiling - Center	10.5
308/302	24	3rd Floor Large Suite South	Plaster	Ceiling	Beige	Fair	Ceiling - Center	14.9
311/305	24	3rd Floor Vault (No Door)	Metal	Facing	Beige	Fair	Wall "B" North	6.9
316/310	25	Suite 310	Plaster	Ceiling	Beige	Fair	Ceiling - South	10.7
332/326	Exterior	Parking Lot	Concrete	Wheel Stop	Yellow	Poor	Ground - West	2.0
333/327	Exterior	Parking Lot	Concrete	Safety Stripe	Yellow	Poor	Ground - West	1.3
346/340	Exterior	Parking Lot East Side	Metal	Bollard	Yellow	Fair	East	1.8

		October 10, 2025						
XRF						Paint		**Indicated**
Reading	Room					Condition	XRF Testing	**Lead**
Sample	Equivalent	Room Description			Paint Film	Intact / Fair	or Confirmatory	**Concentration**
Number	Number	Name	Substrate	Component	Color	or Poor	Sampling Location	**(mg/cm2)**
4 / 1	26 / 1	2nd Floor Main Landing	Plaster	Wall	Ivory	Intact	Wall "B" North	**6.1**
5 / 2	26 / 1	2nd Floor Main Landing	Plaster	Wall	Ivory	Intact	Wall "C" East	**8.0**
10 / 7	26 / 1	2nd Floor Main Landing	Plaster	Ceiling	Ivory	Intact	Ceiling - Center	**8.9**
41 / 38	28 / 4	2nd Floor East Suite	Plaster	Beam	Beige	Fair	Ceiling - Center	**8.9**
42 / 39	28 / 4	2nd Floor East Suite	Plaster	Crown Molding	Beige	Intact	Ceiling - Center	**10.4**
45 / 42	28 / 4	2nd Floor East Vault	Metal	Right Door Casing	Beige	Intact	Wall "A" West	**8.2**
46 / 43	28 / 4	2nd Floor Vault (Mosler Door)	Metal	Safe Door	Beige	Fair	Wall "A" West	**9.1**
47 / 44	28 / 4	2nd Floor Vault Interior	Metal	Left Door	Green	Fair	Wall "A" East	**8.1**
48 / 45	28 / 4	2nd Floor Vault Interior	Metal	Threshold	Gray	Poor	Floor	**9.9**
63 / 60	29 / 5	2nd Floor Lunch Room	Plaster	Wall	Beige	Fair	Wall "D" East	**28.3**
72 / 69	30 / 6	2nd FL Women's Restroom	Plaster	Ceiling	Beige	Fair	Ceiling - North	**8.3**
96 / 93	32 / 9	2nd FL Fire Suppression	Metal	Horizontal Pipe	Red	Intact	Ceiling - West	**1.1**
108/105	33 / 10	2nd Floor SW Corner Room	Plaster	Ceiling	Mustard	Fair	Ceiling - South	**2.6**
109/106	33 / 10	2nd Floor SW Corner Room	Plaster	Crown Molding	Ivory	Fair	Wall "C" South	**9.7**
121/118	34 / 11	2nd Floor Elevator Lobby	Plaster	Ceiling	Ivory	Fair	Ceiling - South	**15.0**
230/227	46 / 12	Basement	Concrete	Pedestal	Gray	Fair	Floor - East	**1.3**
233/230	46 / 12	Basement Door to Elevator	Metal	Door	Gray	Fair	Wall "A" East	**2.1**
251/245	47 / 13	Mechanical Rm - Overflow Pipe	Metal	Vertical Pipe	Yellow	Fair	Wall "B" North	**3.9**

As a caution, some painted surfaces may contain levels of lead below the federal abatement level of <1.0 mg/cm^2, which could create lead dust or lead-contaminated soil hazards if the paint is turned into dust by abrasion, scraping, or sanding.

For more detailed information see Attachment 1: XRF Readings & Field Notes, Attachment 2: Site Plan and Attachment 3: Licenses / Certifications.

Photo exhibits of Positive readings listed above are depicted below:



1) View Elevator Penthouse & Main Fire Stairs; valve on right.



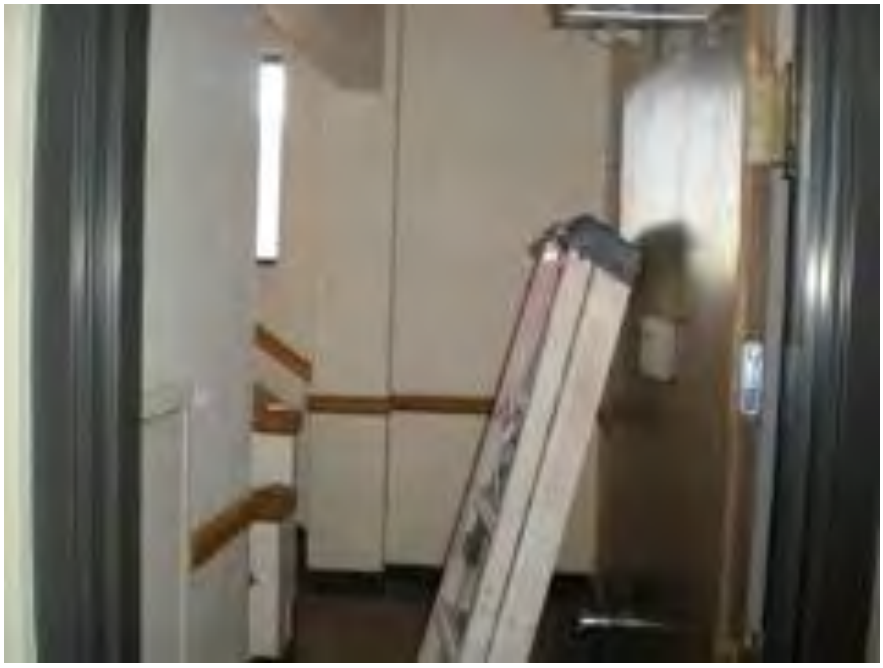
2) View of the Elevator Penthouse roof access door



3) View of shut-off valve just northwest of the penthouse.



4) View of the south side of the Elevator Penthouse



5) View of the main fire escape stairway



6) View of the painted brass handrail bracket.



7) View of the elevator penthouse; note the south window.



8) View of the painted floor in the elevator penthouse.



9) View of the 5th Floor Elevator car #1, left door.



10) View of the 4th Floor doorway to the main fire escape stairs.



11) View 3rd Floor Large Suite on South side



12) View of the painted Concrete ceiling beam (307/301).



13) View of the painted plaster ceiling (308/302).



14) View of the 3rd Floor Vault (no door).



15) View of ceiling in Suite 310.



16) View of painted plaster ceiling in Suite 310



17) View South across the subject parking lot.



18) View of a painted concrete wheel stop.



19) View of a parking space safety stripe.



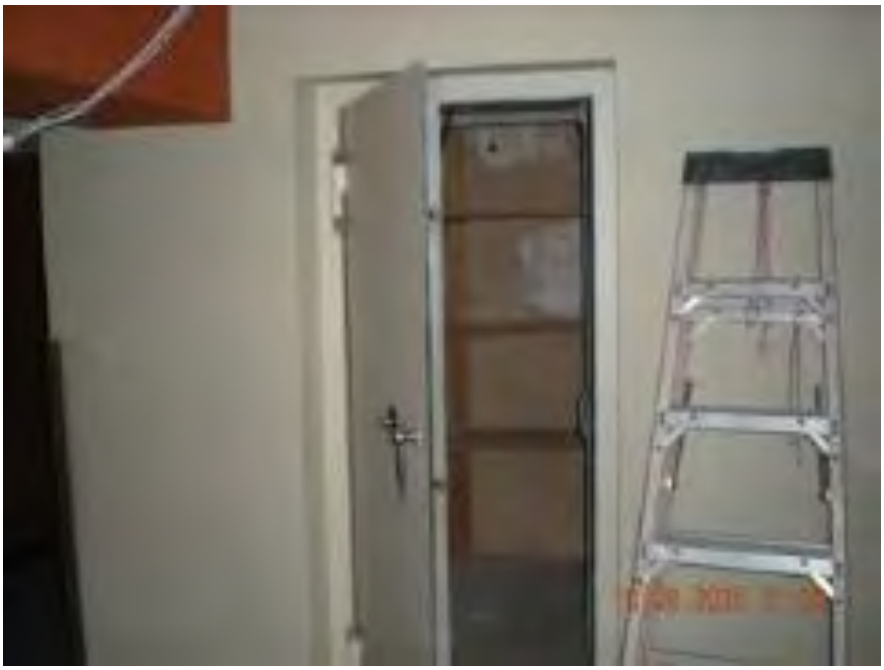
20) View of a bollard on the east side of the parking lot.



21) View painted plaster wall (B-North) 2nd Floor Landing.



22) View of plaster ceiling beam 2nd Floor (original 1st Floor)



23) View of the Mosler records Vault in the East side suite.



24) View of a positive reading on the vault door threshold.



25) View of original east wall in the Lunch room.



26) View of updated Women's Restroom; positive on ceiling.



27) View of fire suppression piping in 2nd Floor Phone Room.



28) View of positive readings on 2nd FL (original SWC) ceiling.



29) View of positive reading on 2nd FL (original) Balcony ceiling



30) View of bottom of elevator shaft; entry door has LBP.



31) View of Basement stairs; the sump pedestal is on the right.



32) View of Mechanical Room discharge piping on west wall.

Recommendations:

PARTIAL DEMOLITION:

Any construction or maintenance activity associated with the vacant building identified above is subject to O.S.H.S.A. regulations. Please review the Occupational Safety and Health Administration (OSHA) regulations found in 29 CFR, Part 1926.62, known as the OSHA Lead Exposure in Construction Industry Standard.

During any partial demolition, debris should be segregated between painted metal, painted wood and drywall, and painted brick, stucco, and aggregate materials.

It is presumed that the elevator cars, doors and control circuitry will be removed and replaced with modern equipment.

Painted older components should be presumed to be covered with some lead-contaminated paint and along with other lead-contaminated building materials, should be either recycled, or remediated or analyzed for Toxicity Characteristics Leaching Procedure (TCLP) by any demolition contractor before disposal that is compliant with the T.C.E.Q.

Any metal, such as structural steel, plumbing, and the miscellaneous metal components can be sold as salvage scrap for recycling to a scrap dealer.

As an additional caution, welding, torches, and heat guns operating at a temperature above 1,100° F must not be used on Lead-contaminated surfaces. These lead-contaminated surfaces should not be power washed without containment of the run-off.

Noting that this may be a historical property, the windows and other components that could be restored should be taken off-site and properly deleaded if necessary. Many of the windows have been replaced with anodized metal frames

The 2nd and 3rd floor ceilings and various LBP painted floors can be deleaded. The ceilings may also be encapsulated or properly encased if allowed. The painted metal components not removed can be deleaded or properly encapsulated if allowed.

The painted fire suppression piping is painted, with some lengths covered with LBP films and other lengths free of LBP. Generally, the piping is encased in residential finish out, although, in an abundance of caution, the exposed painted fire suppression piping can be encapsulated, and repainted if required.

The contractor's O.S.H.A. competent person must decide the level of engineering controls, and worker personal protection equipment (ppe), depending on the activity that will create air-borne dust.

The contractor is deemed the generator of any lead-contaminated waste stream, and should dispose of debris in an appropriate level land fill.

A visual assessment is all that would be required for the exterior of the building after any exterior remediation activities are complete.

After the interior demolition activities, it is recommended that there be a special cleaning, following the HUD Guidelines before the attempt at clearance.

Please be advised that the EPA has lowered the clearance levels, effective January 12, 2026. Please see the provided links below concerning lead based paint controls and maintenance.

New dust-lead action levels

Location	**Old Standard**	**New Standard (effective Jan. 12, 2026)**
Floors	10 µg/ft²	5 µg/ft²
Interior Windowsills	100 µg/ft²	40 µg/ft²

SPECIAL CLEANING FOLLOWING LEAD HAZARD CONTROL ACTIVITIES

After any lead hazard control activities have been completed, the treated area of the structure must be inspected and properly cleaned following HUD specified cleaning protocols, as detailed in the Guidelines for the Evaluation and Control of LBP Hazards in Housing (Second Edition - July 2012), published by the U.S. Department of Housing and Urban Development. Some of the required steps include removing large debris and paint chips followed by HEPA vacuuming of all horizontal surfaces (floors, windowsills, troughs, etc.). The cleaning protocols described in this publication guide the contractor in doing a proper cleaning and improving the chances of passing clearance inspections after remediation.

If the interior of the historic structure is remediated with an encapsulant or encasement, the historic property may be subject to the EPA Renovation and Repair Rule for future repair activities.

The de minimus areas (40 CFR 93 § 153 defines de minimis levels, that is, the minimum threshold for which a conformity determination must be performed, for various criteria pollutants in various areas) are slightly larger under the EPA Renovation and Repair Rule than the LBP guidelines. Any deteriorated paint

film surfaces can be stabilized, in areas below the de minimus levels, and a liquid deglosser used to prepare these surfaces for painting.

(1) Minor repair and maintenance exception changes to < 6 ft2 per room for interiors, 20 ft2 for exteriors. To qualify, the project cannot involve the use of high dust generating (prohibited) practices or window replacement.

(2) Emergency renovations specifically include interim controls performed in response to an elevated blood lead level in a child.

(3) Persons performing renovations for compensation in pre-1978 housing may use either Protect Your Family or Renovate Right to comply with the existing requirement to provide a lead hazard information pamphlet to the owners and occupants of target (pre-1978) housing before beginning renovations.

§ 745.65 Lead-based paint hazards. (Currently Promulgated)

(b) *Dust-lead hazard.* A dust-lead hazard is surface dust in a residential dwelling or child-occupied facility that contains a mass-per-area concentration of lead equal to or exceeding 10 µg/ft ^{2} on floors or 100 µg/ft ^{2} on interior window sills based on wipe samples.

http://portal.hud.gov/hudportal/HUD?src=/program_offices/healthy_homes/trai ning/rrp/rrp

Please review the Occupational Safety and Health Administration (OSHA) regulations found in 29 CFR, Part 1926.62, known as the OSHA Lead Exposure in Construction Industry Standard.

Links to HUD Lead-Based Paint Information:

https://portal.hud.gov/hudportal/HUD?src=/program_offices/healthy_homes/lb p/hudguidelines

Chapter 11: Interim Controls

https://portal.hud.gov/hudportal/documents/huddoc?id=lbph-13.pdf

Chapter 6: Ongoing Lead-Safe Maintenance

https://portal.hud.gov/hudportal/documents/huddoc?id=lbph-08.pdf

Chapter 18: Historic preservation

http://www.hud.gov/offices/lead/lbp/hudguidelines/Ch18.pdf

Link to EPA Clearance Standards:

https://www.federalregister.gov/documents/2019/07/09/2019-14024/review-of-the-dust-lead-hazard-standards-and-the-definition-of-lead-based-paint

Please review the Occupational Safety and Health Administration (OSHA) regulations found in 29 CFR, Part 1926.62, known as the OSHA Lead Exposure in Construction Industry Standard.

Links to HUD Lead-Based Paint Information:

https://portal.hud.gov/hudportal/HUD?src=/program_offices/healthy_homes/lb p/hudguidelines

A summary report is attached in the body of this report. As per the second edition (July 2012) of the *HUD Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*, "a copy of this summary must be provided to new lessees (tenants) and purchasers of this property under Federal law (24CFR part 35 and 40 CFR part 745) before they become obligated under a lease or sales contract. The complete report must also be provided to new purchasers and it must be made available to new tenants. Landlords (lessors) and sellers are also required to distribute an educational pamphlet approved by the U.S. Environmental Protection Agency and include standard warning language in their leases or sales contracts to ensure that parents have the information they need to protect their children from lead-based paint hazards."

If additional suspect lead paint or dust hazards should be found during any renovation or demolition, these materials should be sampled for lead and handled appropriately following all local, state and federal rules and regulations at that time.

The client agreed to Scope of Work, a sequential XRF reading report, Site Plan, Licenses and Certifications are attached to this letter.



Thomas A. Bazan CRS, CEI

Risk Assessor

TDSHS #: 2070001

Attachment 1: XRF Readings & Field Notes

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XRF SEQUENTIAL READING FIELD REPORT FORM FOR LEAD-BASED PAINT INSPECTIONS

XRF MANUFACTURER/SERIAL NUMBER: Viken Pb200e s/n #1013					PROPERTY ID: 301 Cypress St., Abeline, TX				Unit No.	
RADIATION SOURCE ASSAY DATE: December 25, 2024					RISK ASSESSOR: T. Bazan (TDSHS # 2070001)				Job Started:	8:40 AM
XRF INTERNAL REPORT NUMBER: 10/09/2025					ABATEMENT LEVEL: 1.0 mg/cm2				Job Finished:	4:19 PM
XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
4 / 1	Exterior	Roof Penthouse	Metal	Door	Beige	Poor	North	**8.7**	Auto	**Positive**
5 / 2	Exterior	Roof Valve	Metal	Wheel	Orange	Poor	North	**1.2**	Auto	**Positive**
6 / 3	Exterior	North Wall	Brick	Wall	Beige	Fair	North	0.1	Auto	**Negative**
7 / 4	Exterior	North Wall	Concrete	Cap	White	Fair	North	0.5	Auto	**Negative**
8 / 5	Exterior	Penthouse	Concrete	Window Sill	Beige	Poor	West	0.1	Auto	**Negative**
9 / 6	Exterior	Penthouse - Window	Wood	Cover	Beige	Poor	West	0.2	Auto	**Negative**
10 / 7	Exterior	Penthouse - Window	Wood	Sash	Beige	Poor	South	**8.2**	Auto	**Positive**
11 / 8	Exterior	Flag Pole	Metal	Pole	Beige	Poor	SWC	0.1	Auto	**Negative**
12 / 9	Exterior	Small I-Beams	Metal	Brace	Brown	Poor	SWC	0.0	Auto	**Negative**
13 / 10	8th Floor	Main Fire Stairs Landing	Concrete	Floor	Gray	Poor	Floor - North	0.2	Auto	**Negative**
14 / 11	8th Floor	Main Fire Stairs Landing	Concrete	Wall	Ivory	Fair	Wall "D" East	0.1	Auto	**Negative**
15 / 12	8th Floor	Main Fire Stairs Landing	Plaster	Ceiling	Ivory	Fair	Ceiling - North	0.0	Auto	**Negative**
16 / 13	8th Floor	Stairs	Wood	Chair Rail	Brown	Fair	Wall "D" East	0.2	Auto	**Negative**
17 / 14	8th Floor	Stairs	Wood	Handrail	Brown	Fair	Wall "B" West	0.1	Auto	**Negative**
18 / 15	8th Floor	Stairs	Metal	Handrail Bracket	Brown	Fair	Wall "B" West	**15.6**	Auto	**Positive**
19 / 16	8th Floor	Stairs	Wood	Rail Cap	Brown	Fair	Wall "B" West	0.2	Auto	**Negative**
20 / 17	8th Floor	Stairs	Metal	Stringer	Black	Fair	Wall "B" West	0.0	Auto	**Negative**
21 / 18	8th Floor	Stairs	Metal	Tread Edge	Black	Poor	Wall "C" North	0.4	Auto	**Negative**
22 / 19	Penthouse	Office	Metal	Left Door Jamb	Gray	Fair	Wall "A" East	0.4	Auto	**Negative**
23 / 20	Penthouse	Office	Concrete	Floor	Red	Fair	Floor - East	**3.9**	Auto	**Positive**

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24 / 21	Penthouse	Office	Plaster	Wall	Ivory	Fair	Wall "A" East	0.2	Auto	Negative
25 / 22	Penthouse	Office	Plaster	Wall	Ivory	Fair	Wall "B" South	0.1	Auto	Negative
26 / 23	Penthouse	Office	Plaster	Wall	Ivory	Poor	Wall "C" West	0.1	Auto	Negative
27 / 24	Penthouse	Office	Plaster	Wall	Ivory	Fair	Wall "D" North	0.3	Auto	Negative
28 / 25	Penthouse	Office	Plaster	Baseboard	Red/Gray	Fair	Wall "D" North	0.2	Auto	Negative
29 / 26	Penthouse	Elevator Motor Room	Concrete	Floor	Beige	Fair	Floor - North	1.8	Auto	Positive
30 / 27	Penthouse	Motor	Metal	Housing	Blue	Fair	Center	0.6	Auto	Negative
31 / 28	Penthouse	Window	Wood	Window Sill	Gray	Fair	Wall "C" South	0.1	Auto	Negative
32 / 29	Penthouse	1/2 Door	Wood	Door	Gray	Fair	Wall "D" West	0.6	Auto	Negative
33 / 30	Penthouse	Ceiling Heater	Metal	Frame	Beige	Fair	Ceiling - North	0.1	Auto	Negative
34 / 31	7th Floor	Main Stairway Landing	Concrete	Floor	Brown	Fair	Floor - West	0.2	Auto	Negative
35 / 32	7th Floor	Main Stairway Landing	Concrete	Floor	Black	Fair	Floor - West	0.0	Auto	Negative
36 / 33	7th Floor	Firehose Cabinet	Metal	Cover	Beige	Fair	Wall "A" North	0.1	Auto	Negative
37 / 34	7th Floor	Doorway to 7th Floor	Metal	Left Door Jamb	Black	Fair	Wall "D" West	0.2	Auto	Negative
38 / 35	7th Floor	Doorway to 7th Floor	Wood	Door	Brown	Fair	Wall "D" West	0.0	Auto	Negative
39 / 36	1	Elevator Lobby/Hallway	DW/WP	Wall	Ivory	Fair	Wall "A" East	0.2	Auto	Negative
40 / 37	1	Elevator Lobby/Hallway	DW/WP	Wall	Red	Fair	Wall "B" South	0.2	Auto	Negative
41 / 38	1	Elevator Lobby/Hallway	DW/WP	Wall	Pattern	Fair	Wall "C" West	0.1	Auto	Negative
42 / 39	1	Elevator Lobby/Hallway	DW/WP	Wall	Ivory	Fair	Wall "D" North	0.2	Auto	Negative
43 / 40	1	Elevator Lobby/Hallway	Drywall	Ceiling	White	Fair	Ceiling - Center	0.1	Auto	Negative

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44 / 41	1	Lobby Hall - Air Vent	Metal	Register	Ivory	Intact	Ceiling - Center	0.3	Auto	Negative
45 / 42	1	Hallway - Window	Metal	Window Sill	Black	Intact	Wall "C" West	0.1	Auto	Negative
46 / 43	2	Men's Restroom	Metal	Left Door Jamb	Charcoal	Intact	Wall "A" South	0.4	Auto	Negative
47 / 44	2	Men's Restroom - Window	Metal	Window Sill	Black	Intact	Wall "B" West	0.2	Auto	Negative
48 / 45	2	Men's Restroom	Ceramic Tile	Wall	Ivory	Intact	Wall "B" West	0.2	Auto	Negative
49 / 46	2	Men's Restroom	Drywall	Ceiling	White	Intact	Ceiling - Center	0.1	Auto	Negative
50 / 47	2	Men's Restroom - Air Vent	Metal	Grate	Ivory	Intact	Ceiling - North	0.3	Auto	Negative
51 / 48	2	Men's Restroom - Stall	Metal	Door	Brown	Intact	Wall "C" North	0.0	Auto	Negative
52 / 49	3	Women's Restroom - Stall	Metal	Door	Brown	Intact	Wall "D" North	0.0	Auto	Negative
53 / 50	3	Access	Metal	Cover	Ivory	Intact	Ceiling - Center	0.1	Auto	Negative
54 / 51	3	Women's Restroom	Drywall	Ceiling	White	Intact	Ceiling - Center	0.0	Auto	Negative
55 / 52	3	Women's Restroom	Ceramic Tile	Wall	Ivory	Intact	Wall "C" West	0.2	Auto	Negative
56 / 53	3	Women's RR - Window	Metal	Window Sill	Black	Intact	Wall "C" West	0.3	Auto	Negative
57 / 54	3	Women's RR - Doorway	Metal	Left Door Jamb	Black	Intact	Wall "A" East	0.3	Auto	Negative
58 / 55	1	Elevator #1	Metal	Left Door Jamb	Charcoal	Intact	Wall "A" East	0.5	Auto	Negative
59 / 56	1	Elevator #1	Metal	Left Door	Charcoal	Intact	Wall "A" East	0.4	Auto	Negative
60 / 57	1	Elevator #2	Metal	Right Door	Charcoal	Intact	Wall "A" East	0.5	Auto	Negative
61 / 58	1	Elevator #2	Metal	Right Door Jamb	Charcoal	Intact	Wall "A" East	0.4	Auto	Negative
62 / 59	4	NE Restroom by Exit	Metal	Left Door Jamb	Brown	Intact	Wall "A" East	0.4	Auto	Negative
63 / 60	4	NE Restroom - Window	Metal	Window Sill	Black	Fair	Wall "D" North	0.5	Auto	Negative

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64 / 61	4	NE Restroom by Exit	Wood	Baseboard	Brown	Intact	Wall "A" East	0.1	Auto	Negative
65 / 62	4	NE Restroom - Vanity	Wood	Facing	Brown	Intact	Wall "C" West	0.1	Auto	Negative
66 / 63	4	NE Restroom by Exit	DW/WP	Wall	Beige	Fair	Wall "A" East	0.0	Auto	Negative
67 / 64	4	NE Restroom by Exit	DW/WP	Wall	Beige	Fair	Wall "B" South	0.1	Auto	Negative
68 / 65	4	NE Restroom by Exit	DW/WP	Wall	Beige	Fair	Wall "C" West	0.1	Auto	Negative
69 / 66	4	NE Restroom by Exit	Drywall	Wall	Bare	Poor	Wall "D" North	0.2	Auto	Negative
70 / 67	4	NE Restroom by Exit	Drywall	Ceiling	White	Fair	Ceiling - Center	0.2	Auto	Negative
71 / 68	4	NE Restroom - Heater	Metal	Case	Ivory	Intact	Wall "D" North	0.0	Auto	Negative
72 / 69	7th Floor	Northeast Stairway	Metal	Left Door Jamb	Charcoal	Intact	Wall "A" West	0.5	Auto	Negative
73 / 70	7th Floor	Landing	Metal	Railing	Ivory	Fair	Wall "B" North	0.0	Auto	Negative
74 / 71	7th Floor	Northeast Stairway	Metal	Handrail	Ivory	Intact	Wall "C" East	0.1	Auto	Negative
75 / 72	7th Floor	Stairs	Metal	Stringer	Beige	Fair	Wall "C" East	0.0	Auto	Negative
76 / 73	7th Floor	Stairs	Metal	Riser	Beige	Fair	Wall "D" South	0.1	Auto	Negative
77 / 74	7th Floor	Northeast Stairway	CMU	Wall	Ivory	Fair	Wall "A" West	0.3	Auto	Negative
78 / 75	7th Floor	Northeast Stairway	CMU	Wall	Ivory	Fair	Wall "B" North	0.4	Auto	Negative
79 / 76	7th Floor	Northeast Stairway	CMU	Wall	Ivory	Fair	Wall "C" East	0.4	Auto	Negative
80 / 77	7th Floor	Northeast Stairway	Drywall	Wall	Ivory	Fair	Wall "D" South	0.1	Auto	Negative
81 / 78	7th Floor	Firehose	Metal	Cover	Beige	Intact	Wall "C" East	0.1	Auto	Negative
82 / 79	7th Floor	Telephone	Metal	Cover	Beige	Intact	Wall "D" South	0.0	Auto	Negative
83 / 80	7th Floor	Doorway to Suite 700	Wood	Door	Brown	Fair	Wall "A" West	0.2	Auto	Negative

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84 / 81	5	Suite 701	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" South	0.3	Auto	Negative
85 / 82	5	Suite 701 - Window	Metal	Window Sill	Black	Fair	Wall "B" West	0.1	Auto	Negative
86 / 83	5	Suite 701	Wood	Door	Brown	Fair	Wall "A" South	0.0	Auto	Negative
87 / 84	5	Suite 701	DW/WP	Wall	Ivory	Fair	Wall "A" South	0.1	Auto	Negative
88 / 85	5	Suite 701	Drywall	Wall	Bare	Fair	Wall "B" West	0.2	Auto	Negative
89 / 86	5	Suite 701	DW/WP	Wall	Gray	Fair	Wall "C" North	0.0	Auto	Negative
90 / 87	5	Suite 701	DW/WP	Wall	Ivory	Fair	Wall "D" East	0.1	Auto	Negative
91 / 88	5	Power Panel	Metal	Cover	Ivory	Fair	Wall "D" East	0.0	Auto	Negative
92 / 89	6th Floor	Elevator Lobby/Hallway	Metal	Left Door Jamb	Brown	Fair	Wall "A" East	0.3	Auto	Negative
93 / 90	6	Elevator Lobby/Hallway	Wood	Door	Brown	Fair	Wall "A" East	0.0	Auto	Negative
94 / 91	6	Elevator #1	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" East	0.5	Auto	Negative
95 / 92	6	Elevator #1	Metal	Left Door	Charcoal	Fair	Wall "A" East	0.3	Auto	Negative
96 / 93	6	Elevator #2	Metal	Right Door	Charcoal	Fair	Wall "A" East	0.3	Auto	Negative
97 / 94	6	Elevator #2	Metal	Right Door Jamb	Charcoal	Fair	Wall "A" East	0.5	Auto	Negative
98 / 95	6	Hallway - Window	Metal	Window Sill	Black	Fair	Wall "C" West	0.0	Auto	Negative
99 / 96	6	Elevator Lobby/Hallway	Drywall	Wall	Ivory	Intact	Wall "A" East	0.3	Auto	Negative
100 / 97	6	Elevator Lobby/Hallway	Drywall	Wall	Ivory	Intact	Wall "B" South	0.1	Auto	Negative
101 / 98	6	Elevator Lobby/Hallway	Drywall	Wall	Ivory	Intact	Wall "C" West	0.2	Auto	Negative
102 / 99	6	Elevator Lobby/Hallway	Drywall	Wall	Ivory	Intact	Wall "D" North	0.2	Auto	Negative
103/100	6	Hall Light Fixture	Metal	Frame	Ivory	Intact	Ceiling - North	0.1	Auto	Negative

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104/101	7	Women's Restroom	Wood	Door	Brown	Intact	Wall "A" South	0.0	Auto	Negative
105/102	7	Women's Restroom	Metal	Left Door Jamb	Charcoal	Intact	Wall "A" South	0.3	Auto	Negative
106/103	7	Women's RR - Window	Metal	Window Sill	Black	Intact	Wall "B" West	0.5	Auto	Negative
107/104	7	Women's RR - Stall	Metal	Panel	Salmon	Intact	Wall "C" North	0.0	Auto	Negative
108/105	7	Women's Restroom	Ceramic Tile	Wainscot	Brown	Intact	Wall "B" West	0.4	Auto	Negative
109/106	7	Women's Restroom	Drywall	Wall	Ivory	Intact	Wall "A" South	0.2	Auto	Negative
110/107	7	Women's Restroom	Drywall	Wall	Ivory	Intact	Wall "B" West	0.2	Auto	Negative
111/108	7	Women's Restroom	Drywall	Wall	Ivory	Intact	Wall "C" North	0.2	Auto	Negative
112/109	7	Women's Restroom	Drywall	Wall	Ivory	Intact	Wall "D" East	0.2	Auto	Negative
113/110	7	Air Vent/Return	Metal	Grate	Ivory	Intact	Ceiling - North	0.2	Auto	Negative
114/111	6	Janitor Closet	Metal	Left Door Jamb	Charcoal	Intact	Wall "D" North	0.5	Auto	Negative
115/112	6	Janitor Closet	Wood	Door	Brown	Intact	Wall "D" North	0.0	Auto	Negative
116/113	8	Unisex Restroom	Wood	Door	Brown	Intact	Wall "A" East	0.0	Auto	Negative
117/114	8	Unisex Restroom	Metal	Left Door Jamb	Charcoal	Intact	Wall "A" East	0.1	Auto	Negative
118/115	8	Window	Metal	Window Sill	Black	Intact	Wall "C" West	0.5	Auto	Negative
119/116	8	Unisex Restroom	Ceramic Tile	Wainscot	Brown	Intact	Wall "A" East	0.0	Auto	Negative
120/117	8	Unisex Restroom	Drywall	Wall	Ivory	Intact	Wall "A" East	0.1	Auto	Negative
121/118	8	Unisex Restroom	Drywall	Wall	Ivory	Intact	Wall "B" South	0.2	Auto	Negative
122/119	8	Unisex Restroom	Drywall	Wall	Ivory	Intact	Wall "C" West	0.1	Auto	Negative
123/120	8	Unisex Restroom	Drywall	Wall	Ivory	Intact	Wall "D" North	0.1	Auto	Negative

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124/121	8	Light Fixture	Metal	Frame	Ivory	Intact	Ceiling - Center	0.2	Auto	Negative
125/122	8	Ceiling Tile Frames	Metal	Frame	Ivory	Intact	Ceiling - Center	0.0	Auto	Negative
126/123	9	Suite 630 - Doorway	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" South	0.2	Auto	Negative
127/124	9	Suite 630 - Doorway	Wood	Door	Brown	Fair	Wall "A" South	0.0	Auto	Negative
128/125	9	Suite 630 - Window	Metal	Window Sill	Black	Fair	Wall "B" West	0.2	Auto	Negative
129/126	9	Suite 630	Drywall	Wall	Ivory	Intact	Wall "A" South	0.3	Auto	Negative
130/127	9	Suite 630	Drywall	Wall	Ivory	Intact	Wall "B" West	0.3	Auto	Negative
131/128	9	Painted Paneling	Wood	Panel Wall	Ivory	Intact	Wall "C" North	0.0	Auto	Negative
132/129	9	Suite 630	Drywall	Wall	Ivory	Intact	Wall "D" East	0.3	Auto	Negative
133/130	9	Power Panel	Metal	Cover	Ivory	Intact	Wall "D" East	0.1	Auto	Negative
134/131	9	Light Fixture	Metal	Fixture	White	Intact	Ceiling - East	0.1	Auto	Negative
135/132	10	Suite 600	Concrete	Ceiling	Ivory	Intact	Ceiling - NEC	0.2	Auto	Negative
136/133	10	Suite Entry Door	Metal	Frame	Charcoal	Intact	Wall "A" West	0.1	Auto	Negative
137/134	10	Light Fixture	Metal	Frame	Ivory	Intact	Ceiling - West	0.0	Auto	Negative
138/135	10	Air Return	Metal	Grate	Ivory	Intact	Ceiling - West	0.2	Auto	Negative
139/136	10	Window	Metal	Window Sill	Black	Intact	Wall "B" North	0.2	Auto	Negative
140/137	10	Paneling	Wood	Panel Wall	Ivory	Intact	Wall "A" West	0.3	Auto	Negative
141/138	10	Suite 600	Drywall	Wall	Ivory	Intact	Wall "B" North	0.1	Auto	Negative
142/139	10	Suite 600	Drywall	Wall	Ivory	Intact	Wall "C" East	0.1	Auto	Negative
143/140	10	Suite 600	Drywall	Wall	Ivory	Intact	Wall "D" South	0.3	Auto	Negative

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XRF SEQUENTIAL READING FIELD REPORT FORM FOR LEAD-BASED PAINT INSPECTIONS

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RADIATION SOURCE ASSAY DATE: December 25, 2024					RISK ASSESSOR: T. Bazan (TDSHS # 2070001)				Job Started:	8:40 AM
XRF INTERNAL REPORT NUMBER: 10/09/2025					ABATEMENT LEVEL: 1.0 mg/cm2				Job Finished:	4:19 PM
XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
144/141	5th Floor	Elevator Lobby/Hallway	Wood	Door	Brown	Fair	Wall "A" East	0.0	Auto	Negative
145/142	11	Elevator Lobby/Hallway	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" East	0.6	Auto	Negative
146/143	11	Elevator #1	Metal	Left Door Jamb	Brown	Fair	Wall "A" East	0.5	Auto	Negative
147/144	11	Elevator #1	Metal	Left Door	Brown	Fair	Wall "A" East	1.0	Auto	Positive
148/145	11	Elevator #2	Metal	Right Door	Brown	Fair	Wall "A" East	0.6	Auto	Negative
149/146	11	Elevator #2	Metal	Right Door Jamb	Brown	Fair	Wall "A" East	0.9	Auto	Negative
150/147	11	Hallway - Window	Metal	Window Sill	Black	Intact	Wall "C" West	0.1	Auto	Negative
151/148	11	Elevator Lobby/Hallway	Drywall	Wall	Beige	Fair	Wall "A" East	0.0	Auto	Negative
152/149	11	Elevator Lobby/Hallway	Drywall	Wall	Red	Fair	Wall "B" South	0.0	Auto	Negative
153/150	11	Elevator Lobby/Hallway	Drywall	Wall	Beige	Fair	Wall "C" West	0.2	Auto	Negative
154/151	11	Elevator Lobby/Hallway	Drywall	Wall	Beige	Intact	Wall "D" North	0.1	Auto	Negative
155/152	11	Hallway - Air Vent	Metal	Register	Ivory	Intact	Ceiling - East	0.2	Auto	Negative
156/153	12	Women's Restroom	Wood	Door	Brown	Fair	Wall "A" South	0.0	Auto	Negative
157/154	12	Women's Restroom	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" South	0.3	Auto	Negative
158/155	12	Women's Restroom	Ceramic Tile	Wall	Ivory	Intact	Wall "B" West	0.4	Auto	Negative
159/156	12	Women's Restroom	Drywall	Ceiling	White	Intact	Ceiling - Center	0.1	Auto	Negative
160/157	12	Access Panel	Metal	Cover	Beige	Fair	Ceiling - Center	0.1	Auto	Negative
161/158	11	Janitor Closet	Metal	Left Door Jamb	Charcoal	Fair	Wall "D" North	0.2	Auto	Negative
162/159	11	Janitor Closet	Wood	Door	Brown	Fair	Wall "D" North	0.0	Auto	Negative
163/160	13	Unlabeled Restroom	Wood	Door	Brown	Fair	Wall "A" East	0.0	Auto	Negative

Negative = No LBP found
Lead concentration below
1.0 mg/cm2 or 0.5% by weight

Inconclusive = Lead concentration at or near 1.0 mg/cm2,
confirmatory laboratory sampling indicated

Positive = LBP present
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XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
164/161	13	Unlabeled Restroom	Metal	Left Door Jamb	Charcoal	Fair	Wall "C" West	0.2	Auto	Negative
165/162	13	Restroom - Stall	Metal	Door	Brown	Fair	Ceiling - Center	0.1	Auto	Negative
166/163	13	Unlabeled Restroom	Ceramic Tile	Wall	Ivory	Intact	Ceiling - South	0.2	Auto	Negative
167/164	13	Unlabeled Restroom	Drywall	Ceiling	White	Intact	Wall "A" West	0.1	Auto	Negative
168/165	13	Restroom - Air Vent	Metal	Register	Ivory	Fair	Ceiling - South	0.1	Auto	Negative
169/166	14	Suite 500 - Window	Metal	Frame	Black	Intact	Wall "A" West	0.1	Auto	Negative
170/167	14	Light Fixture	Metal	Frame	Ivory	Intact	Ceiling - South	0.0	Auto	Negative
171/168	14	Air Vent	Metal	Register	Ivory	Intact	Ceiling - South	0.2	Auto	Negative
172/169	14	Suite 500 - Window	Metal	Window Sill	Black	Intact	Wall "D" South	0.2	Auto	Negative
173/170	14	Cabinets/Sink	Wood	Facing	Beige	Fair	Wall "D" South	0.1	Auto	Negative
174/171	14	Suite 500	DW/WP	Wall	Beige	Fair	Wall "A" West	0.2	Auto	Negative
175/172	14	Suite 500	DW/WP	Wall	Beige	Fair	Wall "B" North	0.1	Auto	Negative
176/173	14	Suite 500	DW/WP	Wall	Beige	Fair	Wall "C" East	0.2	Auto	Negative
177/174	14	Above Drop Ceiling	Concrete	Ceiling	Beige	Fair	Ceiling - NEC	0.2	Auto	Negative
178/175	15	Northwest Suite	Concrete	Ceiling	Beige	Fair	Ceiling - South	0.1	Auto	Negative
179/176	15	Northwest Suite	Wood	Door	Brown	Fair	Wall "A" South	0.2	Auto	Negative
180/177	15	Northwest Suite	Metal	Left Door Jamb	Black	Fair	Wall "A" South	0.1	Auto	Negative
181/178	15	Northwest Suite Window	Metal	Window Sill	Black	Fair	Wall "B" West	0.3	Auto	Negative
182/179	15	Light Fixture	Metal	Frame	Ivory	Intact	Ceiling - West	0.1	Auto	Negative
183/180	15	Air Vent	Metal	Grate	Ivory	Intact	Ceiling - West	0.2	Auto	Negative

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XRF INTERNAL REPORT NUMBER: 10/09/2025	ABATEMENT LEVEL: 1.0 mg/cm2	Job Finished: 4:19 PM

XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
184/181	15	Northwest Suite	DW/WP	Wall	Ivory	Fair	Wall "A" South	0.2	Auto	Negative
185/182	15	Northwest Suite	DW/WP	Wall	Ivory	Fair	Wall "B" West	0.1	Auto	Negative
186/183	15	Northwest Suite	DW/WP	Wall	Ivory	Fair	Wall "C" North	0.2	Auto	Negative
187/184	15	Northwest Suite	DW/WP	Wall	Ivory	Fair	Wall "D" East	0.2	Auto	Negative
188/185	15	Closet North of Stairs	Drywall	Wall	Ivory	Fair	Wall "C" South	0.2	Auto	Negative
189/186	15	Closet North of Stairs	Wood	Shelf	Ivory	Fair	Wall "C" South	0.2	Auto	Negative
190/187	15	Closet North of Stairs	Wood	Door	Brown	Fair	Wall "A" North	0.2	Auto	Negative
191/188	15	Closet North of Stairs	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" North	0.1	Auto	Negative
195/189	4th Floor	Doorway to Elevator Lobby	Wood	Door	Brown	Fair	Wall "A" East	0.0	Auto	Negative
196/190	16	Doorway to Elevator Lobby	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" East	1.1	Auto	Positive
197/191	16	Elevator #1	Metal	Left Door Jamb	Charcoal	Intact	Wall "A" East	0.7	Auto	Negative
198/192	16	Elevator #1	Metal	Left Door	Charcoal	Intact	Wall "A" East	0.4	Auto	Negative
199/193	16	Elevator #2	Metal	Right Door	Charcoal	Intact	Wall "A" East	0.5	Auto	Negative
200/194	16	Elevator #2	Metal	Right Door Jamb	Charcoal	Fair	Wall "A" East	0.9	Auto	Negative
201/195	16	Hallway - Window	Metal	Window Sill	Black	Fair	Wall "C" West	0.3	Auto	Negative
202/196	16	Air Vent	Metal	Register	Beige	Fair	Ceiling - Center	0.2	Auto	Negative
203/197	16	Elevator Lobby/Hallway	Drywall	Ceiling	White	Fair	Ceiling - Center	0.1	Auto	Negative
204/198	16	Elevator Lobby/Hallway	Drywall	Wall	Light Blue	Fair	Wall "A" East	0.1	Auto	Negative
205/199	16	Elevator Lobby/Hallway	Drywall	Wall	Light Blue	Fair	Wall "B" South	0.1	Auto	Negative
206/200	16	Elevator Lobby/Hallway	Drywall	Wall	Light Blue	Fair	Wall "C" West	0.1	Auto	Negative

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207/201	16	Elevator Lobby/Hallway	Drywall	Wall	Light Blue	Intact	Wall "D" North	0.2	Auto	Negative
208/202	17	Women's Restroom	Wood	Door	Brown	Intact	Wall "A" South	0.0	Auto	Negative
209/203	17	Women's RR Doorway	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" South	0.3	Auto	Negative
210/204	17	Women's RR Window	Wood	Frame	Black	Intact	Wall "B" West	0.3	Auto	Negative
211/205	17	Women's Restroom	Ceramic Tile	Wall	Ivory	Fair	Wall "B" West	0.3	Auto	Negative
212/206	17	Women's Restroom	Drywall	Ceiling	White	Intact	Ceiling - Center	0.2	Auto	Negative
213/207	17	Access Panel	Metal	Cover	Beige	Intact	Ceiling - North	0.2	Auto	Negative
214/208	17	Women's Restroom - Stall	Metal	Door	Brown	Fair	Wall "C" North	0.0	Auto	Negative
215/209	17	Women's RR - Closet	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" West	0.2	Auto	Negative
216/210	17	Women's RR - Closet	Wood	Door	Brown	Fair	Wall "A" West	0.0	Auto	Negative
217/211	17	Women's RR - Closet	Drywall	Wall	Beige	Fair	Wall "C" East	0.2	Auto	Negative
218/212	18	Suite 410	Drywall	Wall	Light Blue	Intact	Wall "A" West	0.1	Auto	Negative
219/213	18	Suite 410	Drywall	Wall	Light Blue	Intact	Wall "B" North	0.1	Auto	Negative
220/214	18	Suite 410	Drywall	Wall	Light Blue	Intact	Wall "C" East	0.6	Auto	Negative
221/215	18	Suite 410	Drywall	Wall	Light Blue	Intact	Wall "D" South	0.3	Auto	Negative
222/216	18	Cupboards	Wood	Back Side	Ivory	Intact	Wall "B" North	0.0	Auto	Negative
223/217	18	Cabinets/Sink	Wood	Facing	Ivory	Intact	Wall "B" North	0.2	Auto	Negative
224/218	18	Power Panel	Metal	Cover	Gray	Intact	Wall "A" West	0.0	Auto	Negative
225/219	18	Suite 410	Concrete	Beam	Beige	Fair	Ceiling - South	0.1	Auto	Negative
226/220	18	Suite 410	Plaster	Ceiling	Ivory	Fair	Ceiling - South	0.3	Auto	Negative

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227/221	18	Light Fixture	Metal	Frame	White	Intact	Ceiling - South	0.0	Auto	Negative
228/222	18	Air Vent	Metal	Register	Ivory	Intact	Ceiling - South	0.1	Auto	Negative
229/223	18	Suite 410 - Window	Metal	Window Sill	Black	Intact	Wall "D" South	0.2	Auto	Negative
230/224	19	Unisex Restroom	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" East	0.3	Auto	Negative
231/225	19	Unisex Restroom	Wood	Door	Brown	Fair	Wall "A" East	0.0	Auto	Negative
232/226	19	Unisex Restroom - Vanity	Wood	Facing	Brown	Fair	Wall "D" North	0.1	Auto	Negative
233/227	19	Unisex Restroom - Window	Wood	Frame	Black	Intact	Wall "C" West	0.2	Auto	Negative
234/228	19	Unisex Restroom	Ceramic Tile	Wall	Ivory	Intact	Wall "A" East	0.2	Auto	Negative
235/229	19	Unisex Restroom	Ceramic Tile	Floor	Pattern	Intact	Floor - East	0.2	Auto	Negative
236/230	19	Unisex Restroom - Stall	Metal	Door	Brown	Fair	Wall "B" South	0.1	Auto	Negative
237/231	19	Air Vent	Metal	Grate	Ivory	Intact	Ceiling - North	0.1	Auto	Negative
238/232	19	Unisex Restroom	Drywall	Ceiling	White	Intact	Ceiling - Center	0.2	Auto	Negative
239/233	20	Suite 409 - Doorway	Wood	Door	Brown	Fair	Wall "A" South	0.1	Auto	Negative
240/234	20	Suite 409 - Doorway	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" South	0.4	Auto	Negative
241/235	20	Suite 409 - Window	Metal	Window Sill	Black	Fair	Wall "B" West	0.0	Auto	Negative
242/236	20	Air Vent	Metal	Grate	Beige	Intact	Ceiling - Center	0.2	Auto	Negative
243/237	20	Light Fixture	Metal	Frame	White	Intact	Ceiling - Center	0.1	Auto	Negative
244/238	20	Power Panel	Metal	Cover	Ivory	Intact	Wall "D" East	0.0	Auto	Negative
245/239	20	Suite 409	DW/WP	Wall	Ivory	Intact	Wall "A" South	0.2	Auto	Negative
246/240	20	Suite 409	DW/WP	Wall	Ivory	Intact	Wall "B" West	0.3	Auto	Negative

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Lead concentration below
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247/241	20	Suite 409	DW/WP	Wall	Ivory	Intact	Wall "C" North	0.7	Auto	Negative
248/242	20	Suite 409	DW/WP	Wall	Ivory	Intact	Wall "D" East	0.7	Auto	Negative
249/243	20	Closet North of Stairs	Drywall	Wall	Ivory	Intact	Wall "C" South	0.2	Auto	Negative
250/244	4th Floor	Northeast Stairway	Wood	Door	Brown	Fair	Wall "D" West	0.0	Auto	Negative
251/245	4th Floor	Northeast Stairway	Metal	Left Door Jamb	Charcoal	Fair	Wall "D" West	0.6	Auto	Negative
252/246	4th Floor	Northeast Stairway	Metal	Railing	Ivory	Fair	Wall "A" North	0.0	Auto	Negative
253/247	4th Floor	Northeast Stairway	Metal	Handrail	Ivory	Fair	Wall "A" North	0.0	Auto	Negative
254/248	4th Floor	Firehose Cabinet	Metal	Cover	Beige	Intact	Wall "C" South	0.1	Auto	Negative
255/249	4th Floor	Northeast Stairway	Plaster	Ceiling	Ivory	Intact	Ceiling - Center	0.2	Auto	Negative
256/250	4th Floor	Northeast Stairway	CMU	Wall	Ivory	Intact	Wall "A" North	0.0	Auto	Negative
257/251	4th Floor	Northeast Stairway	CMU	Wall	Ivory	Intact	Wall "D" West	0.0	Auto	Negative
258/252	4th Floor	Northeast Stairway	CMU	Wall	Ivory	Intact	Wall "B" East	0.0	Auto	Negative
259/253	4th Floor	Northeast Stairway	Drywall	Wall	Ivory	Intact	Wall "D" South	0.1	Auto	Negative
260/254	4th Floor	Main Stairway Landing	Plaster	Wall	Ivory	Fair	Wall "A" North	0.0	Auto	Negative
261/255	4th Floor	Main Stairway Landing	Plaster	Wall	Ivory	Intact	Wall "B" East	0.1	Auto	Negative
262/256	4th Floor	Main Stairway Landing	Plaster	Wall	Ivory	Intact	Wall "C" South	0.1	Auto	Negative
263/257	4th Floor	Main Stairway Landing	Plaster	Wall	Ivory	Fair	Wall "D" West	0.1	Auto	Negative
264/258	4th Floor	Main Stairway Landing	Plaster	Ceiling	Ivory	Intact	Ceiling - Center	0.1	Auto	Negative
265/259	4th Floor	Main Stairway Landing	Concrete	Floor	Red	Fair	Floor - Center	0.0	Auto	Negative
266/260	4th Floor	Main Stairway Landing	Concrete	Edge	Brown	Fair	Floor - South	0.1	Auto	Negative

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267/261	4th Floor	Main Stairs	Wood	Chair Rail	Brown	Intact	Wall "D" West	0.1	Auto	Negative
268/262	4th Floor	Main Stairs	Wood	Handrail	Brown	Fair	Wall "D" West	0.1	Auto	Negative
269/263	4th Floor	Main Stairs	Metal	Handrail Bracket	Brass	Bare	Wall "D" West	15.2	Auto	Positive
270/264	4th Floor	Main Stairs	Wood	Rail Cap	Brown	Intact	Wall "B" East	0.0	Auto	Negative
271/265	4th Floor	Main Stairs	Slate	Stringer	Brown	Fair	Wall "B" East	0.0	Auto	Negative
272/266	3rd Floor	Elevator Lobby/Hallway	Wood	Door	Brown	Fair	Wall "A" East	0.0	Auto	Negative
273/267	21	Elevator Lobby/Hallway	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" East	0.4	Auto	Negative
274/268	21	Elevator #1	Metal	Left Door Jamb	Brown	Fair	Wall "A" East	0.6	Auto	Negative
275/269	21	Elevator #1	Metal	Left Door	Brown	Fair	Wall "A" East	0.5	Auto	Negative
276/270	21	Elevator #2	Metal	Right Door Jamb	Brown	Fair	Wall "A" East	0.6	Auto	Negative
277/271	21	Elevator #2	Metal	Right Door	Brown	Fair	Wall "A" East	0.4	Auto	Negative
278/272	21	Hallway Window	Metal	Window Sill	Black	Intact	Wall "C" West	0.2	Auto	Negative
279/273	21	Air Vent	Metal	Register	White	Intact	Ceiling - Center	0.2	Auto	Negative
280/274	21	Elevator Lobby/Hallway	Drywall	Ceiling	White	Intact	Ceiling - Center	0.1	Auto	Negative
281/275	21	Elevator Lobby/Hallway	DW/WP	Wall	Beige	Fair	Wall "A" East	0.2	Auto	Negative
282/276	21	Elevator Lobby/Hallway	DW/WP	Wall	Beige	Fair	Wall "B" South	0.0	Auto	Negative
283/277	21	Elevator Lobby/Hallway	DW/WP	Wall	Pattern	Fair	Wall "C" West	0.3	Auto	Negative
284/278	21	Elevator Lobby/Hallway	DW/WP	Wall	Beige	Intact	Wall "D" North	0.0	Auto	Negative
285/279	22	ADA Restroom	Wood	Door	Brown	Fair	Wall "A" South	0.1	Auto	Negative
286/280	22	ADA Restroom	Metal	Right Door Jamb	Charcoal	Fair	Wall "A" South	0.1	Auto	Negative

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287/281	22	ADA Restroom - Window	Metal	Window Sill	Black	Intact	Wall "B" West	0.1	Auto	Negative
288/282	22	Air Vent	Metal	Grate	White	Intact	Ceiling - North	0.2	Auto	Negative
289/283	22	ADA Restroom	Drywall	Ceiling	White	Fair	Ceiling - Center	0.2	Auto	Negative
290/284	22	ADA Restroom	Ceramic Tile	Floor	Pattern	Intact	Floor - Center	0.0	Auto	Negative
291/285	22	ADA Restroom	Ceramic Tile	Wall	Ivory	Intact	Wall "D" East	0.1	Auto	Negative
292/286	22	Decorative Tiles	Ceramic Tile	Wall	Black	Intact	Wall "D" East	0.3	Auto	Negative
293/287	23	Women's Restroom	Ceramic Tile	Wall	Ivory	Intact	Wall "A" East	0.3	Auto	Negative
294/288	23	Women's Restroom	Ceramic Tile	Floor	Pattern	Intact	Floor - East	0.2	Auto	Negative
295/289	23	Women's RR - Window	Metal	Window Sill	Black	Intact	Wall "C" West	0.2	Auto	Negative
296/290	23	Women's Restroom	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" East	0.3	Auto	Negative
297/291	23	Women's Restroom	Wood	Door	Brown	Intact	Wall "A" East	0.1	Auto	Negative
298/292	23	Women's RR - Vanity	Wood	Facing	Brown	Intact	Wall "D" North	0.0	Auto	Negative
299/293	23	Women's RR - Stall	Metal	Door	Brown	Intact	Wall "B" South	0.1	Auto	Negative
300/294	23	Air Vent	Metal	Grate	Ivory	Intact	Ceiling - North	0.1	Auto	Negative
301/295	23	Women's Restroom	Drywall	Ceiling	White	Intact	Ceiling - Center	0.1	Auto	Negative
302/296	24	Large Suite South	DW/WP	Wall	Ivory	Intact	Wall "A" West	0.2	Auto	Negative
303/297	24	Large Suite South	DW/WP	Wall	Beige	Fair	Wall "B" North	0.2	Auto	Negative
304/298	24	Large Suite South	DW/WP	Wall	Blue	Intact	Wall "C" East	0.2	Auto	Negative
305/299	24	Large Suite South	DW/WP	Wall	Beige	Intact	Wall "D" South	0.0	Auto	Negative
306/300	24	Large Suite - Window	Metal	Window Sill	Black	Intact	Wall "D" South	0.2	Auto	Negative

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XRF SEQUENTIAL READING FIELD REPORT FORM FOR LEAD-BASED PAINT INSPECTIONS

XRF MANUFACTURER/SERIAL NUMBER: Viken Pb200e s/n #1013	PROPERTY ID: 301 Cypress St., Abeline, TX	Unit No.
RADIATION SOURCE ASSAY DATE: December 25, 2024	RISK ASSESSOR: T. Bazan (TDSHS # 2070001)	Job Started: 8:40 AM
XRF INTERNAL REPORT NUMBER: 10/09/2025	ABATEMENT LEVEL: 1.0 mg/cm2	Job Finished: 4:19 PM

XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
307/301	24	Large Suite South	Concrete	Beam	Ivory	Fair	Ceiling - Center	**10.5**	Auto	**Positive**
308/302	24	Large Suite South	Plaster	Ceiling	Beige	Fair	Ceiling - Center	**14.9**	Auto	**Positive**
309/303	24	Light Fixture	Metal	Frame	White	Intact	Ceiling - West	0.1	Auto	**Negative**
310/304	24	Air Vent	Metal	Register	Ivory	Intact	Ceiling - West	0.0	Auto	**Negative**
311/305	24	Vault (No Door)	Metal	Facing	Beige	Fair	Wall "B" North	**6.9**	Auto	**Positive**
312/306	24	Inside Frame	Metal	Left Door Jamb	Black	Poor	Wall "A" South	0.2	Auto	**Negative**
313/307	24	Vault Interior	Concrete	Wall	Ivory	Fair	Wall "B" West	0.2	Auto	**Negative**
314/308	24	Vault Interior	Concrete	Ceiling	Ivory	Intact	Ceiling - South	0.1	Auto	**Negative**
315/309	24	Vault Interior	Concrete	Floor	Gray	Fair	Floor - South	0.0	Auto	**Negative**
316/310	25	Suite 310	Plaster	Ceiling	Beige	Fair	Ceiling - South	**10.7**	Auto	**Positive**
317/311	25	Light Fixture	Metal	Frame	Ivory	Intact	Ceiling - South	0.1	Auto	**Negative**
318/312	25	Air Vent	Metal	Register	Ivory	Intact	Ceiling - South	0.2	Auto	**Negative**
319/313	25	Suite 310	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" South	0.4	Auto	**Negative**
320/314	25	Suite 310	Wood	Door	Brown	Fair	Wall "A" South	0.1	Auto	**Negative**
321/315	25	Suite 310 - Window	Metal	Window Sill	Black	Fair	Wall "B" West	0.2	Auto	**Negative**
322/316	25	Above Drop Ceiling	Plaster	Wall	Beige	Fair	Wall "B" West	0.3	Auto	**Negative**
323/317	25	Suite 310	Drywall	Wall	Gray	Intact	Wall "A" South	0.1	Auto	**Negative**
324/318	25	Suite 310	Drywall	Wall	Gray	Intact	Wall "B" West	0.2	Auto	**Negative**
325/319	25	Suite 310	Drywall	Wall	Gray	Intact	Wall "C" North	0.1	Auto	**Negative**
326/320	25	Suite 310	Drywall	Wall	Gray	Intact	Wall "D" East	0.1	Auto	**Negative**

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XRF MANUFACTURER/SERIAL NUMBER: Viken Pb200e s/n #1013					PROPERTY ID: 301 Cypress St., Abeline, TX				Unit No.	
RADIATION SOURCE ASSAY DATE: December 25, 2024					RISK ASSESSOR: T. Bazan (TDSHS # 2070001)				Job Started:	8:40 AM
XRF INTERNAL REPORT NUMBER: 10/09/2025					ABATEMENT LEVEL: 1.0 mg/cm2				Job Finished:	4:19 PM
XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
327/321	Exterior	Front Entry	Metal	Door Frame	Black	Intact	West	0.1	Auto	Negative
328/322	Exterior	Front Entry	Stucco	Decorative	Gray	Intact	West	0.1	Auto	Negative
329/323	Exterior	North Entry	Metal	Door Frame	Black	Fair	North	0.2	Auto	Negative
330/324	Exterior	North Entry Porch	Stucco	Ceiling	Gray	Intact	Ceiling - Center	0.2	Auto	Negative
331/325	Exterior	North Entry Porch	Brick	Wall	Beige	Fair	Facing East	0.0	Auto	Negative
332/326	Exterior	Parking Lot	Concrete	Wheel Stop	Yellow	Poor	Ground - West	**2.0**	Auto	Positive
333/327	Exterior	Parking Lot	Concrete	Safety Stripe	Yellow	Poor	Ground - West	**1.3**	Auto	Positive
334/328	Exterior	Mechanical Room	Brick	Wall	Beige	Fair	East	0.0	Auto	Negative
335/329	Exterior	Gutter Downpipe	Metal	Downpipe	Beige	Poor	East	0.1	Auto	Negative
336/330	Exterior	Gutter Downpipe	Metal	Pipe	Beige	Fair	East	0.0	Auto	Negative
337/331	Exterior	Mech Rm - Air Vent	Metal	Louver	Charcoal	Fair	East	0.1	Auto	Negative
338/332	Exterior	Mech Rm Single Door	Metal	Left Door Jamb	Beige	Fair	East	0.6	Auto	Negative
339/333	Exterior	Mech Rm Double Doors	Metal	Right Door Jamb	Beige	Fair	East	0.6	Auto	Negative
340/334	Exterior	Northeast Exit Stairs	Metal	Rail Cap	Beige	Fair	North	0.1	Auto	Negative
341/335	Exterior	Northeast Exit Stairs	Metal	Handrail	Beige	Fair	North	0.1	Auto	Negative
342/336	Exterior	Northeast Exit	Metal	Left Door Jamb	Beige	Fair	North	0.6	Auto	Negative
343/337	Exterior	East Addition Door	Metal	Left Door Jamb	Beige	Fair	North	0.4	Auto	Negative
344/338	Exterior	East Addition Wall	Brick	Wall	Beige	Poor	North	0.2	Auto	Negative
345/339	Exterior	Power Disconnect	Metal	Cover	Beige	Poor	North	0.0	Auto	Negative
346/340	Exterior	Parking Lot East Side	Metal	Bollard	Yellow	Fair	East	**1.8**	Auto	Positive

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XRF MANUFACTURER/SERIAL NUMBER: Viken Pb200e s/n #1013	PROPERTY ID: 301 Cypress St., Abeline, TX	Unit No.
RADIATION SOURCE ASSAY DATE: December 25, 2024	RISK ASSESSOR: T. Bazan (TDSHS # 2070001)	Job Started: 8:40 AM
XRF INTERNAL REPORT NUMBER: 10/09/2025	ABATEMENT LEVEL: 1.0 mg/cm2	Job Finished: 4:19 PM

XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
347/341	Exterior	East Side Addition	Metal	Downpipe	Charcoal	Fair	East	0.1	Auto	**Negative**
348/342	Exterior	1054 N. 3rd St. - Doorway	Metal	Frame	Black	Fair	South	0.2	Auto	**Negative**
349/343	Exterior	Other Doorway	Metal	Frame	Black	Fair	South	0.2	Auto	**Negative**
350/344	Exterior	1054 N. 3rd St. - Window	Metal	Frame	Black	Fair	South	0.3	Auto	**Negative**
		XRF Calibration								
1		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	1.0	Auto	
2		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	0.9	Auto	
3		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	0.9	Auto	
		XRF Calibration								
192		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	1.0	Auto	
193		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	1.0	Auto	
194		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	1.0	Auto	
351		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	1.1	Auto	
352		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	1.0	Auto	
353		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	1.0	Auto	
--END--	----------	--END OF UNIT--	----------	--END--	----------	--END--	----------	--END--	----------	--END--

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RADIATION SOURCE ASSAY DATE: December 25, 2024					RISK ASSESSOR: T. Bazan (TDSHS # 2070001)				Job Started:	8:15 AM
XRF INTERNAL REPORT NUMBER: 10/10/2025					ABATEMENT LEVEL: 1.0 mg/cm2				Job Finished:	1:15 PM
XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
4 / 1	26 / 1	2nd Floor Main Landing	Plaster	Wall	Ivory	Intact	Wall "B" North	**6.1**	Auto	**Positive**
5 / 2	26 / 1	2nd Floor Main Landing	Plaster	Wall	Ivory	Intact	Wall "C" East	**8.0**	Auto	**Positive**
6 / 3	26 / 1	2nd Floor Main Landing	Plaster	Wall	Ivory	Intact	Wall "D" South	0.0	Auto	**Negative**
7 / 4	26 / 1	2nd Floor Main Landing	Plaster	Wall	Ivory	Intact	Wall "A" West	0.0	Auto	**Negative**
8 / 5	26 / 1	2nd Floor Main Landing	Plaster	Wainscot	Ivory	Fair	Wall "D" South	0.1	Auto	**Negative**
9 / 6	26 / 1	2nd Floor Main Landing	Plaster	Wainscot	Ivory	Intact	Wall "B" North	0.2	Auto	**Negative**
10 / 7	26 / 1	2nd Floor Main Landing	Plaster	Ceiling	Ivory	Intact	Ceiling - Center	**8.9**	Auto	**Positive**
11 / 8	26 / 1	2nd Floor Main Landing	Wood	Chair Rail	Brown	Fair	Wall "B" North	0.2	Auto	**Negative**
12 / 9	26 / 1	2nd Floor Main Landing	Wood	Handrail	Brown	Fair	Wall "D" South	0.1	Auto	**Negative**
13 / 10	26 / 1	2nd Floor Main Landing	Plaster	Baseboard	Brown	Fair	Wall "B" North	0.0	Auto	**Negative**
14 / 11	26 / 1	Doorway - North	Metal	Left Door Jamb	Charcoal	Fair	Wall "B" North	0.0	Auto	**Negative**
15 / 12	26 / 1	Doorway - East	Metal	Door	Charcoal	Fair	Wall "C" East	0.2	Auto	**Negative**
16 / 13	2nd Floor	Main Fire Stairs Landing	Plaster	Wall	Ivory	Fair	Wall "B" West	0.2	Auto	**Negative**
17 / 14	2nd Floor	Main Fire Stairs Landing	Plaster	Wainscot	Beige	Fair	Wall "B" West	0.3	Auto	**Negative**
18 / 15	2nd Floor	Main Fire Stairs Landing	Wood	Chair Rail	Brown	Fair	Wall "D" East	0.1	Auto	**Negative**
19 / 16	2nd Floor	Main Fire Stairs Landing	Plaster	Baseboard	Brown	Fair	Wall "D" East	0.5	Auto	**Negative**
20 / 17	2nd Floor	Main Fire Stairs	Plaster	Ceiling	Ivory	Intact	Ceiling - South	0.3	Auto	**Negative**
21 / 18	2nd Floor	Firehose Cabinet	Metal	Door	Ivory	Intact	Wall "B" West	0.1	Auto	**Negative**
22 / 19	27 / 3	Northwest Corner Room	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" South	0.1	Auto	**Negative**
23 / 20	27 / 3	Northwest Corner Room	Wood	Door	Brown	Fair	Wall "A" South	0.0	Auto	**Negative**

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XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
24 / 21	27 / 3	Northwest Corner Room	DW/WP	Wall	Beige	Fair	Wall "A" South	0.1	Auto	Negative
25 / 22	27 / 3	Northwest Corner Room	DW/WP	Wall	Beige	Fair	Wall "B" West	0.1	Auto	Negative
26 / 23	27 / 3	Northwest Corner Room	Plaster	Wall	Brown	Fair	Wall "B" West	0.2	Auto	Negative
27 / 24	27 / 3	Northwest Corner Room	DW/WP	Wall	Red	Poor	Wall "C" North	0.8	Auto	Negative
28 / 25	27 / 3	Northwest Corner Room	Drywall	Wall	Bare	Test for Bias	Wall "C" North	0.1	Auto	Negative
29 / 26	27 / 3	Northwest Corner Room	Plaster	Wall	Beige	Fair	Wall "C" North	0.4	Auto	Negative
30 / 27	27 / 3	NW Corner Rm-Window #4	Wood	Sash	Beige	Poor	Wall "C" North	0.1	Auto	Negative
31 / 28	27 / 3	NW Corner Rm-Window #4	Wood	Sash Track	Beige	Intact	Wall "C" North	0.1	Auto	Negative
32 / 29	27 / 3	Northwest Corner Room	Plaster	Beam	Beige	Intact	Ceiling - Center	0.2	Auto	Negative
33 / 30	27 / 3	Northwest Corner Room	Plaster	Ceiling	Beige	Intact	Ceiling - Center	0.3	Auto	Negative
34 / 31	27 / 3	Northwest Corner Room	DW/WP	Wall	Beige	Intact	Wall "D" East	0.2	Auto	Negative
35 / 32	27 / 3	NW Corner Rm-Heater	Metal	Case	Ivory	Fair	Wall "B" West	0.2	Auto	Negative
36 / 33	28 / 4	East Suite	Metal	Case	Ivory	Fair	Wall "D" South	0.2	Auto	Negative
37 / 34	28 / 4	East Suite	DW/WP	Wall	Beige	Intact	Wall "A" West	0.2	Auto	Negative
38 / 35	28 / 4	East Suite	DW/WP	Wall	Beige	Intact	Wall "B" North	0.1	Auto	Negative
39 / 36	28 / 4	East Suite	DW/WP	Wall	Beige	Intact	Wall "C" East	0.2	Auto	Negative
40 / 37	28 / 4	East Suite	DW/WP	Wall	Red	Intact	Wall "D" South	0.7	Auto	Negative
41 / 38	28 / 4	2nd Floor East Suite	Plaster	Beam	Beige	Fair	Ceiling - Center	8.9	Auto	Positive
42 / 39	28 / 4	2nd Floor East Suite	Plaster	Crown Molding	Beige	Intact	Ceiling - Center	10.4	Auto	Positive
43 / 40	28 / 4	2nd Floor East Suite	Plaster	Crown Molding	Beige	Intact	Ceiling - Center	0.1	Auto	Negative

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44 / 41	28 / 4	Brace for Ceiling Pan	Metal	Angle Iron	Red	Intact	Ceiling - Center	0.0	Auto	Negative
45 / 42	28 / 4	East Suite	Wood	Baseboard	Beige	Intact	Wall "B" North	8.2	Auto	Positive
46 / 43	28 / 4	2nd Floor East Vault	Metal	Right Door Casing	Beige	Intact	Wall "A" West	9.1	Auto	Positive
47 / 44	28 / 4	2nd Fl Vault (Mosler Door)	Metal	Safe Door	Beige	Fair	Wall "A" West	8.1	Auto	Positive
48 / 45	28 / 4	2nd Floor Vault Interior	Metal	Left Door	Green	Fair	Wall "A" East	9.9	Auto	Positive
49 / 46	28 / 4	2nd Floor Vault Interior	Metal	Threshold	Gray	Poor	Floor	0.2	Auto	Negative
50 / 47	28 / 4	2nd Floor Vault Interior	Plaster	Wall	Beige	Intact	Wall "A" East	0.3	Auto	Negative
51 / 48	28 / 4	2nd Floor Vault Interior	Plaster	Ceiling	Beige	Fair	Ceiling - Center	0.0	Auto	Negative
52 / 49	29 / 5	2nd Floor Lunch Room	Metal	Web Joist	Yellow	Fair	Ceiling - North	0.0	Auto	Negative
53 / 50	29 / 5	Sprinkler System	Metal	Horizontal Pipe	Black	Intact	Ceiling - North	0.1	Auto	Negative
54 / 51	29 / 5	Light Fixture	Metal	Frame	White	Intact	Ceiling - East	0.2	Auto	Negative
55 / 52	29 / 5	Air Vent	Metal	Register	Ivory	Intact	Ceiling - West	0.2	Auto	Negative
56 / 53	29 / 5	Heater	Metal	Case	Beige	Intact	Wall "C" North	0.1	Auto	Negative
57 / 54	29 / 5	2nd Floor Lunch Room	Wood	Door	Brown	Fair	Wall "A" South	0.0	Auto	Negative
58 / 55	29 / 5	2nd Floor Lunch Room	Wood	Left Door Jamb	Beige	Fair	Wall "A" South	0.1	Auto	Negative
59 / 56	29 / 5	2nd Floor Lunch Room	Wood	Baseboard	Beige	Fair	Wall "A" South	0.0	Auto	Negative
60 / 57	29 / 5	2nd Floor Lunch Room	DW/WP	Wall	Beige	Intact	Wall "A" South	0.8	Auto	Negative
61 / 58	29 / 5	2nd Floor Lunch Room	DW/WP	Wall	Red	Intact	Wall "B" West	0.2	Auto	Negative
62 / 59	29 / 5	2nd Floor Lunch Room	DW/WP	Wall	Beige	Intact	Wall "C" North	0.0	Auto	Negative
63 / 60	29 / 5	2nd Floor Lunch Room	Brick	Wall	Beige	Intact	Wall "D" East	28.3	Auto	Positive

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64 / 61	29 / 5	2nd Floor Lunch Room	Plaster	Wall	Beige	Fair	Wall "D" East	0.2	Auto	Negative
65 / 62	29 / 5	2nd Floor Lunch Room	DW/WP	Wall	Beige	Intact	Wall "D" East	0.0	Auto	Negative
66 / 63	29 / 5	Cabinets behind Bar	Wood	Facing	Brown	Fair	Wall "D" East	0.0	Auto	Negative
67 / 64	30 / 6	Women's Restroom	Wood	Door	Brown	Fair	Wall "A" South	0.3	Auto	Negative
68 / 65	30 / 6	Women's Restroom	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" South	0.2	Auto	Negative
69 / 66	30 / 6	Heater	Metal	Case	Beige	Fair	Wall "B" West	0.0	Auto	Negative
70 / 67	30 / 6	Women's Restroom Stalls	Metal	Door	Salmon	Fair	Wall "D" East	0.1	Auto	Negative
71 / 68	30 / 6	Women's Restroom Vanity	Wood	Facing	Brown	Fair	Wall "D" East	0.2	Auto	Negative
72 / 69	30 / 6	Air Vent	Metal	Grate	Ivory	Fair	Ceiling - North	8.3	Auto	Positive
73 / 70	30 / 6	2nd FL Women's Restroom	Plaster	Ceiling	Beige	Fair	Ceiling - North	0.3	Auto	Negative
74 / 71	30 / 6	Women's Restroom	Ceramic Tile	Wall	Ivory	Intact	Wall " B" West	0.1	Auto	Negative
75 / 72	30 / 6	Women's Restroom	Ceramic Tile	Floor	Pattern	Intact	Floor - West	0.2	Auto	Negative
76 / 73	31 / 7	Men's Restroom	Ceramic Tile	Floor	Pattern	Intact	Floor - East	0.2	Auto	Negative
77 / 74	31 / 7	Men's Restroom	Ceramic Tile	Wall	Ivory	Intact	Wall "D" North	0.1	Auto	Negative
78 / 75	31 / 7	Men's Restroom	Wood	Door	Brown	Intact	Wall "A" East	0.1	Auto	Negative
79 / 76	31 / 7	Men's Restroom	Metal	Left Door Jamb	Charcoal	Intact	Wall "A" East	0.1	Auto	Negative
80 / 77	31 / 7	Men's Restroom Stalls	Metal	Door	Salmon	Intact	Wall "C" West	0.2	Auto	Negative
81 / 78	31 / 7	Men's Restroom	Drywall	Ceiling	White	Intact	Ceiling - East	0.1	Auto	Negative
82 / 79	2nd Floor	Northeast Fire Stairs	Wood	Door	Brown	Fair	Wall "A" South	0.4	Auto	Negative
83 / 80	2nd Floor	Northeast Fire Stairs	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" South	0.2	Auto	Negative

Negative = No LBP found
Lead concentration below
1.0 mg/cm2 or 0.5% by weight

Inconclusive = Lead concentration at or near 1.0 mg/cm2,
confirmatory laboratory sampling indicated

Positive = LBP present
See Lead Hazard Control Plan

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XRF SEQUENTIAL READING FIELD REPORT FORM FOR LEAD-BASED PAINT INSPECTIONS

XRF MANUFACTURER/SERIAL NUMBER: Viken Pb200e s/n #1013	PROPERTY ID: 301 Cypress St., Abeline, TX	Unit No.
RADIATION SOURCE ASSAY DATE: December 25, 2024	RISK ASSESSOR: T. Bazan (TDSHS # 2070001)	Job Started: 8:15 AM
XRF INTERNAL REPORT NUMBER: 10/10/2025	ABATEMENT LEVEL: 1.0 mg/cm2	Job Finished: 1:15 PM

XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
84 / 81	2nd Floor	Firehose Cabinet	Metal	Cover	Beige	Intact	Wall "D" East	0.1	Auto	Negative
85 / 82	2nd Floor	Northeast Fire Stairs	Metal	Railing	Beige	Fair	Wall "C" North	0.0	Auto	Negative
86 / 83	2nd Floor	Northeast Fire Stairs	Metal	Handrail	Beige	Fair	Wall "C" North	0.2	Auto	Negative
87 / 84	2nd Floor	Northeast Fire Stairs	Metal	Stringer	Beige	Fair	Wall "C" North	0.0	Auto	Negative
88 / 85	2nd Floor	Northeast Fire Stairs	Metal	Riser	Beige	Fair	Wall "C" North	0.1	Auto	Negative
89 / 86	2nd Floor	Northeast Fire Stairs	Concrete	Ceiling	Beige	Intact	Ceiling - Center	0.0	Auto	Negative
90 / 87	2nd Floor	Northeast Fire Stairs	CMU	Wall	Beige	Intact	Wall "A" South	0.4	Auto	Negative
91 / 88	2nd Floor	Northeast Fire Stairs	CMU	Wall	Beige	Intact	Wall "B" West	0.5	Auto	Negative
92 / 89	2nd Floor	Northeast Fire Stairs	CMU	Wall	Beige	Intact	Wall "D" East	0.1	Auto	Negative
93 / 90	32 / 9	Phone Room	Concrete	Floor	Red	Poor	Floor - West	0.2	Auto	Negative
94 / 91	32 / 9	Phone Room	Plaster	Ceiling	Beige	Fair	Ceiling - West	0.6	Auto	Negative
95 / 92	32 / 9	Phone Room	Plaster	Crown Molding	Beige	Intact	Wall "A" West	0.4	Auto	Negative
96 / 93	32 / 9	Phone Room	Concrete	Beam	Beige	Intact	Wall "A" West	1.1	Auto	Positive
97 / 94	32 / 9	2nd FL Fire Suppression	Metal	Horizontal Pipe	Red	Intact	Ceiling - West	0.2	Auto	Negative
98 / 95	32 / 9	Phone Room	Drywall	Wall	Ivory	Fair	Wall "A" West	0.3	Auto	Negative
99 / 96	32 / 9	Phone Room	Plaster	Wall	Beige	Fair	Wall "B" North	0.3	Auto	Negative
100 / 97	32 / 9	Phone Room	Plaster	Wall	Beige	Fair	Wall "D" South	0.3	Auto	Negative
101 / 98	32 / 9	Heater	Metal	Case	Beige	Fair	Wall "C" East	0.3	Auto	Negative
102 / 99	32 / 9	Decorative Crown Mold	Plaster	Upper Trim	Beige	Intact	Wall "C" East	0.2	Auto	Negative
103/100	32 / 9	Power Panel	Metal	Cover	Beige	Intact	Wall "C" East	0.0	Auto	Negative

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XRF MANUFACTURER/SERIAL NUMBER: Viken Pb200e s/n #1013	PROPERTY ID: 301 Cypress St., Abeline, TX	Unit No.
RADIATION SOURCE ASSAY DATE: December 25, 2024	RISK ASSESSOR: T. Bazan (TDSHS # 2070001)	Job Started: 8:15 AM
XRF INTERNAL REPORT NUMBER: 10/10/2025	ABATEMENT LEVEL: 1.0 mg/cm2	Job Finished: 1:15 PM

XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
104/101	33 / 10	Southwest Corner Room	Wood	Door	Brown	Fair	Wall "A" North	0.1	Auto	Negative
105/102	33 / 10	Southwest Corner Room	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" North	0.2	Auto	Negative
106/103	33 / 10	Light Fixture	Metal	Frame	Ivory	Intact	Ceiling - South	0.0	Auto	Negative
107/104	33 / 10	Air Vent	Metal	Grate	Ivory	Intact	Ceiling - South	0.3	Auto	Negative
108/105	33 / 10	2nd Floor SW Corner Room	Plaster	Ceiling	Mustard	Fair	Ceiling - South	2.6	Auto	Positive
109/106	33 / 10	2nd Floor SW Corner Room	Plaster	Crown Molding	Ivory	Fair	Wall "C" South	9.7	Auto	Positive
110/107	33 / 10	2nd Floor SW Corner Room	Drywall	Wall	Beige	Fair	Wall "A" North	0.2	Auto	Negative
111/108	33 / 10	2nd Floor SW Corner Room	Drywall	Wall	Beige	Fair	Wall "B" East	0.1	Auto	Negative
112/109	33 / 10	2nd Floor SW Corner Room	DW/WP	Wall	Beige	Fair	Wall "C" South	0.6	Auto	Negative
113/110	33 / 10	2nd Floor SW Corner Room	DW/WP	Wall	Beige	Fair	Wall "D" West	0.0	Auto	Negative
114/111	33 / 10	Heater	Metal	Cover	Ivory	Fair	Wall "C" South	0.1	Auto	Negative
115/112	34 / 11	2nd Floor Elevator Lobby	Metal	Left Door Jamb	Black	Fair	Wall "A" East	0.2	Auto	Negative
116/113	34 / 11	Heater	Metal	Cover	Ivory	Fair	Wall "D" North	0.2	Auto	Negative
117/114	34 / 11	Elevator #1	Metal	Left Door Jamb	Brown	Fair	Wall "A" East	0.0	Auto	Negative
118/115	34 / 11	Elevator #1	Metal	Left Door	Brown	Fair	Wall "A" East	0.0	Auto	Negative
119/116	34 / 11	Elevator #2	Metal	Right Door	Brown	Fair	Wall "A" East	0.1	Auto	Negative
120/117	34 / 11	Elevator #2	Metal	Right Door Jamb	Brown	Fair	Wall "A" East	0.1	Auto	Negative
121/118	34 / 11	2nd Floor Elevator Lobby	Plaster	Ceiling	Ivory	Fair	Ceiling - South	15.0	Auto	Positive
122/119	34 / 11	2nd Floor Elevator Lobby	Wood	Floor	Brown	Fair	Floor - Center	0.5	Auto	Negative
123/120	34 / 11	2nd Floor Elevator Lobby	Wood	Rail Cap	Brown	Intact	Wall "C" West	0.0	Auto	Negative

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XRF SEQUENTIAL READING FIELD REPORT FORM FOR LEAD-BASED PAINT INSPECTIONS

XRF MANUFACTURER/SERIAL NUMBER: Viken Pb200e s/n #1013	PROPERTY ID: 301 Cypress St., Abeline, TX	Unit No.
RADIATION SOURCE ASSAY DATE: December 25, 2024	RISK ASSESSOR: T. Bazan (TDSHS # 2070001)	Job Started: 8:15 AM
XRF INTERNAL REPORT NUMBER: 10/10/2025	ABATEMENT LEVEL: 1.0 mg/cm2	Job Finished: 1:15 PM

XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
124/121	34 / 11	2nd Floor Elevator Lobby	DW/WP	Wall	Beige	Intact	Wall "A" East	0.1	Auto	Negative
125/122	34 / 11	2nd Floor Elevator Lobby	DW/WP	Wall	Beige	Intact	Wall "B" South	0.2	Auto	Negative
126/123	34 / 11	2nd Floor Elevator Lobby	DW/WP	Wall	Beige	Intact	Wall "C" West	0.1	Auto	Negative
127/124	34 / 11	2nd Floor Elevator Lobby	DW/WP	Wall	Beige	Intact	Wall "D" North	0.1	Auto	Negative
128/125	1st Floor	Front Entry / Lobby	Metal	Left Door	Charcoal	Fair	Wall "A" West	0.2	Auto	Negative
129/126	35 / 1	Elevator #1	Metal	Left Door Jamb	Brown	Fair	Wall "C" East	0.1	Auto	Negative
130/127	35 / 1	Elevator #1	Metal	Left Door	Brown	Fair	Wall "C" East	0.5	Auto	Negative
131/128	35 / 1	Elevator #2	Metal	Right Door	Brown	Fair	Wall "C" East	0.2	Auto	Negative
132/129	35 / 1	Elevator #2	Metal	Right Door Jamb	Brown	Fair	Wall "C" East	0.6	Auto	Negative
133/130	35 / 1	Heater	Metal	Cover	Ivory	Fair	Wall "A" West	0.1	Auto	Negative
134/131	35 / 1	Front Entry / Lobby	Drywall	Wall	Beige	Fair	Wall "A" West	0.2	Auto	Negative
135/132	35 / 1	Front Entry / Lobby	Drywall	Wall	Beige	Fair	Wall "B" North	0.2	Auto	Negative
136/133	35 / 1	Front Entry / Lobby	Drywall	Ceiling	White	Fair	Ceiling - Center	0.2	Auto	Negative
137/134	35 / 1	Main Lobby-Above Ceiling	Metal	Angle Iron	Red	Intact	Ceiling - Center	0.1	Auto	Negative
138/135	36 / 2	North Entry Foyer Entry	Metal	Door	Black	Fair	Wall "A" North	0.2	Auto	Negative
139/136	36 / 2	North Entry Foyer Door	Metal	Left Door	Black	Fair	Wall "C" South	0.2	Auto	Negative
140/137	36 / 2	North Entry Foyer	Ceramic Tile	Floor	Gray	Intact	Floor - Center	0.0	Auto	Negative
141/138	36 / 2	North Entry Foyer	Drywall	Ceiling	White	Fair	Ceiling - Center	0.1	Auto	Negative
142/139	36 / 2	North Entry Foyer	Plastic	Wall	Beige	Fair	Wall "B" East	0.1	Auto	Negative
143/140	37 / 3	North Entry Hallway	Brick	Wall	Beige	Fair	Wall "D" West	0.1	Auto	Negative

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XRF MANUFACTURER/SERIAL NUMBER: Viken Pb200e s/n #1013					PROPERTY ID: 301 Cypress St., Abeline, TX				Unit No.	
RADIATION SOURCE ASSAY DATE: December 25, 2024					RISK ASSESSOR: T. Bazan (TDSHS # 2070001)				Job Started:	8:15 AM
XRF INTERNAL REPORT NUMBER: 10/10/2025					ABATEMENT LEVEL: 1.0 mg/cm2				Job Finished:	1:15 PM
XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
144/141	37 / 3	North Entry Hallway	Metal	Plate	Bare	-	Wall "D" West	0.1	Auto	Negative
145/142	38 / 4	Print Shop 101	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" East	0.3	Auto	Negative
146/143	38 / 4	Print Shop 101	Wood	Left Door	Brown	Fair	Wall "A" East	0.1	Auto	Negative
147/144	38 / 4	Print Shop 101	Plaster	Ceiling	Beige	Fair	Ceiling - Center	0.2	Auto	Negative
148/145	38 / 4	Print Shop 101	Plaster	Beam	Ivory	Intact	Ceiling - Center	0.3	Auto	Negative
149/146	38 / 4	Print Shop 101	Drywall	Wall	Ivory	Intact	Wall "A" East	0.2	Auto	Negative
150/147	26 / 1	Doorway - East	Metal	Door	Charcoal	Fair	Wall "C" East	0.2	Auto	Negative
151/148	38 / 4	Print Shop 101	Drywall	Wall	Ivory	Intact	Wall "B" South	0.1	Auto	Negative
152/149	38 / 4	Print Shop 101	Plaster	Wall	Beige	Fair	Wall "C" West	0.4	Auto	Negative
153/150	38 / 4	Print Shop 101	Plaster	Wall	Beige	Fair	Wall "D" North	0.1	Auto	Negative
154/151	39 / 5	Suite 103	Wood	Door	Brown	Fair	Wall "A" West	0.2	Auto	Negative
155/152	39 / 5	Suite 103	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" West	0.1	Auto	Negative
156/153	39 / 5	Suite 103	DW/WP	Wall	Beige	Fair	Wall "A" West	0.2	Auto	Negative
157/154	39 / 5	Suite 103	DW/WP	Wall	Blue	Fair	Wall "B" North	0.2	Auto	Negative
158/155	39 / 5	Suite 103	DW/WP	Wall	Beige	Fair	Wall "C" East	0.2	Auto	Negative
159/156	39 / 5	Suite 103	DW/WP	Wall	Beige	Fair	Wall "D" South	0.1	Auto	Negative
160/157	2nd Floor	Main Fire Stairs Landing	Plaster	Wall	Ivory	Fair	Wall "B" West	0.2	Auto	Negative
161/158	39 / 5	Above Drop Ceiling	Plaster	Beam	Beige	Fair	Ceiling - West	0.1	Auto	Negative
162/159	40 / 6	Men's Restroom	Wood	Door	Brown	Fair	Wall "A" East	0.2	Auto	Negative
163/160	40 / 6	Men's Restroom	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" East	0.2	Auto	Negative

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XRF MANUFACTURER/SERIAL NUMBER: Viken Pb200e s/n #1013	PROPERTY ID: 301 Cypress St., Abeline, TX	Unit No.
RADIATION SOURCE ASSAY DATE: December 25, 2024	RISK ASSESSOR: T. Bazan (TDSHS # 2070001)	Job Started: 8:15 AM
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XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
164/161	40 / 6	Men's Restroom Stall	Metal	Door	Salmon	Fair	Wall "B" South	0.3	Auto	Negative
165/162	40 / 6	Light Fixture	Metal	Frame	White	Intact	Ceiling - Center	0.1	Auto	Negative
166/163	40 / 6	Men's Restroom	Drywall	Ceiling	Ivory	Intact	Ceiling - Center	0.3	Auto	Negative
167/164	40 / 6	Men's Restroom	Ceramic Tile	Wall	Ivory	Intact	Wall "D" North	0.0	Auto	Negative
168/165	40 / 6	Men's Restroom	Ceramic Tile	Floor	Pattern	Intact	Floor - East	0.2	Auto	Negative
169/166	41 /7	Hall by Women's RR	Plaster	Beam	Light Green	Fair	Ceiling - Center	0.1	Auto	Negative
170/167	2nd Floor	Main Fire Stairs Landing	Plaster	Wainscot	Beige	Fair	Wall "B" West	0.3	Auto	Negative
171/168	42 / 8	Women's Restroom	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" South	0.1	Auto	Negative
172/169	42 / 8	Women's Restroom Vanity	Wood	Facing	Brown	Fair	Wall "D" East	0.2	Auto	Negative
173/170	42 / 8	Women's Restroom	Ceramic Tile	Wall	Ivory	Intact	Wall "B" West	0.0	Auto	Negative
174/171	42 / 8	Women's Restroom	Ceramic Tile	Floor	Pattern	Intact	Floor - West	0.2	Auto	Negative
175/172	42 / 8	Women's Restroom Stalls	Metal	Door	Salmon	Fair	Wall "D" East	0.2	Auto	Negative
176/173	43 / 9	Janitor Closet	Plaster	Ceiling	Beige	Intact	Ceiling - East	0.2	Auto	Negative
177/174	43 / 9	Janitor Closet	Drywall	Wall	Ivory	Fair	Wall "A" West	0.1	Auto	Negative
178/175	43 / 9	Janitor Closet	Drywall	Wall	Ivory	Fair	Wall "B" North	0.2	Auto	Negative
179/176	43 / 9	Janitor Closet	Drywall	Wall	Ivory	Fair	Wall "C" East	0.2	Auto	Negative
180/177	2nd Floor	Main Fire Stairs Landing	Wood	Chair Rail	Brown	Fair	Wall "D" East	0.1	Auto	Negative
181/178	43 / 9	Janitor Closet	Wood	Door	Brown	Fair	Wall "A" West	0.3	Auto	Negative
182/179	43 / 9	Janitor Closet	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" West	0.0	Auto	Negative
183/180	43 / 9	Built-In Shelves	Wood	Shelf	Brown	Fair	Wall "C" East	0.7	Auto	Negative

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184/181	43 / 9	Fire Suppression	Metal	Horizontal Pipe	Red	Intact	Wall "A" West	0.1	Auto	Negative
185/182	44 / 10	East Basement Landing	Wood	Door	Brown	Fair	Wall "A" East	0.6	Auto	Negative
186/183	44 / 10	East Basement Landing	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" East	0.2	Auto	Negative
187/184	44 / 10	Landing - Pipe Chase	Metal	Cover	Gray	Fair	Wall "C" West	0.5	Auto	Negative
188/185	44 / 10	East Basement Landing	CMU	Wall	Ivory	Intact	Wall "A" East	0.1	Auto	Negative
189/186	44 / 10	East Basement Landing	Concrete	Header	Ivory	Intact	Wall "B" South	0.4	Auto	Negative
190/187	2nd Floor	Main Fire Stairs Landing	Plaster	Baseboard	Brown	Fair	Wall "D" East	0.4	Auto	Negative
191/188	44 / 10	East Basement Landing	CMU	Wall	Ivory	Intact	Wall "D" North	0.2	Auto	Negative
192/189	44 / 10	Stairs	Metal	Landing Pan	Ivory	Intact	Ceiling - North	0.0	Auto	Negative
193/190	44 / 10	Bottom Landing	Metal	Handrail	Brown	Fair	Wall "A" East	0.1	Auto	Negative
194/191	44 / 10	Stairs	Metal	Stringer	Brown	Fair	Wall "A" East	0.0	Auto	Negative
195/192	44 / 10	Stairs	Metal	Riser	Brown	Fair	Wall "D" North	0.2	Auto	Negative
196/193	44 / 10	Bottom Landing	Concrete	Floor	Red	Poor	Floor - Center	0.3	Auto	Negative
197/194	44 / 10	East Basement	Concrete	Wall	Ivory	Fair	Wall "A" North	0.2	Auto	Negative
198/195	44 / 10	East Basement	Concrete	Wall	Ivory	Fair	Wall "B" East	0.2	Auto	Negative
199/196	44 / 10	East Basement	Concrete	Wall	Ivory	Fair	Wall "C" South	0.1	Auto	Negative
200/197	2nd Floor	Main Fire Stairs	Plaster	Ceiling	Ivory	Intact	Ceiling - South	0.1	Auto	Negative
201/198	44 / 10	East Basement	Concrete	Ceiling	Ivory	Fair	Ceiling - North	0.3	Auto	Negative
202/199	44 / 10	East Basement	Concrete	Pedestal	Black	Fair	Wall "C" South	0.2	Auto	Negative
203/200	44 / 10	East Basement	Concrete	Floor	Red	Fair	Floor - South	0.2	Auto	Negative

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XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
204/201	44 / 10	East Basement	Wood	Shelf	Ivory	Intact	Wall "B" East	0.0	Auto	Negative
205/202	45 / 11	North Exit for NE Stairs	Metal	Door	Beige	Fair	Wall "C" North	0.1	Auto	Negative
206/203	45 / 11	North Exit for NE Stairs	Metal	Left Door Jamb	Charcoal	Fair	Wall "C" North	0.5	Auto	Negative
207/204	45 / 11	North Exit for NE Stairs	Metal	Handrail	Ivory	Fair	Wall "B" West	0.0	Auto	Negative
208/205	45 / 11	North Exit for NE Stairs	Metal	Stringer	Ivory	Fair	Wall "B" West	0.1	Auto	Negative
209/206	1st Floor	Structural West of 105	Metal	I-Beam	Red	Intact	Ceiling - Center	0.1	Auto	Negative
210/207	46 / 12	Main Basement Landing	Metal	Left Door Jamb	Charcoal	Fair	Wall "A" East	0.2	Auto	Negative
211/208	46 / 12	Main Basement Landing	Wood	Door	Brown	Fair	Wall "A" East	0.2	Auto	Negative
212/209	46 / 12	Phone Panel	Metal	Cover	Beige	Fair	Wall "B" South	0.1	Auto	Negative
213/210	46 / 12	Main Basement Landing	Wood	Shelf	Ivory	Fair	Wall "B" South	0.1	Auto	Negative
214/211	46 / 12	Main Basement Landing	Drywall	Wall	Ivory	Fair	Wall "A" East	0.1	Auto	Negative
215/212	46 / 12	Main Basement Landing	Drywall	Wall	Ivory	Fair	Wall "B" South	0.1	Auto	Negative
216/213	46 / 12	Main Basement Landing	Drywall	Wall	Ivory	Fair	Wall "C" West	0.1	Auto	Negative
217/214	46 / 12	Main Basement Landing	Drywall	Wall	Ivory	Fair	Wall "D" North	0.2	Auto	Negative
218/215	46 / 12	Main Basement Landing	Drywall	Ceiling	Ivory	Fair	Ceiling - Center	0.1	Auto	Negative
219/216	46 / 12	Basement Landing Closet	Wood	Door	Beige	Fair	Wall "A" South	0.1	Auto	Negative
220/217	46 / 12	Basement Landing Closet	Wood	Shelf	Beige	Fair	Wall "C" North	0.2	Auto	Negative
221/218	46 / 12	Stairs	Metal	Handrail	Black	Poor	Wall "B" South	0.7	Auto	Negative
222/219	46 / 12	Stairs	Concrete	Tread	Red	Fair	Wall "C" West	0.0	Auto	Negative
223/220	46 / 12	Stairs	Concrete	Header	Ivory	Intact	Wall "C" West	0.0	Auto	Negative

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confirmatory laboratory sampling indicated

Positive = LBP present
See Lead Hazard Control Plan

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PHASE
TRUSTED ENVIRONMENTAL SOLUTIONS

XRF SEQUENTIAL READING FIELD REPORT FORM FOR LEAD-BASED PAINT INSPECTIONS

XRF MANUFACTURER/SERIAL NUMBER: Viken Pb200e s/n #1013	PROPERTY ID: 301 Cypress St., Abeline, TX	Unit No.
RADIATION SOURCE ASSAY DATE: December 25, 2024	RISK ASSESSOR: T. Bazan (TDSHS # 2070001)	Job Started: 8:15 AM
XRF INTERNAL REPORT NUMBER: 10/10/2025	ABATEMENT LEVEL: 1.0 mg/cm2	Job Finished: 1:15 PM

XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
224/221	46 / 12	Basement	Concrete	Wall	Ivory	Fair	Wall "A" East	0.0	Auto	Negative
225/222	46 / 12	Basement	Concrete	Wall	Ivory	Fair	Wall "B" South	0.3	Auto	Negative
226/223	46 / 12	Basement	Concrete	Wall	Ivory	Fair	Wall "C" West	0.4	Auto	Negative
227/224	46 / 12	Basement	Concrete	Wall	Ivory	Fair	Wall "D" North	0.0	Auto	Negative
228/225	46 / 12	Basement	Concrete	Ceiling	Ivory	Fair	Ceiling - East	0.1	Auto	Negative
229/226	46 / 12	Basement	Concrete	Floor	Red	Poor	Floor - East	0.5	Auto	Negative
230/227	27 / 3	Northwest Corner Room	Wood	Door	Brown	Fair	Wall "A" South	1.3	Auto	Positive
231/228	46 / 12	Shelving	Metal	Frame	Gray	Fair	Wall "C" West	0.1	Auto	Negative
232/229	46 / 12	Structural	Metal	I-Beam	Ivory	Fair	Wall "C" West	0.3	Auto	Negative
233/230	46 / 12	Basement Door to Elevator	Metal	Door	Gray	Fair	Wall "A" East	2.1	Auto	Positive
234/231	46 / 12	Doorway to Shop	Metal	Left Door Jamb	Ivory	Fair	Wall "D" North	0.6	Auto	Negative
238/232	47 / 13	Mechanical Room	Concrete	Floor	Gray	Fair	Floor - South	0.2	Auto	Negative
239/233	47 / 13	Mechanical Room	Wood	Door	Brown	Fair	Wall "A" South	0.1	Auto	Negative
240/234	47 / 13	Mechanical Room	Metal	Left Door Jamb	Ivory	Fair	Wall "A" South	0.5	Auto	Negative
241/235	47 / 13	Mechanical Room	CMU	Wall	Beige	Fair	Wall "A" South	0.5	Auto	Negative
242/236	47 / 13	Mechanical Room	CMU	Wall	Beige	Fair	Wall "B" West	0.5	Auto	Negative
243/237	47 / 13	Mechanical Room	CMU	Wall	Beige	Fair	Wall "C" North	0.4	Auto	Negative
244/238	47 / 13	Mechanical Room	CMU	Wall	Beige	Fair	Wall "D" East	0.4	Auto	Negative
245/239	47 / 13	Mechanical Room	Concrete	Ceiling	Ivory	Intact	Ceiling - NWC	0.1	Auto	Negative
246/240	47 / 13	Structural	Metal	I-Beam	Ivory	Intact	Ceiling - NWC	0.2	Auto	Negative

Negative = No LBP found
Lead concentration below
1.0 mg/cm2 or 0.5% by weight

Inconclusive = Lead concentration at or near 1.0 mg/cm2,
confirmatory laboratory sampling indicated

Positive = LBP present
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XRF MANUFACTURER/SERIAL NUMBER: Viken Pb200e s/n #1013					PROPERTY ID: 301 Cypress St., Abeline, TX				Unit No.	
RADIATION SOURCE ASSAY DATE: December 25, 2024					RISK ASSESSOR: T. Bazan (TDSHS # 2070001)				Job Started:	8:15 AM
XRF INTERNAL REPORT NUMBER: 10/10/2025					ABATEMENT LEVEL: 1.0 mg/cm2				Job Finished:	1:15 PM
XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
247/241	47 / 13	Mechanical Room	Metal	Support Post	Ivory	Fair	Wall "A" West	0.1	Auto	Negative
248/242	47 / 13	Ladder to Roof	Metal	Ladder Side	Ivory	Poor	Wall "A" West	0.1	Auto	Negative
249/243	47 / 13	Fire Pump	Concrete	Pedestal	Red	Poor	Floor - NWC	0.0	Auto	Negative
250/244	47 / 13	Incoming Water Line	Metal	Vertical Pipe	Red	Intact	Wall "A" West	0.4	Auto	Negative
251/245	47 / 13	Mech Rm - Overflow Pipe	Metal	Vertical Pipe	Yellow	Fair	Wall "B" North	3.9	Auto	Positive
252/246	47 / 13	Power Disconnect	Metal	Panel Cover	Gray	Fair	Wall "D" South	0.1	Auto	Negative
253/247	47 / 13	Doorway	Metal	Door	Beige	Fair	Wall "C" East	0.1	Auto	Negative
254/248	47 / 13	Double Doors	Metal	Left Door Jamb	Beige	Fair	Wall "C" East	0.6	Auto	Negative
255/249	47 / 13	Roof Drain	Metal	Vertical Pipe	Beige	Poor	Wall "C" East	0.1	Auto	Negative
256/250	47 / 13	Exhaust Vent	Metal	Louver Frame	Beige	Fair	Wall "C" East	0.0	Auto	Negative
257/251	Exterior	Mechanical Roof	Metal	Hatch	Beige	Poor	North	0.1	Auto	Negative
258/252	Exterior	Mechanical Roof	Brick	Wall	Beige	Fair	West - NW Corner	0.1	Auto	Negative
259/253	Exterior	Mechanical Roof	Concrete	Window Sill	Ivory	Poor	West-Facing East	0.3	Auto	Negative
260/254	Exterior	Mechanical Roof	Concrete	Column	Beige	Fair	West-Facing East	0.1	Auto	Negative
261/255	Exterior	Mechanical Roof	Brick	Wall	Beige	Fair	North	0.0	Auto	Negative
262/256	Exterior	Mech Roof- Enclosure	Metal	Wall	Ivory	Fair	South	0.2	Auto	Negative
263/257	Exterior	Mechanical Roof	Metal	Empty Frame	Ivory	Poor	South Frame	0.1	Auto	Negative
264/258	Exterior	Mechanical Roof	Brick	Wall	Beige	Fair	East Wall	0.0	Auto	Negative
265/259	Exterior	Mechanical Roof	Metal	Vert. Drain Pipe	Beige	Fair	South Wall	0.1	Auto	Negative
266/260	Exterior	Mech Roof - Chiller	Metal	Case	Ivory	Fair	North Unit	0.4	Auto	Negative

Negative = No LBP found
Lead concentration below
1.0 mg/cm2 or 0.5% by weight

Inconclusive = Lead concentration at or near 1.0 mg/cm2,
confirmatory laboratory sampling indicated

Positive = LBP present
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XRF SEQUENTIAL READING FIELD REPORT FORM FOR LEAD-BASED PAINT INSPECTIONS

XRF MANUFACTURER/SERIAL NUMBER: Viken Pb200e s/n #1013	PROPERTY ID: 301 Cypress St., Abeline, TX	Unit No.
RADIATION SOURCE ASSAY DATE: December 25, 2024	RISK ASSESSOR: T. Bazan (TDSHS # 2070001)	Job Started: 8:15 AM
XRF INTERNAL REPORT NUMBER: 10/10/2025	ABATEMENT LEVEL: 1.0 mg/cm2	Job Finished: 1:15 PM

XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
267/261	48 / 1	Retail Building - Structural	Metal	Web Joist	Black	Intact	Ceiling - West	0.1	Auto	Negative
268/262	48 / 1	Front Room	Metal	Door	Black	Intact	Wall "A" South	0.2	Auto	Negative
269/263	48 / 1	Front Room	Drywall	Wall	Beige	Fair	Wall "A" South	0.1	Auto	Negative
270/264	48 / 1	Front Room	Drywall	Wall	Beige	Fair	Wall "B" West	0.1	Auto	Negative
271/265	48 / 1	Front Room	Drywall	Wall	White	Fair	Wall "C" North	0.1	Auto	Negative
272/266	48 / 1	Front Room	Drywall	Wall	Brown	Fair	Wall "D" East	0.1	Auto	Negative
273/267	48 / 2	Front Office	Drywall	Wall	Beige	Fair	Wall "A" North	0.2	Auto	Negative
274/268	48 / 2	Front Office	Drywall	Wall	Beige	Fair	Wall "B" East	0.1	Auto	Negative
275/269	48 / 2	Front Office	Drywall	Wall	Beige	Fair	Wall "C" South	0.2	Auto	Negative
276/270	48 / 2	Front Office	Drywall	Wall	Beige	Fair	Wall "A" West	0.1	Auto	Negative
277/271	48 / 2	Front Office Window	Metal	Frame	Black	Intact	Wall "C" South	0.4	Auto	Negative
278/272	48 / 3	Hallway	Drywall	Wall	Gray	Fair	Wall "C" North	0.1	Auto	Negative
279/273	48 / 3	Hallway - Air Vent	Metal	Diffuser	Ivory	Intact	Ceiling - Center	0.1	Auto	Negative
280/274	48 / 3	Hallway - Air Return	Metal	Grate	Ivory	Intact	Wall "C" North	0.2	Auto	Negative
281/275	48 / 4	Display Room	Metal	Window	Black	Intact	Wall "A" East	0.3	Auto	Negative
282/276	48 / 5	Store Room	Metal	Left Door Jamb	Charcoal	Fair	Wall "C" North	0.6	Auto	Negative
283/277	48 / 5	Store Room	Drywall	Wall	Green	Fair	Wall "A" South	0.1	Auto	Negative
284/278	48 / 5	Store Room	Drywall	Wall	Green	Fair	Wall "B" West	0.1	Auto	Negative
286/279	48 / 5	Store Room	Drywall	Wall	Green	Fair	Wall "C" North	0.1	Auto	Negative
286/280	48 / 5	Store Room	Drywall	Wall	Green	Fair	Wall "D" East	0.2	Auto	Negative

Negative = No LBP found
Lead concentration below
1.0 mg/cm2 or 0.5% by weight

Inconclusive = Lead concentration at or near 1.0 mg/cm2,
confirmatory laboratory sampling indicated

Positive = LBP present
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XRF MANUFACTURER/SERIAL NUMBER: Viken Pb200e s/n #1013	PROPERTY ID: 301 Cypress St., Abeline, TX	Unit No.
RADIATION SOURCE ASSAY DATE: December 25, 2024	RISK ASSESSOR: T. Bazan (TDSHS # 2070001)	Job Started: 8:15 AM
XRF INTERNAL REPORT NUMBER: 10/10/2025	ABATEMENT LEVEL: 1.0 mg/cm2	Job Finished: 1:15 PM

XRF Reading Sample Number	Room Equivalent Number	Room Description Name	Substrate	Component	Paint Film Color	Paint Condition Intact / Fair or Poor	XRF Testing or Confirmatory Sampling Location	Indicated Lead Concentration (mg/cm2)	XRF Testing Mode	LBP Hazard Classification Positive / Negative or Inconclusive
		XRF Calibration								
1		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	1.1	Auto	
2		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	1.2	Auto	
3		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	1.1	Auto	
235		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	1.0	Auto	
236		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	0.9	Auto	
237		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	0.9	Auto	
287		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	0.9	Auto	
288		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	1.0	Auto	
289		Calibration	Wood	Test Film	Red	Intact	NIST SRM 1.05	0.9	Auto	
--END--	----------	--END OF UNIT--	----------	--END--	----------	--END--	----------	--END--	----------	--END--

Negative = No LBP found
Lead concentration below
1.0 mg/cm2 or 0.5% by weight

Inconclusive = Lead concentration at or near 1.0 mg/cm2,
confirmatory laboratory sampling indicated

Positive = LBP present
See Lead Hazard Control Plan

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
Day 1													Day 1
10/9/2025	8:41:05	0	0	T. Bazan	1.0	5	---	1	1	1.0	mg/cm2	0.1	Calibration
10/9/2025	8:41:26	0	0	T. Bazan	1.0	5	---	2	2	0.9	mg/cm2	0.1	Calibration
10/9/2025	8:41:48	0	0	T. Bazan	1.0	5	---	3	3	0.9	mg/cm2	0.1	Calibration
10/9/2025	8:44:05	32.4502	-99.73474	T. Bazan	1.0	2	1	4	4	8.7	mg/cm2	0.2	Positive
10/9/2025	8:46:00	32.452	-99.73382	T. Bazan	1.0	5	2	5	5	1.2	mg/cm2	0.1	Positive
10/9/2025	8:48:06	32.4519	-99.73387	T. Bazan	1.0	2	3	6	6	0.1	mg/cm2	0.2	Negative
10/9/2025	8:48:28	32.4517	-99.73389	T. Bazan	1.0	2	4	7	7	0.5	mg/cm2	0.2	Negative
10/9/2025	8:49:58	32.4516	-99.73386	T. Bazan	1.0	2	5	8	8	0.1	mg/cm2	0.2	Negative
10/9/2025	8:50:17	32.4516	-99.73392	T. Bazan	1.0	2	6	9	9	0.2	mg/cm2	0.2	Negative
10/9/2025	8:51:40	32.4517	-99.73396	T. Bazan	1.0	2	7	10	10	8.2	mg/cm2	0.2	Positive
10/9/2025	8:52:54	32.4517	-99.73396	T. Bazan	1.0	2	8	11	11	0.1	mg/cm2	0.2	Negative
10/9/2025	8:54:24	32.4518	-99.73386	T. Bazan	1.0	2	9	12	12	0.0	mg/cm2	0.2	Negative
10/9/2025	8:57:42	32.4518	-99.7338	T. Bazan	1.0	2	10	13	13	0.2	mg/cm2	0.2	Negative
10/9/2025	8:58:10	32.4519	-99.73385	T. Bazan	1.0	2	11	14	14	0.1	mg/cm2	0.2	Negative
10/9/2025	8:59:39	32.4516	-99.73393	T. Bazan	1.0	2	12	15	15	0.0	mg/cm2	0.2	Negative
10/9/2025	9:02:31	32.4518	-99.73389	T. Bazan	1.0	2	13	16	16	0.2	mg/cm2	0.2	Negative
10/9/2025	9:02:46	32.4518	-99.73385	T. Bazan	1.0	2	14	17	17	0.1	mg/cm2	0.2	Negative
10/9/2025	9:02:55	32.4519	-99.73383	T. Bazan	1.0	2	15	18	18	15.6	mg/cm2	0.2	Positive
10/9/2025	9:03:51	32.4519	-99.7338	T. Bazan	1.0	2	16	19	19	0.2	mg/cm2	0.2	Negative
10/9/2025	9:04:03	32.4518	-99.73389	T. Bazan	1.0	2	17	20	20	0.0	mg/cm2	0.2	Negative
10/9/2025	9:04:52	32.4517	-99.73392	T. Bazan	1.0	2	18	21	21	0.4	mg/cm2	0.2	Negative
10/9/2025	9:06:08	32.4519	-99.73394	T. Bazan	1.0	2	19	22	22	0.4	mg/cm2	0.2	Negative
10/9/2025	9:06:58	32.4518	-99.73394	T. Bazan	1.0	2	20	23	23	3.9	mg/cm2	0.2	Positive
10/9/2025	9:10:08	32.4519	-99.73389	T. Bazan	1.0	2	21	24	24	0.2	mg/cm2	0.2	Negative
10/9/2025	9:10:29	32.4518	-99.73387	T. Bazan	1.0	2	22	25	25	0.1	mg/cm2	0.2	Negative
10/9/2025	9:10:58	32.4516	-99.73389	T. Bazan	1.0	2	23	26	26	0.1	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/9/2025	9:11:24	32.4519	-99.7339	T. Bazan	1.0	2	24	27	27	0.3	mg/cm2	0.2	Negative
10/9/2025	9:11:57	32.4517	-99.73388	T. Bazan	1.0	2	25	28	28	0.2	mg/cm2	0.2	Negative
10/9/2025	9:13:24	32.4516	-99.73393	T. Bazan	1.0	2	26	29	29	1.8	mg/cm2	0.2	Positive
10/9/2025	9:14:12	32.4516	-99.73393	T. Bazan	1.0	2	27	30	30	0.6	mg/cm2	0.2	Negative
10/9/2025	9:15:07	32.4519	-99.73387	T. Bazan	1.0	2	28	31	31	0.1	mg/cm2	0.2	Negative
10/9/2025	9:16:00	32.452	-99.73386	T. Bazan	1.0	2	29	32	32	0.6	mg/cm2	0.2	Negative
10/9/2025	9:17:36	0	0	T. Bazan	1.0	2	30	33	33	0.1	mg/cm2	0.2	Negative
10/9/2025	9:25:41	0	0	T. Bazan	1.0	2	31	34	34	0.2	mg/cm2	0.2	Negative
10/9/2025	9:25:48	0	0	T. Bazan	1.0	2	32	35	35	0.0	mg/cm2	0.2	Negative
10/9/2025	9:26:49	0	0	T. Bazan	1.0	2	33	36	36	0.1	mg/cm2	0.2	Negative
10/9/2025	9:28:16	0	0	T. Bazan	1.0	2	34	37	37	0.2	mg/cm2	0.2	Negative
10/9/2025	9:29:10	0	0	T. Bazan	1.0	2	35	38	38	0.0	mg/cm2	0.2	Negative
10/9/2025	9:31:10	0	0	T. Bazan	1.0	2	36	39	39	0.2	mg/cm2	0.2	Negative
10/9/2025	9:31:25	0	0	T. Bazan	1.0	2	37	40	40	0.2	mg/cm2	0.2	Negative
10/9/2025	9:31:37	0	0	T. Bazan	1.0	2	38	41	41	0.1	mg/cm2	0.2	Negative
10/9/2025	9:32:17	0	0	T. Bazan	1.0	2	39	42	42	0.2	mg/cm2	0.2	Negative
10/9/2025	9:32:46	0	0	T. Bazan	1.0	2	40	43	43	0.1	mg/cm2	0.2	Negative
10/9/2025	9:33:03	0	0	T. Bazan	1.0	2	41	44	44	0.3	mg/cm2	0.2	Negative
10/9/2025	9:34:31	0	0	T. Bazan	1.0	2	42	45	45	0.1	mg/cm2	0.2	Negative
10/9/2025	9:37:36	0	0	T. Bazan	1.0	2	43	46	46	0.4	mg/cm2	0.2	Negative
10/9/2025	9:38:02	0	0	T. Bazan	1.0	2	44	47	47	0.2	mg/cm2	0.2	Negative
10/9/2025	9:38:46	0	0	T. Bazan	1.0	2	45	48	48	0.2	mg/cm2	0.2	Negative
10/9/2025	9:40:40	0	0	T. Bazan	1.0	2	46	49	49	0.1	mg/cm2	0.2	Negative
10/9/2025	9:40:50	0	0	T. Bazan	1.0	2	47	50	50	0.3	mg/cm2	0.2	Negative
10/9/2025	9:41:02	0	0	T. Bazan	1.0	2	48	51	51	0.0	mg/cm2	0.2	Negative
10/9/2025	9:43:17	0	0	T. Bazan	1.0	2	49	52	52	0.0	mg/cm2	0.2	Negative
10/9/2025	9:43:31	0	0	T. Bazan	1.0	2	50	53	53	0.1	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/9/2025	9:43:45	0	0	T. Bazan	1.0	2	51	54	54	0.0	mg/cm2	0.2	Negative
10/9/2025	9:44:31	0	0	T. Bazan	1.0	2	52	55	55	0.2	mg/cm2	0.2	Negative
10/9/2025	9:45:25	0	0	T. Bazan	1.0	2	53	56	56	0.3	mg/cm2	0.2	Negative
10/9/2025	9:45:39	0	0	T. Bazan	1.0	2	54	57	57	0.3	mg/cm2	0.2	Negative
10/9/2025	9:46:35	0	0	T. Bazan	1.0	2	55	58	58	0.5	mg/cm2	0.2	Negative
10/9/2025	9:46:52	0	0	T. Bazan	1.0	2	56	59	59	0.4	mg/cm2	0.2	Negative
10/9/2025	9:47:12	0	0	T. Bazan	1.0	2	57	60	60	0.5	mg/cm2	0.2	Negative
10/9/2025	9:47:20	0	0	T. Bazan	1.0	2	58	61	61	0.4	mg/cm2	0.2	Negative
10/9/2025	9:56:08	0	0	T. Bazan	1.0	2	59	62	62	0.4	mg/cm2	0.2	Negative
10/9/2025	9:56:17	0	0	T. Bazan	1.0	2	60	63	63	0.5	mg/cm2	0.2	Negative
10/9/2025	10:00:30	0	0	T. Bazan	1.0	2	61	64	64	0.1	mg/cm2	0.2	Negative
10/9/2025	10:00:39	0	0	T. Bazan	1.0	2	62	65	65	0.1	mg/cm2	0.2	Negative
10/9/2025	10:01:17	0	0	T. Bazan	1.0	2	63	66	66	0.0	mg/cm2	0.2	Negative
10/9/2025	10:01:30	0	0	T. Bazan	1.0	2	64	67	67	0.1	mg/cm2	0.2	Negative
10/9/2025	10:01:38	0	0	T. Bazan	1.0	2	65	68	68	0.1	mg/cm2	0.2	Negative
10/9/2025	10:01:51	0	0	T. Bazan	1.0	2	66	69	69	0.2	mg/cm2	0.2	Negative
10/9/2025	10:02:29	0	0	T. Bazan	1.0	2	67	70	70	0.2	mg/cm2	0.2	Negative
10/9/2025	10:02:41	0	0	T. Bazan	1.0	2	68	71	71	0.0	mg/cm2	0.2	Negative
10/9/2025	10:04:26	0	0	T. Bazan	1.0	2	69	72	72	0.5	mg/cm2	0.2	Negative
10/9/2025	10:04:40	0	0	T. Bazan	1.0	2	70	73	73	0.0	mg/cm2	0.2	Negative
10/9/2025	10:05:09	0	0	T. Bazan	1.0	2	71	74	74	0.1	mg/cm2	0.2	Negative
10/9/2025	10:05:21	0	0	T. Bazan	1.0	2	72	75	75	0.0	mg/cm2	0.2	Negative
10/9/2025	10:05:29	0	0	T. Bazan	1.0	2	73	76	76	0.1	mg/cm2	0.2	Negative
10/9/2025	10:08:13	0	0	T. Bazan	1.0	2	74	77	77	0.3	mg/cm2	0.2	Negative
10/9/2025	10:08:22	0	0	T. Bazan	1.0	2	75	78	78	0.4	mg/cm2	0.2	Negative
10/9/2025	10:08:33	0	0	T. Bazan	1.0	2	76	79	79	0.4	mg/cm2	0.2	Negative
10/9/2025	10:08:44	0	0	T. Bazan	1.0	2	77	80	80	0.1	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/9/2025	10:09:12	0	0	T. Bazan	1.0	2	78	81	81	0.1	mg/cm2	0.2	Negative
10/9/2025	10:09:21	0	0	T. Bazan	1.0	2	79	82	82	0.0	mg/cm2	0.2	Negative
10/9/2025	10:09:34	0	0	T. Bazan	1.0	2	80	83	83	0.2	mg/cm2	0.2	Negative
10/9/2025	10:14:49	0	0	T. Bazan	1.0	2	81	84	84	0.3	mg/cm2	0.2	Negative
10/9/2025	10:15:02	0	0	T. Bazan	1.0	2	82	85	85	0.1	mg/cm2	0.2	Negative
10/9/2025	10:15:16	0	0	T. Bazan	1.0	2	83	86	86	0.0	mg/cm2	0.2	Negative
10/9/2025	10:15:33	0	0	T. Bazan	1.0	2	84	87	87	0.1	mg/cm2	0.2	Negative
10/9/2025	10:15:50	0	0	T. Bazan	1.0	2	85	88	88	0.2	mg/cm2	0.2	Negative
10/9/2025	10:16:00	0	0	T. Bazan	1.0	2	86	89	89	0.0	mg/cm2	0.2	Negative
10/9/2025	10:16:19	0	0	T. Bazan	1.0	2	87	90	90	0.1	mg/cm2	0.2	Negative
10/9/2025	10:16:27	0	0	T. Bazan	1.0	2	88	91	91	0.0	mg/cm2	0.2	Negative
10/9/2025	10:37:14	0	0	T. Bazan	1.0	2	89	92	92	0.3	mg/cm2	0.2	Negative
10/9/2025	10:37:26	0	0	T. Bazan	1.0	2	90	93	93	0.0	mg/cm2	0.2	Negative
10/9/2025	10:37:41	0	0	T. Bazan	1.0	2	91	94	94	0.5	mg/cm2	0.2	Negative
10/9/2025	10:37:49	0	0	T. Bazan	1.0	2	92	95	95	0.3	mg/cm2	0.2	Negative
10/9/2025	10:38:02	0	0	T. Bazan	1.0	2	93	96	96	0.3	mg/cm2	0.2	Negative
10/9/2025	10:38:13	0	0	T. Bazan	1.0	2	94	97	97	0.5	mg/cm2	0.2	Negative
10/9/2025	10:38:58	0	0	T. Bazan	1.0	2	95	98	98	0.0	mg/cm2	0.2	Negative
10/9/2025	10:39:15	0	0	T. Bazan	1.0	2	96	99	99	0.3	mg/cm2	0.2	Negative
10/9/2025	10:39:27	0	0	T. Bazan	1.0	2	97	100	100	0.1	mg/cm2	0.2	Negative
10/9/2025	10:39:39	0	0	T. Bazan	1.0	2	98	101	101	0.2	mg/cm2	0.2	Negative
10/9/2025	10:39:59	0	0	T. Bazan	1.0	2	99	102	102	0.2	mg/cm2	0.2	Negative
10/9/2025	10:40:45	0	0	T. Bazan	1.0	2	100	103	103	0.1	mg/cm2	0.2	Negative
10/9/2025	10:46:38	0	0	T. Bazan	1.0	2	101	104	104	0.0	mg/cm2	0.2	Negative
10/9/2025	10:46:47	0	0	T. Bazan	1.0	2	102	105	105	0.3	mg/cm2	0.2	Negative
10/9/2025	10:46:58	0	0	T. Bazan	1.0	2	103	106	106	0.5	mg/cm2	0.2	Negative
10/9/2025	10:47:12	0	0	T. Bazan	1.0	2	104	107	107	0.0	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/9/2025	10:47:27	0	0	T. Bazan	1.0	2	105	108	108	0.4	mg/cm2	0.2	Negative
10/9/2025	10:47:35	0	0	T. Bazan	1.0	2	106	109	109	0.2	mg/cm2	0.2	Negative
10/9/2025	10:47:44	0	0	T. Bazan	1.0	2	107	110	110	0.2	mg/cm2	0.2	Negative
10/9/2025	10:47:52	0	0	T. Bazan	1.0	2	108	111	111	0.2	mg/cm2	0.2	Negative
10/9/2025	10:48:11	0	0	T. Bazan	1.0	2	109	112	112	0.2	mg/cm2	0.2	Negative
10/9/2025	10:49:16	0	0	T. Bazan	1.0	2	110	113	113	0.2	mg/cm2	0.2	Negative
10/9/2025	10:51:02	0	0	T. Bazan	1.0	2	111	114	114	0.5	mg/cm2	0.2	Negative
10/9/2025	10:51:09	0	0	T. Bazan	1.0	2	112	115	115	0.0	mg/cm2	0.2	Negative
10/9/2025	10:52:09	0	0	T. Bazan	1.0	2	113	116	116	0.0	mg/cm2	0.2	Negative
10/9/2025	10:52:20	0	0	T. Bazan	1.0	2	114	117	117	0.1	mg/cm2	0.2	Negative
10/9/2025	10:52:53	0	0	T. Bazan	1.0	2	115	118	118	0.5	mg/cm2	0.2	Negative
10/9/2025	10:53:54	0	0	T. Bazan	1.0	2	116	119	119	0.0	mg/cm2	0.2	Negative
10/9/2025	10:54:02	0	0	T. Bazan	1.0	2	117	120	120	0.1	mg/cm2	0.2	Negative
10/9/2025	10:54:15	0	0	T. Bazan	1.0	2	118	121	121	0.2	mg/cm2	0.2	Negative
10/9/2025	10:54:30	0	0	T. Bazan	1.0	2	119	122	122	0.1	mg/cm2	0.2	Negative
10/9/2025	10:54:38	0	0	T. Bazan	1.0	2	120	123	123	0.1	mg/cm2	0.2	Negative
10/9/2025	10:57:00	0	0	T. Bazan	1.0	2	121	124	124	0.2	mg/cm2	0.2	Negative
10/9/2025	10:57:11	0	0	T. Bazan	1.0	2	122	125	125	0.0	mg/cm2	0.2	Negative
10/9/2025	10:59:33	0	0	T. Bazan	1.0	2	123	126	126	0.2	mg/cm2	0.2	Negative
10/9/2025	10:59:42	0	0	T. Bazan	1.0	2	124	127	127	0.0	mg/cm2	0.2	Negative
10/9/2025	10:59:57	0	0	T. Bazan	1.0	2	125	128	128	0.2	mg/cm2	0.2	Negative
10/9/2025	11:00:14	0	0	T. Bazan	1.0	2	126	129	129	0.3	mg/cm2	0.2	Negative
10/9/2025	11:00:41	0	0	T. Bazan	1.0	2	127	130	130	0.3	mg/cm2	0.2	Negative
10/9/2025	11:00:51	0	0	T. Bazan	1.0	2	128	131	131	0.0	mg/cm2	0.2	Negative
10/9/2025	11:01:18	0	0	T. Bazan	1.0	2	129	132	132	0.3	mg/cm2	0.2	Negative
10/9/2025	11:01:46	0	0	T. Bazan	1.0	2	130	133	133	0.1	mg/cm2	0.2	Negative
10/9/2025	11:02:37	0	0	T. Bazan	1.0	2	131	134	134	0.1	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/9/2025	11:04:49	0	0	T. Bazan	1.0	2	132	135	135	0.2	mg/cm2	0.2	Negative
10/9/2025	11:11:35	0	0	T. Bazan	1.0	2	133	136	136	0.1	mg/cm2	0.2	Negative
10/9/2025	11:11:49	0	0	T. Bazan	1.0	2	134	137	137	0.0	mg/cm2	0.2	Negative
10/9/2025	11:12:18	0	0	T. Bazan	1.0	2	135	138	138	0.2	mg/cm2	0.2	Negative
10/9/2025	11:12:27	0	0	T. Bazan	1.0	2	136	139	139	0.2	mg/cm2	0.2	Negative
10/9/2025	11:12:47	0	0	T. Bazan	1.0	2	137	140	140	0.3	mg/cm2	0.2	Negative
10/9/2025	11:13:00	0	0	T. Bazan	1.0	2	138	141	141	0.1	mg/cm2	0.2	Negative
10/9/2025	11:13:25	0	0	T. Bazan	1.0	2	139	142	142	0.1	mg/cm2	0.2	Negative
10/9/2025	11:13:37	0	0	T. Bazan	1.0	2	140	143	143	0.3	mg/cm2	0.2	Negative
10/9/2025	11:40:16	0	0	T. Bazan	1.0	2	141	144	144	0.0	mg/cm2	0.2	Negative
10/9/2025	11:40:35	0	0	T. Bazan	1.0	2	142	145	145	0.6	mg/cm2	0.2	Negative
10/9/2025	11:42:17	0	0	T. Bazan	1.0	2	143	146	146	0.5	mg/cm2	0.2	Negative
10/9/2025	11:42:37	0	0	T. Bazan	1.0	5	144	147	147	1.0	mg/cm2	0.1	Positive
10/9/2025	11:43:14	0	0	T. Bazan	1.0	2	145	148	148	0.6	mg/cm2	0.2	Negative
10/9/2025	11:43:24	0	0	T. Bazan	1.0	5	146	149	149	0.9	mg/cm2	0.1	Negative
10/9/2025	11:44:23	0	0	T. Bazan	1.0	2	147	150	150	0.1	mg/cm2	0.2	Negative
10/9/2025	11:45:33	0	0	T. Bazan	1.0	2	148	151	151	0.0	mg/cm2	0.2	Negative
10/9/2025	11:45:44	0	0	T. Bazan	1.0	2	149	152	152	0.0	mg/cm2	0.2	Negative
10/9/2025	11:45:56	0	0	T. Bazan	1.0	2	150	153	153	0.2	mg/cm2	0.2	Negative
10/9/2025	11:46:15	0	0	T. Bazan	1.0	2	151	154	154	0.1	mg/cm2	0.2	Negative
10/9/2025	11:47:00	0	0	T. Bazan	1.0	2	152	155	155	0.2	mg/cm2	0.2	Negative
10/9/2025	11:49:50	0	0	T. Bazan	1.0	2	153	156	156	0.0	mg/cm2	0.2	Negative
10/9/2025	11:49:59	0	0	T. Bazan	1.0	2	154	157	157	0.3	mg/cm2	0.2	Negative
10/9/2025	11:50:09	0	0	T. Bazan	1.0	2	155	158	158	0.4	mg/cm2	0.2	Negative
10/9/2025	11:51:10	0	0	T. Bazan	1.0	2	156	159	159	0.1	mg/cm2	0.2	Negative
10/9/2025	11:51:35	0	0	T. Bazan	1.0	2	157	160	160	0.1	mg/cm2	0.2	Negative
10/9/2025	11:53:08	0	0	T. Bazan	1.0	2	158	161	161	0.2	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/9/2025	11:53:15	0	0	T. Bazan	1.0	2	159	162	162	0.0	mg/cm2	0.2	Negative
10/9/2025	11:54:20	0	0	T. Bazan	1.0	2	160	163	163	0.0	mg/cm2	0.2	Negative
10/9/2025	11:57:44	0	0	T. Bazan	1.0	2	161	164	164	0.2	mg/cm2	0.2	Negative
10/9/2025	11:58:52	0	0	T. Bazan	1.0	2	162	165	165	0.1	mg/cm2	0.2	Negative
10/9/2025	11:59:10	0	0	T. Bazan	1.0	2	163	166	166	0.2	mg/cm2	0.2	Negative
10/9/2025	11:59:28	0	0	T. Bazan	1.0	2	164	167	167	0.1	mg/cm2	0.2	Negative
10/9/2025	11:59:38	0	0	T. Bazan	1.0	2	165	168	168	0.1	mg/cm2	0.2	Negative
10/9/2025	12:02:01	0	0	T. Bazan	1.0	2	166	169	169	0.1	mg/cm2	0.2	Negative
10/9/2025	12:04:50	0	0	T. Bazan	1.0	2	167	170	170	0.0	mg/cm2	0.2	Negative
10/9/2025	12:05:01	0	0	T. Bazan	1.0	2	168	171	171	0.2	mg/cm2	0.2	Negative
10/9/2025	12:05:21	0	0	T. Bazan	1.0	2	169	172	172	0.2	mg/cm2	0.2	Negative
10/9/2025	12:06:02	0	0	T. Bazan	1.0	2	170	173	173	0.1	mg/cm2	0.2	Negative
10/9/2025	12:07:14	0	0	T. Bazan	1.0	2	171	174	174	0.2	mg/cm2	0.2	Negative
10/9/2025	12:07:35	0	0	T. Bazan	1.0	2	172	175	175	0.1	mg/cm2	0.2	Negative
10/9/2025	12:09:01	0	0	T. Bazan	1.0	2	173	176	176	0.2	mg/cm2	0.2	Negative
10/9/2025	12:09:31	0	0	T. Bazan	1.0	2	174	177	177	0.2	mg/cm2	0.2	Negative
10/9/2025	12:11:50	0	0	T. Bazan	1.0	2	175	178	178	0.1	mg/cm2	0.2	Negative
10/9/2025	12:14:58	0	0	T. Bazan	1.0	2	176	179	179	0.2	mg/cm2	0.2	Negative
10/9/2025	12:16:19	0	0	T. Bazan	1.0	2	177	180	180	0.1	mg/cm2	0.2	Negative
10/9/2025	12:16:30	0	0	T. Bazan	1.0	2	178	181	181	0.3	mg/cm2	0.2	Negative
10/9/2025	12:16:45	0	0	T. Bazan	1.0	2	179	182	182	0.1	mg/cm2	0.2	Negative
10/9/2025	12:18:07	0	0	T. Bazan	1.0	2	180	183	183	0.2	mg/cm2	0.2	Negative
10/9/2025	12:18:16	0	0	T. Bazan	1.0	2	181	184	184	0.2	mg/cm2	0.2	Negative
10/9/2025	12:21:17	0	0	T. Bazan	1.0	2	182	185	185	0.1	mg/cm2	0.2	Negative
10/9/2025	12:21:29	0	0	T. Bazan	1.0	2	183	186	186	0.2	mg/cm2	0.2	Negative
10/9/2025	12:21:46	0	0	T. Bazan	1.0	2	184	187	187	0.2	mg/cm2	0.2	Negative
10/9/2025	12:22:01	0	0	T. Bazan	1.0	2	185	188	188	0.2	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/9/2025	12:23:18	0	0	T. Bazan	1.0	2	186	189	189	0.2	mg/cm2	0.2	Negative
10/9/2025	12:23:30	0	0	T. Bazan	1.0	2	187	190	190	0.2	mg/cm2	0.2	Negative
10/9/2025	12:25:49	0	0	T. Bazan	1.0	2	188	191	191	0.1	mg/cm2	0.2	Negative
10/9/2025	12:27:16	0	0	T. Bazan	1.0	5	---	192	192	1.0	mg/cm2	0.1	Calibration
10/9/2025	12:27:49	0	0	T. Bazan	1.0	5	---	193	193	1.0	mg/cm2	0.1	Calibration
10/9/2025	12:28:07	0	0	T. Bazan	1.0	5	---	194	194	1.0	mg/cm2	0.1	Calibration
10/9/2025	12:56:48	0	0	T. Bazan	1.0	2	189	195	195	0.0	mg/cm2	0.2	Negative
10/9/2025	12:57:30	0	0	T. Bazan	1.0	5	190	196	196	1.1	mg/cm2	0.1	Positive
10/9/2025	12:58:37	0	0	T. Bazan	1.0	4	191	197	197	0.7	mg/cm2	0.1	Negative
10/9/2025	12:59:06	0	0	T. Bazan	1.0	2	192	198	198	0.4	mg/cm2	0.2	Negative
10/9/2025	12:59:22	0	0	T. Bazan	1.0	2	193	199	199	0.5	mg/cm2	0.2	Negative
10/9/2025	12:59:31	0	0	T. Bazan	1.0	5	194	200	200	0.9	mg/cm2	0.1	Negative
10/9/2025	13:00:03	0	0	T. Bazan	1.0	2	195	201	201	0.3	mg/cm2	0.2	Negative
10/9/2025	13:03:22	0	0	T. Bazan	1.0	2	196	202	202	0.2	mg/cm2	0.2	Negative
10/9/2025	13:03:31	0	0	T. Bazan	1.0	2	197	203	203	0.1	mg/cm2	0.2	Negative
10/9/2025	13:03:50	0	0	T. Bazan	1.0	2	198	204	204	0.1	mg/cm2	0.2	Negative
10/9/2025	13:04:03	0	0	T. Bazan	1.0	2	199	205	205	0.1	mg/cm2	0.2	Negative
10/9/2025	13:04:18	0	0	T. Bazan	1.0	2	200	206	206	0.1	mg/cm2	0.2	Negative
10/9/2025	13:06:39	0	0	T. Bazan	1.0	2	201	207	207	0.2	mg/cm2	0.2	Negative
10/9/2025	13:09:09	0	0	T. Bazan	1.0	2	202	208	208	0.0	mg/cm2	0.2	Negative
10/9/2025	13:09:20	0	0	T. Bazan	1.0	2	203	209	209	0.3	mg/cm2	0.2	Negative
10/9/2025	13:09:38	0	0	T. Bazan	1.0	2	204	210	210	0.3	mg/cm2	0.2	Negative
10/9/2025	13:10:11	0	0	T. Bazan	1.0	2	205	211	211	0.3	mg/cm2	0.2	Negative
10/9/2025	13:11:37	0	0	T. Bazan	1.0	2	206	212	212	0.2	mg/cm2	0.2	Negative
10/9/2025	13:11:51	0	0	T. Bazan	1.0	2	207	213	213	0.2	mg/cm2	0.2	Negative
10/9/2025	13:12:04	0	0	T. Bazan	1.0	2	208	214	214	0.0	mg/cm2	0.2	Negative
10/9/2025	13:21:47	0	0	T. Bazan	1.0	2	209	215	215	0.2	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/9/2025	13:22:01	0	0	T. Bazan	1.0	2	210	216	216	0.0	mg/cm2	0.2	Negative
10/9/2025	13:22:34	0	0	T. Bazan	1.0	2	211	217	217	0.2	mg/cm2	0.2	Negative
10/9/2025	13:26:42	0	0	T. Bazan	1.0	2	212	218	218	0.1	mg/cm2	0.2	Negative
10/9/2025	13:26:52	0	0	T. Bazan	1.0	2	213	219	219	0.1	mg/cm2	0.2	Negative
10/9/2025	13:27:34	0	0	T. Bazan	1.0	2	214	220	220	0.6	mg/cm2	0.2	Negative
10/9/2025	13:27:56	0	0	T. Bazan	1.0	2	215	221	221	0.3	mg/cm2	0.2	Negative
10/9/2025	13:28:50	0	0	T. Bazan	1.0	2	216	222	222	0.0	mg/cm2	0.2	Negative
10/9/2025	13:29:25	0	0	T. Bazan	1.0	2	217	223	223	0.2	mg/cm2	0.2	Negative
10/9/2025	13:29:51	0	0	T. Bazan	1.0	2	218	224	224	0.0	mg/cm2	0.2	Negative
10/9/2025	13:32:02	0	0	T. Bazan	1.0	2	219	225	225	0.1	mg/cm2	0.2	Negative
10/9/2025	13:32:20	0	0	T. Bazan	1.0	2	220	226	226	0.3	mg/cm2	0.2	Negative
10/9/2025	13:32:35	0	0	T. Bazan	1.0	2	221	227	227	0.0	mg/cm2	0.2	Negative
10/9/2025	13:33:09	0	0	T. Bazan	1.0	2	222	228	228	0.1	mg/cm2	0.2	Negative
10/9/2025	13:33:46	0	0	T. Bazan	1.0	2	223	229	229	0.2	mg/cm2	0.2	Negative
10/9/2025	13:39:49	0	0	T. Bazan	1.0	2	224	230	230	0.3	mg/cm2	0.2	Negative
10/9/2025	13:39:58	0	0	T. Bazan	1.0	2	225	231	231	0.0	mg/cm2	0.2	Negative
10/9/2025	13:40:09	0	0	T. Bazan	1.0	2	226	232	232	0.1	mg/cm2	0.2	Negative
10/9/2025	13:40:49	0	0	T. Bazan	1.0	2	227	233	233	0.2	mg/cm2	0.2	Negative
10/9/2025	13:41:03	0	0	T. Bazan	1.0	2	228	234	234	0.2	mg/cm2	0.2	Negative
10/9/2025	13:42:19	0	0	T. Bazan	1.0	2	229	235	235	0.2	mg/cm2	0.2	Negative
10/9/2025	13:42:29	0	0	T. Bazan	1.0	2	230	236	236	0.1	mg/cm2	0.2	Negative
10/9/2025	13:43:01	0	0	T. Bazan	1.0	2	231	237	237	0.1	mg/cm2	0.2	Negative
10/9/2025	13:43:15	0	0	T. Bazan	1.0	2	232	238	238	0.2	mg/cm2	0.2	Negative
10/9/2025	13:46:22	0	0	T. Bazan	1.0	2	233	239	239	0.1	mg/cm2	0.2	Negative
10/9/2025	13:46:30	0	0	T. Bazan	1.0	2	234	240	240	0.4	mg/cm2	0.2	Negative
10/9/2025	13:46:48	0	0	T. Bazan	1.0	2	235	241	241	0.0	mg/cm2	0.2	Negative
10/9/2025	13:48:25	0	0	T. Bazan	1.0	2	236	242	242	0.2	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/9/2025	13:48:35	0	0	T. Bazan	1.0	2	237	243	243	0.1	mg/cm2	0.2	Negative
10/9/2025	13:48:52	0	0	T. Bazan	1.0	2	238	244	244	0.0	mg/cm2	0.2	Negative
10/9/2025	13:49:46	0	0	T. Bazan	1.0	2	239	245	245	0.2	mg/cm2	0.2	Negative
10/9/2025	13:50:01	0	0	T. Bazan	1.0	2	240	246	246	0.3	mg/cm2	0.2	Negative
10/9/2025	13:52:04	0	0	T. Bazan	1.0	2	241	247	247	0.7	mg/cm2	0.2	Negative
10/9/2025	13:52:21	0	0	T. Bazan	1.0	2	242	248	248	0.7	mg/cm2	0.2	Negative
10/9/2025	13:53:02	0	0	T. Bazan	1.0	2	243	249	249	0.2	mg/cm2	0.2	Negative
10/9/2025	13:56:33	0	0	T. Bazan	1.0	2	244	250	250	0.0	mg/cm2	0.2	Negative
10/9/2025	13:56:42	0	0	T. Bazan	1.0	2	245	251	251	0.6	mg/cm2	0.2	Negative
10/9/2025	13:56:59	0	0	T. Bazan	1.0	2	246	252	252	0.0	mg/cm2	0.2	Negative
10/9/2025	13:57:37	0	0	T. Bazan	1.0	2	247	253	253	0.0	mg/cm2	0.2	Negative
10/9/2025	13:57:53	0	0	T. Bazan	1.0	2	248	254	254	0.1	mg/cm2	0.2	Negative
10/9/2025	13:58:50	0	0	T. Bazan	1.0	2	249	255	255	0.2	mg/cm2	0.2	Negative
10/9/2025	13:59:05	0	0	T. Bazan	1.0	2	250	256	256	0.0	mg/cm2	0.2	Negative
10/9/2025	13:59:44	0	0	T. Bazan	1.0	2	251	257	257	0.0	mg/cm2	0.2	Negative
10/9/2025	14:00:09	0	0	T. Bazan	1.0	2	252	258	258	0.0	mg/cm2	0.2	Negative
10/9/2025	14:00:36	0	0	T. Bazan	1.0	2	253	259	259	0.1	mg/cm2	0.2	Negative
10/9/2025	14:02:59	0	0	T. Bazan	1.0	2	254	260	260	0.0	mg/cm2	0.2	Negative
10/9/2025	14:03:17	0	0	T. Bazan	1.0	2	255	261	261	0.1	mg/cm2	0.2	Negative
10/9/2025	14:03:41	0	0	T. Bazan	1.0	2	256	262	262	0.1	mg/cm2	0.2	Negative
10/9/2025	14:04:24	0	0	T. Bazan	1.0	2	257	263	263	0.1	mg/cm2	0.2	Negative
10/9/2025	14:04:42	0	0	T. Bazan	1.0	2	258	264	264	0.1	mg/cm2	0.2	Negative
10/9/2025	14:06:00	0	0	T. Bazan	1.0	2	259	265	265	0.0	mg/cm2	0.2	Negative
10/9/2025	14:06:08	0	0	T. Bazan	1.0	2	260	266	266	0.1	mg/cm2	0.2	Negative
10/9/2025	14:09:28	0	0	T. Bazan	1.0	2	261	267	267	0.1	mg/cm2	0.2	Negative
10/9/2025	14:09:38	0	0	T. Bazan	1.0	2	262	268	268	0.1	mg/cm2	0.2	Negative
10/9/2025	14:09:51	0	0	T. Bazan	1.0	2	263	269	269	**15.2**	mg/cm2	0.2	**Positive**

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Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/9/2025	14:10:29	0	0	T. Bazan	1.0	2	264	270	270	0.0	mg/cm2	0.2	Negative
10/9/2025	14:11:08	0	0	T. Bazan	1.0	2	265	271	271	0.0	mg/cm2	0.2	Negative
10/9/2025	14:42:02	0	0	T. Bazan	1.0	2	266	272	272	0.0	mg/cm2	0.2	Negative
10/9/2025	14:42:10	0	0	T. Bazan	1.0	2	267	273	273	0.4	mg/cm2	0.2	Negative
10/9/2025	14:42:51	0	0	T. Bazan	1.0	2	268	274	274	0.6	mg/cm2	0.2	Negative
10/9/2025	14:42:59	0	0	T. Bazan	1.0	2	269	275	275	0.5	mg/cm2	0.2	Negative
10/9/2025	14:43:23	0	0	T. Bazan	1.0	2	270	276	276	0.6	mg/cm2	0.2	Negative
10/9/2025	14:43:31	0	0	T. Bazan	1.0	2	271	277	277	0.4	mg/cm2	0.2	Negative
10/9/2025	14:43:47	0	0	T. Bazan	1.0	2	272	278	278	0.2	mg/cm2	0.2	Negative
10/9/2025	14:45:07	0	0	T. Bazan	1.0	2	273	279	279	0.2	mg/cm2	0.2	Negative
10/9/2025	14:45:15	0	0	T. Bazan	1.0	2	274	280	280	0.1	mg/cm2	0.2	Negative
10/9/2025	14:46:25	0	0	T. Bazan	1.0	2	275	281	281	0.2	mg/cm2	0.2	Negative
10/9/2025	14:46:38	0	0	T. Bazan	1.0	2	276	282	282	0.0	mg/cm2	0.2	Negative
10/9/2025	14:46:49	0	0	T. Bazan	1.0	2	277	283	283	0.3	mg/cm2	0.2	Negative
10/9/2025	14:47:19	0	0	T. Bazan	1.0	2	278	284	284	0.0	mg/cm2	0.2	Negative
10/9/2025	14:48:47	0	0	T. Bazan	1.0	2	279	285	285	0.1	mg/cm2	0.2	Negative
10/9/2025	14:48:55	0	0	T. Bazan	1.0	2	280	286	286	0.1	mg/cm2	0.2	Negative
10/9/2025	14:50:52	0	0	T. Bazan	1.0	2	281	287	287	0.1	mg/cm2	0.2	Negative
10/9/2025	14:52:57	0	0	T. Bazan	1.0	2	282	288	288	0.2	mg/cm2	0.2	Negative
10/9/2025	14:53:06	0	0	T. Bazan	1.0	2	283	289	289	0.2	mg/cm2	0.2	Negative
10/9/2025	14:53:27	0	0	T. Bazan	1.0	2	284	290	290	0.0	mg/cm2	0.2	Negative
10/9/2025	14:53:46	0	0	T. Bazan	1.0	2	285	291	291	0.1	mg/cm2	0.2	Negative
10/9/2025	14:53:55	0	0	T. Bazan	1.0	2	286	292	292	0.3	mg/cm2	0.2	Negative
10/9/2025	14:55:26	0	0	T. Bazan	1.0	2	287	293	293	0.3	mg/cm2	0.2	Negative
10/9/2025	14:55:40	0	0	T. Bazan	1.0	2	288	294	294	0.2	mg/cm2	0.2	Negative
10/9/2025	14:57:37	0	0	T. Bazan	1.0	2	289	295	295	0.2	mg/cm2	0.2	Negative
10/9/2025	14:57:51	0	0	T. Bazan	1.0	2	290	296	296	0.3	mg/cm2	0.2	Negative

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Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/9/2025	14:58:03	0	0	T. Bazan	1.0	2	291	297	297	0.1	mg/cm2	0.2	Negative
10/9/2025	14:58:17	0	0	T. Bazan	1.0	2	292	298	298	0.0	mg/cm2	0.2	Negative
10/9/2025	14:58:30	0	0	T. Bazan	1.0	2	293	299	299	0.1	mg/cm2	0.2	Negative
10/9/2025	15:00:06	0	0	T. Bazan	1.0	2	294	300	300	0.1	mg/cm2	0.2	Negative
10/9/2025	15:00:17	0	0	T. Bazan	1.0	2	295	301	301	0.1	mg/cm2	0.2	Negative
10/9/2025	15:02:52	0	0	T. Bazan	1.0	2	296	302	302	0.2	mg/cm2	0.2	Negative
10/9/2025	15:03:03	0	0	T. Bazan	1.0	2	297	303	303	0.2	mg/cm2	0.2	Negative
10/9/2025	15:03:35	0	0	T. Bazan	1.0	2	298	304	304	0.2	mg/cm2	0.2	Negative
10/9/2025	15:04:18	0	0	T. Bazan	1.0	2	299	305	305	0.0	mg/cm2	0.2	Negative
10/9/2025	15:04:49	0	0	T. Bazan	1.0	2	300	306	306	0.2	mg/cm2	0.2	Negative
10/9/2025	15:09:42	0	0	T. Bazan	1.0	2	301	307	307	10.5	mg/cm2	0.2	Positive
10/9/2025	15:09:56	0	0	T. Bazan	1.0	2	302	308	308	14.9	mg/cm2	0.2	Positive
10/9/2025	15:12:22	0	0	T. Bazan	1.0	2	303	309	309	0.1	mg/cm2	0.2	Negative
10/9/2025	15:12:37	0	0	T. Bazan	1.0	2	304	310	310	0.0	mg/cm2	0.2	Negative
10/9/2025	15:13:32	0	0	T. Bazan	1.0	2	305	311	311	6.9	mg/cm2	0.2	Positive
10/9/2025	15:14:32	0	0	T. Bazan	1.0	2	306	312	312	0.2	mg/cm2	0.2	Negative
10/9/2025	15:15:13	0	0	T. Bazan	1.0	2	307	313	313	0.2	mg/cm2	0.2	Negative
10/9/2025	15:16:22	0	0	T. Bazan	1.0	2	308	314	314	0.1	mg/cm2	0.2	Negative
10/9/2025	15:16:42	0	0	T. Bazan	1.0	2	309	315	315	0.0	mg/cm2	0.2	Negative
10/9/2025	15:21:41	0	0	T. Bazan	1.0	2	310	316	316	10.7	mg/cm2	0.2	Positive
10/9/2025	15:22:44	0	0	T. Bazan	1.0	2	311	317	317	0.1	mg/cm2	0.2	Negative
10/9/2025	15:22:58	0	0	T. Bazan	1.0	2	312	318	318	0.2	mg/cm2	0.2	Negative
10/9/2025	15:23:35	0	0	T. Bazan	1.0	2	313	319	319	0.4	mg/cm2	0.2	Negative
10/9/2025	15:23:46	0	0	T. Bazan	1.0	2	314	320	320	0.1	mg/cm2	0.2	Negative
10/9/2025	15:24:01	0	0	T. Bazan	1.0	2	315	321	321	0.2	mg/cm2	0.2	Negative
10/9/2025	15:24:37	0	0	T. Bazan	1.0	2	316	322	322	0.3	mg/cm2	0.2	Negative
10/9/2025	15:27:11	0	0	T. Bazan	1.0	2	317	323	323	0.1	mg/cm2	0.2	Negative

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Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/9/2025	15:27:28	0	0	T. Bazan	1.0	2	318	324	324	0.2	mg/cm2	0.2	Negative
10/9/2025	15:27:42	0	0	T. Bazan	1.0	2	319	325	325	0.1	mg/cm2	0.2	Negative
10/9/2025	15:27:57	0	0	T. Bazan	1.0	2	320	326	326	0.1	mg/cm2	0.2	Negative
10/9/2025	15:47:26	0	0	T. Bazan	1.0	2	321	327	327	0.1	mg/cm2	0.2	Negative
10/9/2025	15:47:36	0	0	T. Bazan	1.0	2	322	328	328	0.1	mg/cm2	0.2	Negative
10/9/2025	15:49:50	0	0	T. Bazan	1.0	2	323	329	329	0.2	mg/cm2	0.2	Negative
10/9/2025	15:51:11	0	0	T. Bazan	1.0	2	324	330	330	0.2	mg/cm2	0.2	Negative
10/9/2025	15:51:30	0	0	T. Bazan	1.0	2	325	331	331	0.0	mg/cm2	0.2	Negative
10/9/2025	15:53:06	0	0	T. Bazan	1.0	2	326	332	332	2.0	mg/cm2	0.2	Positive
10/9/2025	15:53:51	32.4515	-99.7322	T. Bazan	1.0	2	327	333	333	1.3	mg/cm2	0.2	Positive
10/9/2025	15:57:19	32.4515	-99.73213	T. Bazan	1.0	2	328	334	334	0.0	mg/cm2	0.2	Negative
10/9/2025	15:57:32	32.4515	-99.7322	T. Bazan	1.0	2	329	335	335	0.1	mg/cm2	0.2	Negative
10/9/2025	15:58:13	32.4518	-99.73233	T. Bazan	1.0	2	330	336	336	0.0	mg/cm2	0.2	Negative
10/9/2025	15:58:49	32.452	-99.73283	T. Bazan	1.0	2	331	337	337	0.1	mg/cm2	0.2	Negative
10/9/2025	15:59:18	32.4519	-99.73266	T. Bazan	1.0	2	332	338	338	0.6	mg/cm2	0.2	Negative
10/9/2025	15:59:59	32.452	-99.73248	T. Bazan	1.0	2	333	339	339	0.6	mg/cm2	0.2	Negative
10/9/2025	16:01:15	32.452	-99.73245	T. Bazan	1.0	2	334	340	340	0.1	mg/cm2	0.2	Negative
10/9/2025	16:01:25	32.4521	-99.73251	T. Bazan	1.0	2	335	341	341	0.1	mg/cm2	0.2	Negative
10/9/2025	16:02:01	32.452	-99.73254	T. Bazan	1.0	2	336	342	342	0.6	mg/cm2	0.2	Negative
10/9/2025	16:03:18	32.452	-99.73252	T. Bazan	1.0	2	337	343	343	0.4	mg/cm2	0.2	Negative
10/9/2025	16:03:26	32.4522	-99.73238	T. Bazan	1.0	2	338	344	344	0.2	mg/cm2	0.2	Negative
10/9/2025	16:04:32	32.4518	-99.73239	T. Bazan	1.0	2	339	345	345	0.0	mg/cm2	0.2	Negative
10/9/2025	16:06:10	32.4511	-99.73187	T. Bazan	1.0	2	340	346	346	1.8	mg/cm2	0.2	Positive
10/9/2025	16:10:13	32.4515	-99.73334	T. Bazan	1.0	2	341	347	347	0.1	mg/cm2	0.2	Negative
10/9/2025	16:12:22	32.4516	-99.73338	T. Bazan	1.0	2	342	348	348	0.2	mg/cm2	0.2	Negative
10/9/2025	16:12:59	32.4515	-99.73346	T. Bazan	1.0	2	343	349	349	0.2	mg/cm2	0.2	Negative
10/9/2025	16:13:57	32.4523	-99.73338	T. Bazan	1.0	2	344	350	350	0.3	mg/cm2	0.2	Negative

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Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/9/2025	16:18:21	32.4527	-99.73335	T. Bazan	1.0	5	---	351	351	1.1	mg/cm2	0.1	Calibration
10/9/2025	16:18:40	32.4528	-99.73378	T. Bazan	1.0	5	---	352	352	1.0	mg/cm2	0.1	Calibration
10/9/2025	16:18:59	0	0	T. Bazan	1.0	5	---	353	353	1.0	mg/cm2	0.1	Calibration
Day 2													Day 2
10/10/2025	8:15:20	0	0	T. Bazan	1.0	5	---	1	354	1.1	mg/cm2	0.1	Calibration
10/10/2025	8:15:38	0	0	T. Bazan	1.0	5	---	2	355	1.2	mg/cm2	0.1	Calibration
10/10/2025	8:16:00	0	0	T. Bazan	1.0	5	---	3	356	1.1	mg/cm2	0.1	Calibration
10/10/2025	8:19:13	0	0	T. Bazan	1.0	2	1	4	357	6.1	mg/cm2	0.2	Positive
10/10/2025	8:20:24	0	0	T. Bazan	1.0	2	2	5	358	8.0	mg/cm2	0.2	Positive
10/10/2025	8:21:27	0	0	T. Bazan	1.0	2	3	6	359	0.0	mg/cm2	0.2	Negative
10/10/2025	8:21:46	0	0	T. Bazan	1.0	2	4	7	360	0.0	mg/cm2	0.2	Negative
10/10/2025	8:22:02	0	0	T. Bazan	1.0	2	5	8	361	0.1	mg/cm2	0.2	Negative
10/10/2025	8:22:32	0	0	T. Bazan	1.0	2	6	9	362	0.2	mg/cm2	0.2	Negative
10/10/2025	8:23:21	0	0	T. Bazan	1.0	2	7	10	363	8.9	mg/cm2	0.2	Positive
10/10/2025	8:25:06	0	0	T. Bazan	1.0	2	8	11	364	0.2	mg/cm2	0.2	Negative
10/10/2025	8:25:17	0	0	T. Bazan	1.0	2	9	12	365	0.1	mg/cm2	0.2	Negative
10/10/2025	8:26:03	0	0	T. Bazan	1.0	2	10	13	366	0.0	mg/cm2	0.2	Negative
10/10/2025	8:27:18	0	0	T. Bazan	1.0	2	11	14	367	0.0	mg/cm2	0.2	Negative
10/10/2025	8:27:30	0	0	T. Bazan	1.0	2	12	15	368	0.2	mg/cm2	0.2	Negative
10/10/2025	8:29:19	0	0	T. Bazan	1.0	2	13	16	369	0.2	mg/cm2	0.2	Negative
10/10/2025	8:29:30	0	0	T. Bazan	1.0	2	14	17	370	0.3	mg/cm2	0.2	Negative
10/10/2025	8:30:52	0	0	T. Bazan	1.0	2	15	18	371	0.1	mg/cm2	0.2	Negative
10/10/2025	8:31:03	0	0	T. Bazan	1.0	2	16	19	372	0.5	mg/cm2	0.2	Negative
10/10/2025	8:31:43	0	0	T. Bazan	1.0	2	17	20	373	0.3	mg/cm2	0.2	Negative
10/10/2025	8:32:41	0	0	T. Bazan	1.0	2	18	21	374	0.1	mg/cm2	0.2	Negative
10/10/2025	8:37:34	0	0	T. Bazan	1.0	2	19	22	375	0.1	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/10/2025	8:37:43	0	0	T. Bazan	1.0	2	20	23	376	0.0	mg/cm2	0.2	Negative
10/10/2025	8:39:57	0	0	T. Bazan	1.0	2	21	24	377	0.1	mg/cm2	0.2	Negative
10/10/2025	8:40:23	0	0	T. Bazan	1.0	2	22	25	378	0.1	mg/cm2	0.2	Negative
10/10/2025	8:40:36	0	0	T. Bazan	1.0	2	23	26	379	0.2	mg/cm2	0.2	Negative
10/10/2025	8:41:27	0	0	T. Bazan	1.0	4	24	27	380	0.8	mg/cm2	0.1	Negative
10/10/2025	8:41:48	0	0	T. Bazan	1.0	2	25	28	381	0.1	mg/cm2	0.2	Negative
10/10/2025	8:42:20	0	0	T. Bazan	1.0	2	26	29	382	0.4	mg/cm2	0.2	Negative
10/10/2025	8:43:58	0	0	T. Bazan	1.0	2	27	30	383	0.1	mg/cm2	0.2	Negative
10/10/2025	8:44:16	0	0	T. Bazan	1.0	2	28	31	384	0.1	mg/cm2	0.2	Negative
10/10/2025	8:45:31	0	0	T. Bazan	1.0	2	29	32	385	0.2	mg/cm2	0.2	Negative
10/10/2025	8:45:43	0	0	T. Bazan	1.0	2	30	33	386	0.3	mg/cm2	0.2	Negative
10/10/2025	8:46:54	0	0	T. Bazan	1.0	2	31	34	387	0.2	mg/cm2	0.2	Negative
10/10/2025	8:47:57	0	0	T. Bazan	1.0	2	32	35	388	0.2	mg/cm2	0.2	Negative
10/10/2025	8:49:52	0	0	T. Bazan	1.0	2	33	36	389	0.2	mg/cm2	0.2	Negative
10/10/2025	8:50:22	0	0	T. Bazan	1.0	2	34	37	390	0.2	mg/cm2	0.2	Negative
10/10/2025	8:50:41	0	0	T. Bazan	1.0	2	35	38	391	0.1	mg/cm2	0.2	Negative
10/10/2025	8:51:06	0	0	T. Bazan	1.0	2	36	39	392	0.2	mg/cm2	0.2	Negative
10/10/2025	8:51:21	0	0	T. Bazan	1.0	2	37	40	393	0.7	mg/cm2	0.2	Negative
10/10/2025	8:52:24	0	0	T. Bazan	1.0	2	38	41	394	8.9	mg/cm2	0.2	Positive
10/10/2025	8:55:31	0	0	T. Bazan	1.0	2	39	42	395	10.4	mg/cm2	0.2	Positive
10/10/2025	8:56:54	0	0	T. Bazan	1.0	2	40	43	396	0.1	mg/cm2	0.2	Negative
10/10/2025	9:00:01	0	0	T. Bazan	1.0	2	41	44	397	0.0	mg/cm2	0.2	Negative
10/10/2025	9:02:57	0	0	T. Bazan	1.0	2	42	45	398	8.2	mg/cm2	0.2	Positive
10/10/2025	9:03:59	0	0	T. Bazan	1.0	2	43	46	399	9.1	mg/cm2	0.2	Positive
10/10/2025	9:04:47	0	0	T. Bazan	1.0	2	44	47	400	8.1	mg/cm2	0.2	Positive
10/10/2025	9:05:56	0	0	T. Bazan	1.0	2	45	48	401	9.9	mg/cm2	0.2	Positive
10/10/2025	9:07:32	0	0	T. Bazan	1.0	2	46	49	402	0.2	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/10/2025	9:09:00	0	0	T. Bazan	1.0	2	47	50	403	0.3	mg/cm2	0.2	Negative
10/10/2025	9:11:30	0	0	T. Bazan	1.0	2	48	51	404	0.0	mg/cm2	0.2	Negative
10/10/2025	9:11:42	0	0	T. Bazan	1.0	2	49	52	405	0.0	mg/cm2	0.2	Negative
10/10/2025	9:11:55	0	0	T. Bazan	1.0	2	50	53	406	0.1	mg/cm2	0.2	Negative
10/10/2025	9:15:16	0	0	T. Bazan	1.0	2	51	54	407	0.2	mg/cm2	0.2	Negative
10/10/2025	9:15:30	0	0	T. Bazan	1.0	2	52	55	408	0.2	mg/cm2	0.2	Negative
10/10/2025	9:16:43	0	0	T. Bazan	1.0	2	53	56	409	0.1	mg/cm2	0.2	Negative
10/10/2025	9:16:52	0	0	T. Bazan	1.0	2	54	57	410	0.0	mg/cm2	0.2	Negative
10/10/2025	9:17:10	0	0	T. Bazan	1.0	2	55	58	411	0.1	mg/cm2	0.2	Negative
10/10/2025	9:17:29	0	0	T. Bazan	1.0	2	56	59	412	0.0	mg/cm2	0.2	Negative
10/10/2025	9:17:54	0	0	T. Bazan	1.0	4	57	60	413	0.8	mg/cm2	0.1	Negative
10/10/2025	9:18:15	0	0	T. Bazan	1.0	2	58	61	414	0.2	mg/cm2	0.2	Negative
10/10/2025	9:19:51	0	0	T. Bazan	1.0	2	59	62	415	0.0	mg/cm2	0.2	Negative
10/10/2025	9:20:36	0	0	T. Bazan	1.0	2	60	63	416	28.3	mg/cm2	0.2	Positive
10/10/2025	9:25:10	0	0	T. Bazan	1.0	2	61	64	417	0.2	mg/cm2	0.2	Negative
10/10/2025	9:25:20	0	0	T. Bazan	1.0	2	62	65	418	0.0	mg/cm2	0.2	Negative
10/10/2025	9:27:51	0	0	T. Bazan	1.0	2	63	66	419	0.0	mg/cm2	0.2	Negative
10/10/2025	9:28:00	0	0	T. Bazan	1.0	2	64	67	420	0.3	mg/cm2	0.2	Negative
10/10/2025	9:28:34	0	0	T. Bazan	1.0	2	65	68	421	0.2	mg/cm2	0.2	Negative
10/10/2025	9:29:10	0	0	T. Bazan	1.0	2	66	69	422	0.0	mg/cm2	0.2	Negative
10/10/2025	9:29:48	0	0	T. Bazan	1.0	2	67	70	423	0.1	mg/cm2	0.2	Negative
10/10/2025	9:30:35	0	0	T. Bazan	1.0	2	68	71	424	0.2	mg/cm2	0.2	Negative
10/10/2025	9:31:06	0	0	T. Bazan	1.0	2	69	72	425	8.3	mg/cm2	0.2	Positive
10/10/2025	9:32:18	0	0	T. Bazan	1.0	2	70	73	426	0.3	mg/cm2	0.2	Negative
10/10/2025	9:32:49	0	0	T. Bazan	1.0	2	71	74	427	0.1	mg/cm2	0.2	Negative
10/10/2025	9:35:54	0	0	T. Bazan	1.0	2	72	75	428	0.2	mg/cm2	0.2	Negative
10/10/2025	9:36:05	0	0	T. Bazan	1.0	2	73	76	429	0.2	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/10/2025	9:36:46	0	0	T. Bazan	1.0	2	74	77	430	0.1	mg/cm2	0.2	Negative
10/10/2025	9:36:54	0	0	T. Bazan	1.0	2	75	78	431	0.1	mg/cm2	0.2	Negative
10/10/2025	9:37:31	0	0	T. Bazan	1.0	2	76	79	432	0.1	mg/cm2	0.2	Negative
10/10/2025	9:38:07	0	0	T. Bazan	1.0	2	77	80	433	0.2	mg/cm2	0.2	Negative
10/10/2025	9:41:11	0	0	T. Bazan	1.0	2	78	81	434	0.1	mg/cm2	0.2	Negative
10/10/2025	9:41:21	0	0	T. Bazan	1.0	2	79	82	435	0.4	mg/cm2	0.2	Negative
10/10/2025	9:41:34	0	0	T. Bazan	1.0	2	80	83	436	0.2	mg/cm2	0.2	Negative
10/10/2025	9:44:08	0	0	T. Bazan	1.0	2	81	84	437	0.1	mg/cm2	0.2	Negative
10/10/2025	9:44:18	0	0	T. Bazan	1.0	2	82	85	438	0.0	mg/cm2	0.2	Negative
10/10/2025	9:44:33	0	0	T. Bazan	1.0	2	83	86	439	0.2	mg/cm2	0.2	Negative
10/10/2025	9:44:43	0	0	T. Bazan	1.0	2	84	87	440	0.0	mg/cm2	0.2	Negative
10/10/2025	9:45:24	0	0	T. Bazan	1.0	2	85	88	441	0.1	mg/cm2	0.2	Negative
10/10/2025	9:46:57	0	0	T. Bazan	1.0	2	86	89	442	0.0	mg/cm2	0.2	Negative
10/10/2025	9:47:07	0	0	T. Bazan	1.0	2	87	90	443	0.4	mg/cm2	0.2	Negative
10/10/2025	9:47:19	0	0	T. Bazan	1.0	2	88	91	444	0.5	mg/cm2	0.2	Negative
10/10/2025	9:49:09	0	0	T. Bazan	1.0	2	89	92	445	0.1	mg/cm2	0.2	Negative
10/10/2025	9:50:15	0	0	T. Bazan	1.0	2	90	93	446	0.2	mg/cm2	0.2	Negative
10/10/2025	9:50:29	0	0	T. Bazan	1.0	2	91	94	447	0.6	mg/cm2	0.2	Negative
10/10/2025	9:50:50	0	0	T. Bazan	1.0	2	92	95	448	0.4	mg/cm2	0.2	Negative
10/10/2025	9:51:55	0	0	T. Bazan	1.0	5	93	96	449	1.1	mg/cm2	0.1	Positive
10/10/2025	9:54:03	0	0	T. Bazan	1.0	2	94	97	450	0.2	mg/cm2	0.2	Negative
10/10/2025	9:54:33	0	0	T. Bazan	1.0	2	95	98	451	0.3	mg/cm2	0.2	Negative
10/10/2025	9:55:17	0	0	T. Bazan	1.0	2	96	99	452	0.3	mg/cm2	0.2	Negative
10/10/2025	9:55:57	0	0	T. Bazan	1.0	2	97	100	453	0.3	mg/cm2	0.2	Negative
10/10/2025	9:56:41	0	0	T. Bazan	1.0	2	98	101	454	0.3	mg/cm2	0.2	Negative
10/10/2025	9:57:07	0	0	T. Bazan	1.0	2	99	102	455	0.2	mg/cm2	0.2	Negative
10/10/2025	9:58:01	0	0	T. Bazan	1.0	2	100	103	456	0.0	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/10/2025	10:02:42	0	0	T. Bazan	1.0	2	101	104	457	0.1	mg/cm2	0.2	Negative
10/10/2025	10:03:02	0	0	T. Bazan	1.0	2	102	105	458	0.2	mg/cm2	0.2	Negative
10/10/2025	10:03:48	0	0	T. Bazan	1.0	2	103	106	459	0.0	mg/cm2	0.2	Negative
10/10/2025	10:04:37	0	0	T. Bazan	1.0	2	104	107	460	0.3	mg/cm2	0.2	Negative
10/10/2025	10:05:33	0	0	T. Bazan	1.0	2	105	108	461	2.6	mg/cm2	0.2	Positive
10/10/2025	10:06:09	0	0	T. Bazan	1.0	2	106	109	462	9.7	mg/cm2	0.2	Positive
10/10/2025	10:09:35	0	0	T. Bazan	1.0	2	107	110	463	0.2	mg/cm2	0.2	Negative
10/10/2025	10:09:57	0	0	T. Bazan	1.0	2	108	111	464	0.1	mg/cm2	0.2	Negative
10/10/2025	10:10:12	0	0	T. Bazan	1.0	2	109	112	465	0.6	mg/cm2	0.2	Negative
10/10/2025	10:10:33	0	0	T. Bazan	1.0	2	110	113	466	0.0	mg/cm2	0.2	Negative
10/10/2025	10:10:59	0	0	T. Bazan	1.0	2	111	114	467	0.1	mg/cm2	0.2	Negative
10/10/2025	10:12:31	0	0	T. Bazan	1.0	2	112	115	468	0.2	mg/cm2	0.2	Negative
10/10/2025	10:13:10	0	0	T. Bazan	1.0	2	113	116	469	0.2	mg/cm2	0.2	Negative
10/10/2025	10:13:49	0	0	T. Bazan	1.0	2	114	117	470	0.0	mg/cm2	0.2	Negative
10/10/2025	10:13:58	0	0	T. Bazan	1.0	2	115	118	471	0.0	mg/cm2	0.2	Negative
10/10/2025	10:14:16	0	0	T. Bazan	1.0	2	116	119	472	0.1	mg/cm2	0.2	Negative
10/10/2025	10:14:31	0	0	T. Bazan	1.0	2	117	120	473	0.1	mg/cm2	0.2	Negative
10/10/2025	10:15:28	0	0	T. Bazan	1.0	2	118	121	474	15.0	mg/cm2	0.2	Positive
10/10/2025	10:17:35	0	0	T. Bazan	1.0	2	119	122	475	0.5	mg/cm2	0.2	Negative
10/10/2025	10:17:49	0	0	T. Bazan	1.0	2	120	123	476	0.0	mg/cm2	0.2	Negative
10/10/2025	10:19:36	0	0	T. Bazan	1.0	2	121	124	477	0.1	mg/cm2	0.2	Negative
10/10/2025	10:20:15	0	0	T. Bazan	1.0	2	122	125	478	0.2	mg/cm2	0.2	Negative
10/10/2025	10:20:25	0	0	T. Bazan	1.0	2	123	126	479	0.1	mg/cm2	0.2	Negative
10/10/2025	10:20:36	0	0	T. Bazan	1.0	2	124	127	480	0.1	mg/cm2	0.2	Negative
10/10/2025	10:34:01	0	0	T. Bazan	1.0	2	125	128	481	0.2	mg/cm2	0.2	Negative
10/10/2025	10:35:22	0	0	T. Bazan	1.0	2	126	129	482	0.1	mg/cm2	0.2	Negative
10/10/2025	10:35:29	0	0	T. Bazan	1.0	2	127	130	483	0.5	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/10/2025	10:35:43	0	0	T. Bazan	1.0	2	128	131	484	0.2	mg/cm2	0.2	Negative
10/10/2025	10:35:51	0	0	T. Bazan	1.0	2	129	132	485	0.6	mg/cm2	0.2	Negative
10/10/2025	10:36:22	0	0	T. Bazan	1.0	2	130	133	486	0.1	mg/cm2	0.2	Negative
10/10/2025	10:36:34	0	0	T. Bazan	1.0	2	131	134	487	0.2	mg/cm2	0.2	Negative
10/10/2025	10:36:53	0	0	T. Bazan	1.0	2	132	135	488	0.2	mg/cm2	0.2	Negative
10/10/2025	10:37:22	0	0	T. Bazan	1.0	2	133	136	489	0.2	mg/cm2	0.2	Negative
10/10/2025	10:37:58	0	0	T. Bazan	1.0	2	134	137	490	0.1	mg/cm2	0.2	Negative
10/10/2025	10:40:23	0	0	T. Bazan	1.0	2	135	138	491	0.2	mg/cm2	0.2	Negative
10/10/2025	10:41:02	0	0	T. Bazan	1.0	2	136	139	492	0.2	mg/cm2	0.2	Negative
10/10/2025	10:41:41	0	0	T. Bazan	1.0	2	137	140	493	0.0	mg/cm2	0.2	Negative
10/10/2025	10:42:44	0	0	T. Bazan	1.0	2	138	141	494	0.1	mg/cm2	0.2	Negative
10/10/2025	10:43:37	0	0	T. Bazan	1.0	2	139	142	495	0.1	mg/cm2	0.2	Negative
10/10/2025	10:47:59	0	0	T. Bazan	1.0	2	140	143	496	0.1	mg/cm2	0.2	Negative
10/10/2025	10:48:11	0	0	T. Bazan	1.0	2	141	144	497	0.1	mg/cm2	0.2	Negative
10/10/2025	10:52:03	0	0	T. Bazan	1.0	2	142	145	498	0.3	mg/cm2	0.2	Negative
10/10/2025	10:52:12	0	0	T. Bazan	1.0	2	143	146	499	0.1	mg/cm2	0.2	Negative
10/10/2025	10:52:48	0	0	T. Bazan	1.0	2	144	147	500	0.2	mg/cm2	0.2	Negative
10/10/2025	10:53:10	0	0	T. Bazan	1.0	2	145	148	501	0.3	mg/cm2	0.2	Negative
10/10/2025	10:53:57	0	0	T. Bazan	1.0	2	146	149	502	0.2	mg/cm2	0.2	Negative
10/10/2025	10:54:05	0	0	T. Bazan	1.0	2	147	150	503	0.2	mg/cm2	0.2	Negative
10/10/2025	10:54:36	0	0	T. Bazan	1.0	2	148	151	504	0.1	mg/cm2	0.2	Negative
10/10/2025	10:55:26	0	0	T. Bazan	1.0	2	149	152	505	0.4	mg/cm2	0.2	Negative
10/10/2025	10:58:04	0	0	T. Bazan	1.0	2	150	153	506	0.1	mg/cm2	0.2	Negative
10/10/2025	10:58:13	0	0	T. Bazan	1.0	2	151	154	507	0.2	mg/cm2	0.2	Negative
10/10/2025	10:59:06	0	0	T. Bazan	1.0	2	152	155	508	0.1	mg/cm2	0.2	Negative
10/10/2025	10:59:15	0	0	T. Bazan	1.0	2	153	156	509	0.2	mg/cm2	0.2	Negative
10/10/2025	10:59:40	0	0	T. Bazan	1.0	2	154	157	510	0.2	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/10/2025	10:59:51	0	0	T. Bazan	1.0	2	155	158	511	0.2	mg/cm2	0.2	Negative
10/10/2025	11:00:33	0	0	T. Bazan	1.0	2	156	159	512	0.1	mg/cm2	0.2	Negative
10/10/2025	11:00:46	0	0	T. Bazan	1.0	2	157	160	513	0.2	mg/cm2	0.2	Negative
10/10/2025	11:03:07	0	0	T. Bazan	1.0	2	158	161	514	0.1	mg/cm2	0.2	Negative
10/10/2025	11:03:27	0	0	T. Bazan	1.0	2	159	162	515	0.2	mg/cm2	0.2	Negative
10/10/2025	11:04:02	0	0	T. Bazan	1.0	2	160	163	516	0.2	mg/cm2	0.2	Negative
10/10/2025	11:07:32	0	0	T. Bazan	1.0	2	161	164	517	0.3	mg/cm2	0.2	Negative
10/10/2025	11:07:41	0	0	T. Bazan	1.0	2	162	165	518	0.1	mg/cm2	0.2	Negative
10/10/2025	11:07:50	0	0	T. Bazan	1.0	2	163	166	519	0.3	mg/cm2	0.2	Negative
10/10/2025	11:08:17	0	0	T. Bazan	1.0	2	164	167	520	0.0	mg/cm2	0.2	Negative
10/10/2025	11:10:11	0	0	T. Bazan	1.0	2	165	168	521	0.2	mg/cm2	0.2	Negative
10/10/2025	11:12:55	0	0	T. Bazan	1.0	2	166	169	522	0.1	mg/cm2	0.2	Negative
10/10/2025	11:13:03	0	0	T. Bazan	1.0	2	167	170	523	0.3	mg/cm2	0.2	Negative
10/10/2025	11:13:21	0	0	T. Bazan	1.0	2	168	171	524	0.1	mg/cm2	0.2	Negative
10/10/2025	11:13:45	0	0	T. Bazan	1.0	2	169	172	525	0.2	mg/cm2	0.2	Negative
10/10/2025	11:14:00	0	0	T. Bazan	1.0	2	170	173	526	0.0	mg/cm2	0.2	Negative
10/10/2025	11:15:04	0	0	T. Bazan	1.0	2	171	174	527	0.2	mg/cm2	0.2	Negative
10/10/2025	11:16:16	0	0	T. Bazan	1.0	2	172	175	528	0.2	mg/cm2	0.2	Negative
10/10/2025	11:17:02	0	0	T. Bazan	1.0	2	173	176	529	0.2	mg/cm2	0.2	Negative
10/10/2025	11:17:33	0	0	T. Bazan	1.0	2	174	177	530	0.1	mg/cm2	0.2	Negative
10/10/2025	11:17:46	0	0	T. Bazan	1.0	2	175	178	531	0.2	mg/cm2	0.2	Negative
10/10/2025	11:18:00	0	0	T. Bazan	1.0	2	176	179	532	0.2	mg/cm2	0.2	Negative
10/10/2025	11:19:20	0	0	T. Bazan	1.0	2	177	180	533	0.1	mg/cm2	0.2	Negative
10/10/2025	11:19:29	0	0	T. Bazan	1.0	2	178	181	534	0.3	mg/cm2	0.2	Negative
10/10/2025	11:19:43	0	0	T. Bazan	1.0	2	179	182	535	0.0	mg/cm2	0.2	Negative
10/10/2025	11:20:33	0	0	T. Bazan	1.0	2	180	183	536	0.7	mg/cm2	0.2	Negative
10/10/2025	11:23:36	0	0	T. Bazan	1.0	2	181	184	537	0.1	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/10/2025	11:23:44	0	0	T. Bazan	1.0	2	182	185	538	0.6	mg/cm2	0.2	Negative
10/10/2025	11:24:23	0	0	T. Bazan	1.0	2	183	186	539	0.2	mg/cm2	0.2	Negative
10/10/2025	11:26:32	0	0	T. Bazan	1.0	2	184	187	540	0.5	mg/cm2	0.2	Negative
10/10/2025	11:26:49	0	0	T. Bazan	1.0	2	185	188	541	0.1	mg/cm2	0.2	Negative
10/10/2025	11:27:03	0	0	T. Bazan	1.0	2	186	189	542	0.4	mg/cm2	0.2	Negative
10/10/2025	11:27:18	0	0	T. Bazan	1.0	2	187	190	543	0.4	mg/cm2	0.2	Negative
10/10/2025	11:27:34	0	0	T. Bazan	1.0	2	188	191	544	0.2	mg/cm2	0.2	Negative
10/10/2025	11:30:19	0	0	T. Bazan	1.0	2	189	192	545	0.0	mg/cm2	0.2	Negative
10/10/2025	11:30:28	0	0	T. Bazan	1.0	2	190	193	546	0.1	mg/cm2	0.2	Negative
10/10/2025	11:30:37	0	0	T. Bazan	1.0	2	191	194	547	0.0	mg/cm2	0.2	Negative
10/10/2025	11:31:12	0	0	T. Bazan	1.0	2	192	195	548	0.2	mg/cm2	0.2	Negative
10/10/2025	11:33:14	0	0	T. Bazan	1.0	2	193	196	549	0.3	mg/cm2	0.2	Negative
10/10/2025	11:33:25	0	0	T. Bazan	1.0	2	194	197	550	0.2	mg/cm2	0.2	Negative
10/10/2025	11:33:46	0	0	T. Bazan	1.0	2	195	198	551	0.2	mg/cm2	0.2	Negative
10/10/2025	11:34:12	0	0	T. Bazan	1.0	2	196	199	552	0.1	mg/cm2	0.2	Negative
10/10/2025	11:35:08	0	0	T. Bazan	1.0	2	197	200	553	0.1	mg/cm2	0.2	Negative
10/10/2025	11:35:50	0	0	T. Bazan	1.0	2	198	201	554	0.3	mg/cm2	0.2	Negative
10/10/2025	11:35:58	0	0	T. Bazan	1.0	2	199	202	555	0.2	mg/cm2	0.2	Negative
10/10/2025	11:36:39	0	0	T. Bazan	1.0	2	200	203	556	0.2	mg/cm2	0.2	Negative
10/10/2025	11:38:22	0	0	T. Bazan	1.0	2	201	204	557	0.0	mg/cm2	0.2	Negative
10/10/2025	11:40:01	0	0	T. Bazan	1.0	2	202	205	558	0.1	mg/cm2	0.2	Negative
10/10/2025	11:40:12	0	0	T. Bazan	1.0	2	203	206	559	0.5	mg/cm2	0.2	Negative
10/10/2025	11:41:00	0	0	T. Bazan	1.0	2	204	207	560	0.0	mg/cm2	0.2	Negative
10/10/2025	11:41:10	0	0	T. Bazan	1.0	2	205	208	561	0.1	mg/cm2	0.2	Negative
10/10/2025	11:45:12	0	0	T. Bazan	1.0	2	206	209	562	0.1	mg/cm2	0.2	Negative
10/10/2025	11:48:50	0	0	T. Bazan	1.0	2	207	210	563	0.2	mg/cm2	0.2	Negative
10/10/2025	11:49:01	0	0	T. Bazan	1.0	2	208	211	564	0.2	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/10/2025	11:49:28	0	0	T. Bazan	1.0	2	209	212	565	0.1	mg/cm2	0.2	Negative
10/10/2025	11:50:00	0	0	T. Bazan	1.0	2	210	213	566	0.1	mg/cm2	0.2	Negative
10/10/2025	11:50:20	0	0	T. Bazan	1.0	2	211	214	567	0.1	mg/cm2	0.2	Negative
10/10/2025	11:50:37	0	0	T. Bazan	1.0	2	212	215	568	0.1	mg/cm2	0.2	Negative
10/10/2025	11:50:52	0	0	T. Bazan	1.0	2	213	216	569	0.1	mg/cm2	0.2	Negative
10/10/2025	11:51:22	0	0	T. Bazan	1.0	2	214	217	570	0.2	mg/cm2	0.2	Negative
10/10/2025	11:51:41	0	0	T. Bazan	1.0	2	215	218	571	0.1	mg/cm2	0.2	Negative
10/10/2025	11:52:21	0	0	T. Bazan	1.0	2	216	219	572	0.1	mg/cm2	0.2	Negative
10/10/2025	11:52:36	0	0	T. Bazan	1.0	2	217	220	573	0.2	mg/cm2	0.2	Negative
10/10/2025	11:53:43	0	0	T. Bazan	1.0	3	218	221	574	0.7	mg/cm2	0.2	Negative
10/10/2025	11:56:54	0	0	T. Bazan	1.0	2	219	222	575	0.0	mg/cm2	0.2	Negative
10/10/2025	11:57:37	0	0	T. Bazan	1.0	2	220	223	576	0.0	mg/cm2	0.2	Negative
10/10/2025	12:01:30	0	0	T. Bazan	1.0	2	221	224	577	0.0	mg/cm2	0.2	Negative
10/10/2025	12:01:49	0	0	T. Bazan	1.0	2	222	225	578	0.3	mg/cm2	0.2	Negative
10/10/2025	12:02:07	0	0	T. Bazan	1.0	2	223	226	579	0.4	mg/cm2	0.2	Negative
10/10/2025	12:02:23	0	0	T. Bazan	1.0	2	224	227	580	0.0	mg/cm2	0.2	Negative
10/10/2025	12:02:39	0	0	T. Bazan	1.0	2	225	228	581	0.1	mg/cm2	0.2	Negative
10/10/2025	12:03:23	0	0	T. Bazan	1.0	2	226	229	582	0.5	mg/cm2	0.2	Negative
10/10/2025	12:03:52	0	0	T. Bazan	1.0	2	227	230	583	1.3	mg/cm2	0.2	Positive
10/10/2025	12:05:10	0	0	T. Bazan	1.0	2	228	231	584	0.1	mg/cm2	0.2	Negative
10/10/2025	12:05:56	0	0	T. Bazan	1.0	2	229	232	585	0.3	mg/cm2	0.2	Negative
10/10/2025	12:06:59	0	0	T. Bazan	1.0	2	230	233	586	2.1	mg/cm2	0.2	Positive
10/10/2025	12:08:06	32.4518	-99.73422	T. Bazan	1.0	2	231	234	587	0.6	mg/cm2	0.2	Negative
10/10/2025	12:13:01	32.4518	-99.73482	T. Bazan	1.0	5	---	235	588	1.0	mg/cm2	0.1	Calibration
10/10/2025	12:13:20	32.4518	-99.73511	T. Bazan	1.0	5	---	236	589	0.9	mg/cm2	0.1	Calibration
10/10/2025	12:13:36	32.4515	-99.73691	T. Bazan	1.0	5	---	237	590	0.9	mg/cm2	0.1	Calibration
10/10/2025	12:15:48	32.4512	-99.73749	T. Bazan	1.0	2	232	238	591	0.2	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
VIKEN (HEURESIS) Detection; Pb200i XRF Lead Paint Analyzer s/n 1013 App Version REL 5.3.1
T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/10/2025	12:16:30	32.4512	-99.73756	T. Bazan	1.0	2	233	239	592	0.1	mg/cm2	0.2	Negative
10/10/2025	12:16:39	32.4515	-99.73808	T. Bazan	1.0	2	234	240	593	0.5	mg/cm2	0.2	Negative
10/10/2025	12:17:26	32.4516	-99.73666	T. Bazan	1.0	2	235	241	594	0.5	mg/cm2	0.2	Negative
10/10/2025	12:19:26	32.4517	-99.73659	T. Bazan	1.0	2	236	242	595	0.5	mg/cm2	0.2	Negative
10/10/2025	12:20:00	32.4517	-99.73666	T. Bazan	1.0	2	237	243	596	0.4	mg/cm2	0.2	Negative
10/10/2025	12:20:17	32.4517	-99.73783	T. Bazan	1.0	2	238	244	597	0.4	mg/cm2	0.2	Negative
10/10/2025	12:22:32	32.4517	-99.73783	T. Bazan	1.0	2	239	245	598	0.1	mg/cm2	0.2	Negative
10/10/2025	12:22:41	32.4518	-99.73731	T. Bazan	1.0	2	240	246	599	0.2	mg/cm2	0.2	Negative
10/10/2025	12:26:43	32.4518	-99.73748	T. Bazan	1.0	2	241	247	600	0.1	mg/cm2	0.2	Negative
10/10/2025	12:26:51	32.4519	-99.73769	T. Bazan	1.0	2	242	248	601	0.1	mg/cm2	0.2	Negative
10/10/2025	12:27:47	32.4512	-99.73699	T. Bazan	1.0	2	243	249	602	0.0	mg/cm2	0.2	Negative
10/10/2025	12:28:30	32.4518	-99.73759	T. Bazan	1.0	2	244	250	603	0.4	mg/cm2	0.2	Negative
10/10/2025	12:29:39	32.452	-99.7373	T. Bazan	1.0	2	245	251	604	3.9	mg/cm2	0.2	Positive
10/10/2025	12:31:45	32.452	-99.73727	T. Bazan	1.0	2	246	252	605	0.1	mg/cm2	0.2	Negative
10/10/2025	12:32:46	32.4519	-99.7375	T. Bazan	1.0	2	247	253	606	0.1	mg/cm2	0.2	Negative
10/10/2025	12:33:30	32.4518	-99.73779	T. Bazan	1.0	2	248	254	607	0.6	mg/cm2	0.2	Negative
10/10/2025	12:34:03	32.4518	-99.73764	T. Bazan	1.0	2	249	255	608	0.1	mg/cm2	0.2	Negative
10/10/2025	12:34:20	32.4522	-99.73515	T. Bazan	1.0	2	250	256	609	0.0	mg/cm2	0.2	Negative
10/10/2025	12:39:07	32.448	-99.73255	T. Bazan	1.0	2	251	257	610	0.1	mg/cm2	0.2	Negative
10/10/2025	12:40:17	32.4446	-99.73032	T. Bazan	1.0	2	252	258	611	0.1	mg/cm2	0.2	Negative
10/10/2025	12:40:27	32.4289	-99.7216	T. Bazan	1.0	2	253	259	612	0.3	mg/cm2	0.2	Negative
10/10/2025	12:41:13	32.4241	-99.71893	T. Bazan	1.0	2	254	260	613	0.1	mg/cm2	0.2	Negative
10/10/2025	12:41:29	32.4209	-99.71722	T. Bazan	1.0	2	255	261	614	0.0	mg/cm2	0.2	Negative
10/10/2025	12:42:37	32.4209	-99.71722	T. Bazan	1.0	2	256	262	615	0.2	mg/cm2	0.2	Negative
10/10/2025	12:43:08	32.4209	-99.71722	T. Bazan	1.0	2	257	263	616	0.1	mg/cm2	0.2	Negative
10/10/2025	12:44:05	32.4209	-99.71722	T. Bazan	1.0	2	258	264	617	0.0	mg/cm2	0.2	Negative
10/10/2025	12:45:25	32.4209	-99.71722	T. Bazan	1.0	2	259	265	618	0.1	mg/cm2	0.2	Negative

XRF ASSAYS - 301 Cypress Street, Abeline, Taylor County, TX - Job No. 202510013
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T. Bazan [TDSHS R/A #2070001]

Date	Time	Latitude	Longitude	Operator	Action Level	Nominal Seconds	Reading Number	XRF Assay	Total Assays	Pb	Units	Pb +/-	Classification
10/10/2025	12:46:12	0	0	T. Bazan	1.0	2	260	266	619	0.4	mg/cm2	0.2	Negative
10/10/2025	13:01:18	0	0	T. Bazan	1.0	2	261	267	620	0.1	mg/cm2	0.2	Negative
10/10/2025	13:02:58	0	0	T. Bazan	1.0	2	262	268	621	0.2	mg/cm2	0.2	Negative
10/10/2025	13:03:57	0	0	T. Bazan	1.0	2	263	269	622	0.1	mg/cm2	0.2	Negative
10/10/2025	13:04:10	0	0	T. Bazan	1.0	2	264	270	623	0.1	mg/cm2	0.2	Negative
10/10/2025	13:04:31	0	0	T. Bazan	1.0	2	265	271	624	0.1	mg/cm2	0.2	Negative
10/10/2025	13:04:47	0	0	T. Bazan	1.0	2	266	272	625	0.1	mg/cm2	0.2	Negative
10/10/2025	13:05:59	0	0	T. Bazan	1.0	2	267	273	626	0.2	mg/cm2	0.2	Negative
10/10/2025	13:06:10	0	0	T. Bazan	1.0	2	268	274	627	0.1	mg/cm2	0.2	Negative
10/10/2025	13:06:23	0	0	T. Bazan	1.0	2	269	275	628	0.2	mg/cm2	0.2	Negative
10/10/2025	13:06:51	0	0	T. Bazan	1.0	2	270	276	629	0.1	mg/cm2	0.2	Negative
10/10/2025	13:07:15	0	0	T. Bazan	1.0	2	271	277	630	0.4	mg/cm2	0.2	Negative
10/10/2025	13:09:09	0	0	T. Bazan	1.0	2	272	278	631	0.1	mg/cm2	0.2	Negative
10/10/2025	13:09:20	0	0	T. Bazan	1.0	2	273	279	632	0.1	mg/cm2	0.2	Negative
10/10/2025	13:09:32	0	0	T. Bazan	1.0	2	274	280	633	0.2	mg/cm2	0.2	Negative
10/10/2025	13:10:48	0	0	T. Bazan	1.0	2	275	281	634	0.3	mg/cm2	0.2	Negative
10/10/2025	13:11:32	0	0	T. Bazan	1.0	2	276	282	635	0.6	mg/cm2	0.2	Negative
10/10/2025	13:12:19	0	0	T. Bazan	1.0	2	277	283	636	0.1	mg/cm2	0.2	Negative
10/10/2025	13:12:28	0	0	T. Bazan	1.0	2	278	284	637	0.1	mg/cm2	0.2	Negative
10/10/2025	13:12:46	0	0	T. Bazan	1.0	2	279	285	638	0.1	mg/cm2	0.2	Negative
10/10/2025	13:12:57	0	0	T. Bazan	1.0	2	280	286	639	0.2	mg/cm2	0.2	Negative
10/10/2025	13:14:18	0	0	T. Bazan	1.0	5	---	287	640	0.9	mg/cm2	0.1	Calibration
10/10/2025	13:14:35	0	0	T. Bazan	1.0	5	---	288	641	1.0	mg/cm2	0.1	Calibration
10/10/2025	13:14:52	0	0	T. Bazan	1.0	5	---	289	642	0.9	mg/cm2	0.1	Calibration

Attachment 2: Site Plans



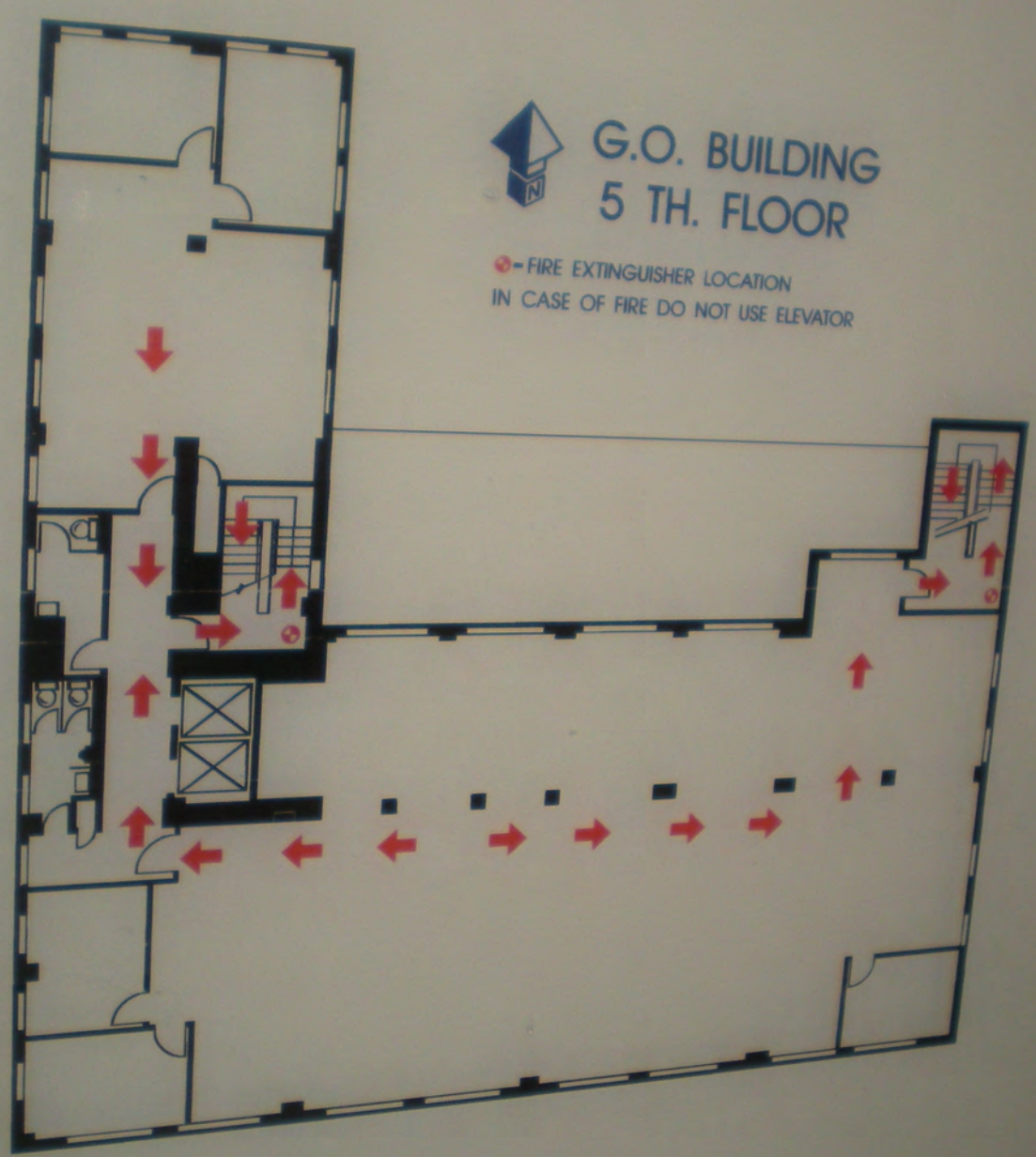

G.O. BUILDING
2 ND. FLOOR
- FIRE EXTINGUISHER LOCATION
IN CASE OF FIRE DO NOT USE ELEVATOR


G.O. BUILDING
3RD. FLOOR
-FIRE EXTINGUISHER LOCATION
IN CASE OF FIRE DO NOT USE ELEVATOR

G.O. BUILDING
4 TH. FLOOR

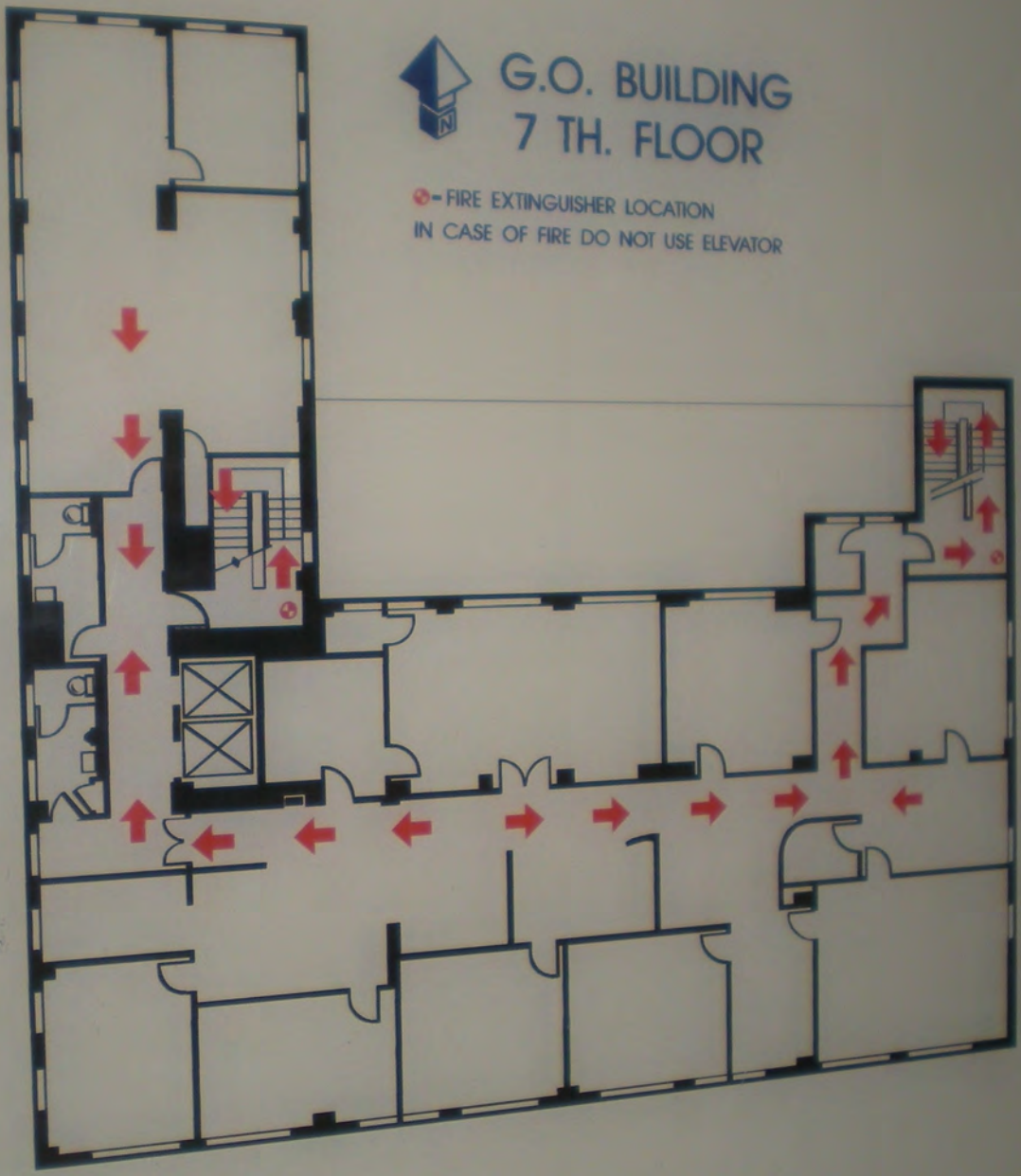
= FIRE EXTINGUISHER LOCATION
IN CASE OF FIRE DO NOT USE ELEVATOR




G.O. BUILDING
5 TH. FLOOR
- FIRE EXTINGUISHER LOCATION
IN CASE OF FIRE DO NOT USE ELEVATOR

G.O. BUILDING
7 TH. FLOOR

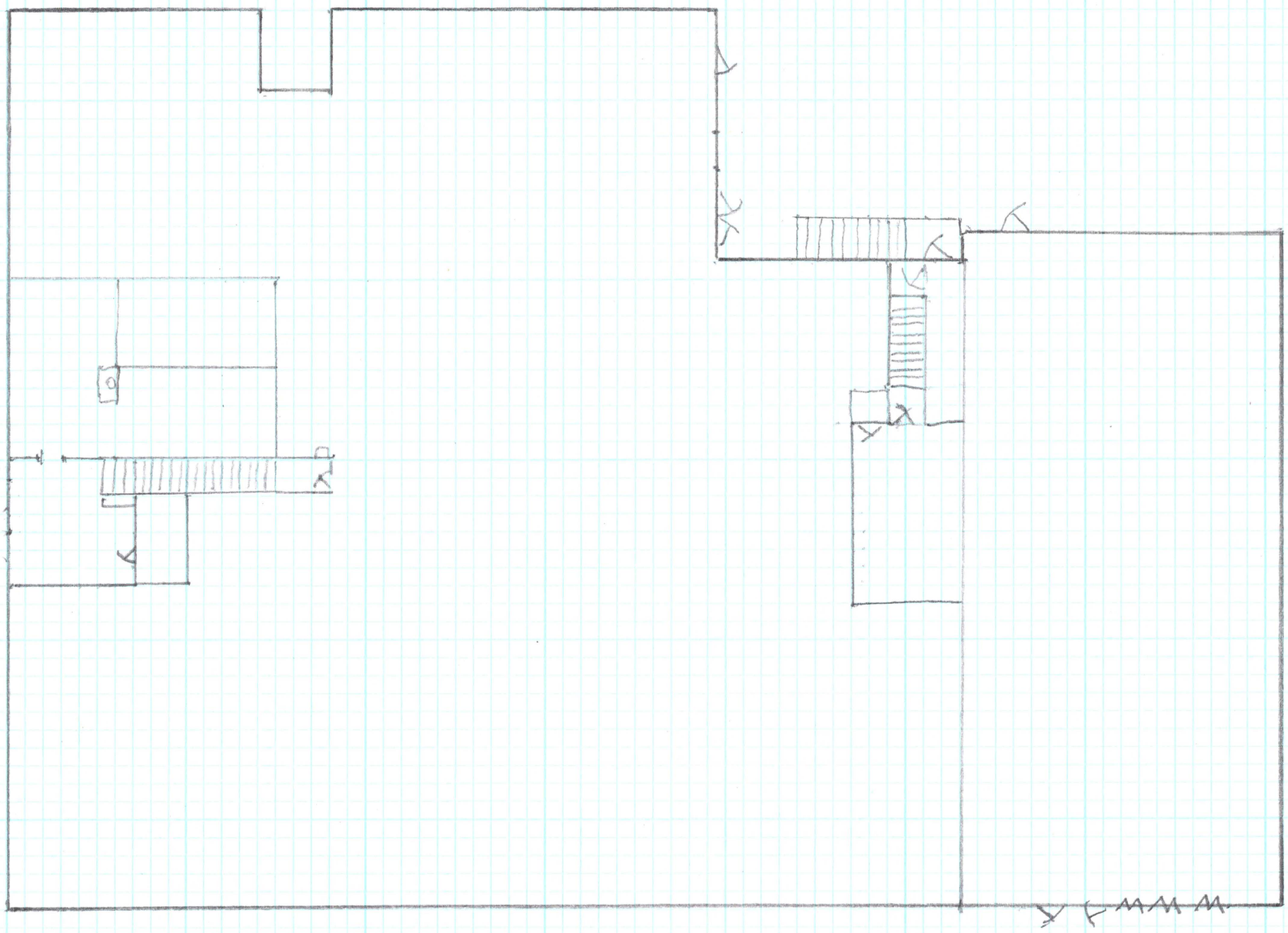
- FIRE EXTINGUISHER LOCATION
IN CASE OF FIRE DO NOT USE ELEVATOR



LEAD BASED PAINT INSPECTION OF A VACANT SEVEN-STORY BUILDING

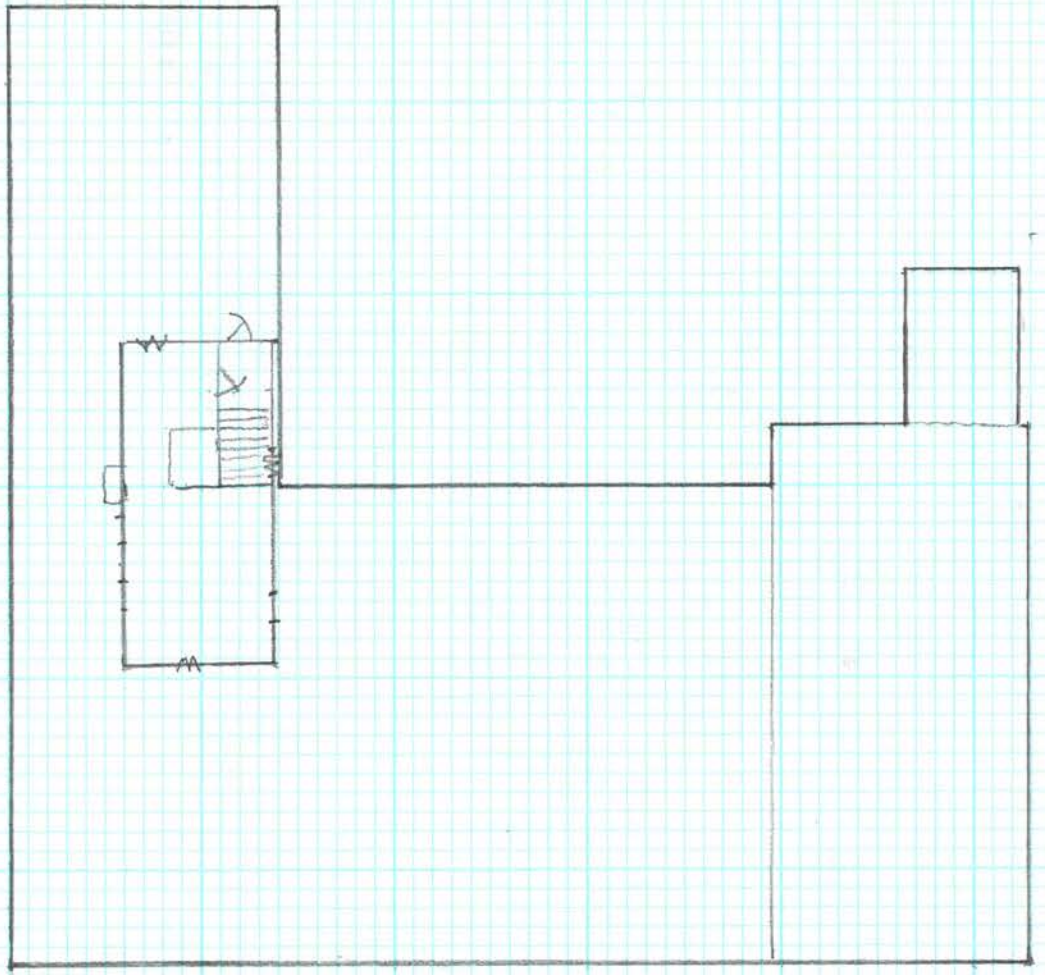
301 Cypress Street, Abilene, Taylor County, Texas
October 9th & 10th, 2025 PELLC Job No. 202510013

Sketch of Ground Floor Perimeter with Two (1) Basements



LEAD-BASED PAINT INSPECTION OF A VACANT SEVEN-STORY BUILDING

301 Cypress Street, Abilene, Taylor County, Texas
October 9th & 10th, 2025, 2025 PELLC Job No. 202510013
Sketch of the Elevator Penthouse



Attachment 3: Licenses / Certifications

Texas Department of State Health Services

BE IT KNOWN THAT

PHASE ENGINEERING LLC

is certified to perform as a

Lead Firm

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1955 and Title 25, Texas Administrative Code, Chapter 295 relating to Texas Environmental Lead Reduction, as long as this license is not suspended or revoked.

Certification Number: 2110073

Expiration Date: 01/27/2026

Jennifer Shuford, MD, MPH, Commissioner of Health

Control Number: 7525

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

SEE BACK

Texas Department of State Health Services

BE IT KNOWN THAT

THOMAS A BAZAN

is certified to perform as a

Lead Risk Assessor

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1955 and Title 25, Texas Administrative Code, Chapter 295 relating to Texas Environmental Lead Reduction, as long as this license is not suspended or revoked.

Certification Number: 2070001

Expiration Date: 08/05/2027

Jennifer Shuford, MD

Jennifer Shuford, MD, MPH, Commissioner of Health

Control Number: 8383

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

SEE BACK

AEHS, INC.

DSHS Lead Training Provider Certification # 20439

CERTIFIES THAT

THOMAS BAZAN

has successfully completed

Lead Inspector Refresher

IN ACCORDANCE WITH ALL REQUIREMENTS OF TEXAS ENVIRONMENTAL LEAD REDUCTION RULES

Certification Number	0625-5377F
Course Completion Date	18 June 2025

Marcie Sinclair

Marcie Sinclair, MS, REM
Training Manager

AEHS, Inc.
4402 Centergate St.
San Antonio, TX 78217
(210) 656-9300
www.aehs-sa.com

Kelly N Brown

Kelly Brown, IAC
Instructor

AEHS, INC.

DSHS Lead Training Provider Certification # 20439

CERTIFIES THAT

THOMAS BAZAN

has successfully completed

Lead Risk Assessor Refresher

IN ACCORDANCE WITH ALL REQUIREMENTS OF TEXAS ENVIRONMENTAL LEAD REDUCTION RULES

Certification Number	0625-5378C
Course Completion Date	19 June 2025

Marcie Sinclair

Marcie Sinclair, MS, REM
Training Manager

AEHS, Inc.
4402 Centergate St.
San Antonio, TX 78217
(210) 656-9300
www.aehs-sa.com

Kelly N Brown

Kelly Brown, IAC
Instructor

Texas Department of State Health Services

BE IT KNOWN THAT

THOMAS A BAZAN

is certified to perform as a

Lead Abatement Supervisor

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1955 and Title 25, Texas Administrative Code, Chapter 295 relating to Texas Environmental Lead Reduction, as long as this license is not suspended or revoked.

Certification Number: 2080131

Expiration Date: 12/07/2025

Jennifer Shuford, MD, MPH, Commissioner of Health

Control Number: 6835

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

SEE BACK

AEHS, INC.

DSHS Lead Training Provider Certification # 20439

CERTIFIES THAT

THOMAS BAZAN

has successfully completed

Lead Supervisor Refresher

IN ACCORDANCE WITH ALL REQUIREMENTS OF TEXAS ENVIRONMENTAL LEAD REDUCTION RULES

Certification Number	0625-5379D
Course Completion Date	20 June 2025

Marcie Sinclair

Marcie Sinclair, MS, REM
Training Manager

AEHS, Inc.
4402 Centergate St.
San Antonio, TX 78217
(210) 656-9300
www.aehs-sa.com

Kelly N Brown

Kelly Brown, IAC
Instructor

CONGRATULATIONS

Thomas Bazan

has successfully completed the U.S. Department

of Housing and Urban Development,

Office of Healthy Homes and Lead Hazard Control's

VISUAL ASSESSMENT COURSE

pursuant to 24 Code of Federal Regulations Part 35

Jonnette G. Hawkins
Director, Program Management and Assurance Division
Office of Healthy Homes and Lead Hazard Control

U.S. Department of Housing and Urban Development

Environmental Assessment Association



EAA
ENVIRONMENTAL
Assessment Association

hereby certifies that



Thomas A. Bazan

has been qualified for membership in the

ENVIRONMENTAL ASSESSMENT ASSOCIATION

and has been admitted by its Board of Directors and declared to be a

Certified Remediation Specialist &
Certified Environmental Inspector

and is hereby granted this certificate under the conditions presented in its by-laws.

Brent Felstead

Executive Director

Member Since: September 1, 1991 ***ID # 7210***

Expiration Date: February 28, 2026

Certificate of Training

Thomas Bazan

Has completed the Viken Detection Corporation training materials presented on the topic of Instrument Operator Training, Pb200i, with regards to the materials licensed by the Commonwealth of Massachusetts and the Nuclear Regulatory Commission.

Instrument Operator Training
Viken Detection Corporation, Pb200i

I confirm that the above named individual has received the training listed on this certificate.

Deblyn Palella — April 1st 2020

Name — Date

XRF Sales, Rentals, Training and Consulting

Title



I certify that I have received the stated training and understand the content presented. I understand that I can follow up this training with questions from Viken Detection Corporation.

_____ — April 1, 2020

Name — Date

Certificate of Training

Thomas Bazan

Has completed the Heuresis Corporation training materials presented on the topic of Instrument Operator Training, Pb200i, with regards to the materials licensed by the Commonwealth of Massachusetts and the Nuclear Regulatory

Instrument Operator Training
Heuresis Corporation, Pb200i

I confirm that the above named individual has received the training listed on this certificate.

Raymond Lindee — 01/18/2016

Name — Date

Regional Representative for Heuresis

Title

I certify that I have received the stated training and understand the content presented. I understand that I can follow up this training with questions from Heuresis Corporation.

01/18/2016

Name — Date

Caution:
radioactive material

Co-57	SN:X5-468
Activity:	5 mCi
Reference Date:	12/25/24
Model Pb200e:	SN:1013

Viken Detection Burlington, MA
+1-617-467-5526

12/16/2024 10:05

Send all kits and requests to:

SUNTRAC Services, Inc.
1818 East Main Street
League City, TX 77573
(281) 338-2133

ATTN: SIT-KIT

CAUTION: Conduct a survey on the outside of each package placed in the U.S. Mails. Any reading over 0.5 mR/hr at contact with the envelope or package shall not be mailed.

LEAK TEST INVENTORY/REPORT FORM

Company Name: Thomas A. Bazan (14539)

Address: 14722 Wind Cave Lane City: Houston State: TX Zip Code: 77040

Isotope: Co 57 Activity: 5 mCi

Source Serial No: X5-468

Device Serial No: 1013

Manufacturer: Eckert & Ziegler Model No.: Pb200i/e

Smear Taken By: T. Bazan Leak Test Date: 04/18/25

--- --- --- --- --- --- --- --- --- --- **DO NOT WRITE BELOW THIS LINE** --- --- --- --- --- --- --- --- --- ---

This is to certify that the above described smear/swab has been assayed at our facilities for indication of source leakage.

Our findings show the leakage to be:

ALPHA	BETA-GAMMA
-----	<.0001

µCi (Wet)

Certified By: _____ Date: 04/25/25

SUNTRAC Services, Inc. Representative
(Texas Radioactive License No. L03062)

2262025

VSSA

Valley Safety Services Associates, Inc.

330 Old Enfield Road, Belchertown, MA 01007
http://www.vssa-inc.com
Tel/Fax: (413)323-9571

Leak Test Data/Certificate

Complete the data requested on the top part of this form and return it with your leak test to the address in the above heading. Following our analysis of your leak test specimen we will return this form to you for your record of the test and results.

Source/Device Description

Device: Source **Model:** Pb200i/e **Serial #:** 1013 **Manufacturer:** Viken

Radioisotope Co - 57 **Activity (mCi)** 6 mci

Source model: A3901 - 2 **Source # :** X5-468 **Manufacturer:** Eckert & Ziegler

The leak testing of this source/device was performed as indicated in manufacturer recommendations or LT-952 kit instructions using kit # 888317

By: Seth Martin Date: 10/15/24

Company: Viken Detection Corporation Telephone: 617-467-5526

Address: 21 North Avenue Email:
Burlington, MA 01803

Do Not Write Below This Line

Leak Test Analysis Result

Analysis of the above test on 16 Oct 24 yielded the following;

☒ Statistical analysis of the radioactive count data of this leak test specimen indicated any activity present is less than 0.005 μCi. The source may be used as authorized.

☐ Statistical analysis of the radioactive count data of this leak test specimen indicated there is greater than 0.005 microcuries of activity present. This source should be considered leaking. Consult your device operations manual; place this unit in storage and make the required notification to your regulatory agency.

REMINDER: YOUR NEXT REQUIRED LEAK TEST FOR THIS DEVICE/SOURCE IS DUE ON OR BEFORE (Exemptions*)

16 Oct 25 N/A

***Model Pb200i is approved under SSDR# MA-1397-D-101-B for a leak testing frequency not to exceed 12months. Model Pb200e does not require leak tesing by end users (SSDR# NR-1397-D-102-E). (Please ensure to check for the requirements of your state.)**

THIS CERTIFICATE IS AN ESSENTIAL RECORD AND SHOULD BE MAINTAINED FOR INSPECTION BY THE REGULATORY AGENCY.

CERTIFICATE #: 888317 **BY:** S R **DATE :** 16 Oct 24

VIKEN
DETECTION

Conversion to PB200e

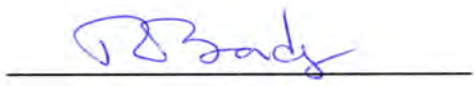
This document confirms that the unit listed below has been converted to the PB200e. All appropriate labels have been applied.

Date: 12-13-2024

Customer: Thomas Bazan

Serial number: 1013

Signature of Authorized Service Representative:



Revision A 5/1/2023

21 North Avenue Burlington, MA 01803 / 617.467.5526 / vikendetection.com

VIKEN
DETECTION
One Sense Ahead

Service Report for Ticket #:
00016383
Date: December 13, 2024

21 North Ave
Burlington, MA 01803

Prepared For: Thomas Bazan

Account: Thomas Andrew Bazan
Billing Address: 14772 Wind Cave Lane
Houston, Texas 77040
United States

Service Representative: Juliann Lipski
Phone: 617-467-5526
Email: jlipski@vikendetection.com

Phone: +1 617-467-5526
Fax: +1 617-467-5024
Email: technicalservice@vikendetection.com

Service Ticket Number	00016383

Service Ticket Info			
Date Issue Reported	December 05, 2024	Covered Under Warranty	No
Description of Issue	Customer would like unit resourced and converted to the PB200e.		

Date Received In	December 05, 2024	Software Version After Repair	5.3.1

Root Cause	

Corrective Action	Resourced Co57 source. Also replaced several parts as part of the resourcing upgrade. Updated software. Unit was put through a calibration validation process and all tests passed. Unit has been converted to a PB200e.

Affected Asset			
Asset Name	Product Code	Product Name	Serial Number
12-100327	12-100327	Pb200e - Lead Paint Analyzer with Accessory Kit	1013

RMA Items				
Part Number	Asset Name	Serial Number	Shipment Status	Asset Quantity
5-000039	Co-57 Source / 5mCi	V6-215	Removed	1
5-002047	Co-57 Source / 6mCi	X5-468	Installed	1

Required Materials and Services				
Product Code	Description	QTY	Unit Price	Extended
10-000003	Domestic 2 Day Shipping	1	$100.00	$100.00
8-100421	Pb200i/e Service - Type i-to-e Conversion	1	$350.00	$0.00
8-100482	Standard Resourcing Service, Pb200	1	$3,950.00	$3,950.00

Products and Services Subtotal	**$4,300.00**
Shipping and Handling Subtotal	**$100.00**
Warranty Subtotal	**$0.00**
Total Discount	**$350.00**
Total Price	**$4,050.00**

Performance Characteristic Sheet

EFFECTIVE DATE: **September 1, 2022**

MANUFACTURER AND MODEL:

Make: ***Heuresis***
Models: ***Model Pb200i, Pb200e***
Source: ***^{57}Co, 5 mCi (nominal – new source)***

FIELD OPERATION GUIDANCE

OPERATING PARAMETERS:

Action Level 1.0 mg/cm^2

XRF CALIBRATION CHECK LIMITS:

0.8 to 1.2 mg/cm^2 (inclusive)

SUBSTRATE CORRECTION:

Not applicable

INCONCLUSIVE RANGE OR THRESHOLD:

ACTION LEVEL MODE READING DESCRIPTION	SUBSTRATE	THRESHOLD (mg/cm^2)
Results not corrected for substrate bias on any substrate	Brick Concrete Drywall Metal Plaster Wood	1.0 1.0 1.0 1.0 1.0 1.0

BACKGROUND INFORMATION

EVALUATION DATA SOURCE AND DATE:

This sheet is supplemental information to be used in conjunction with Chapter 7 of the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* ("HUD Guidelines"). Performance parameters shown on this sheet are calculated using test results on building components in the HUD archive. Testing was conducted on 146 test samples in November 2015, with two separate instruments running software version 2.1-2 in Action Level test mode. The actual source strength of each instrument on the day of testing was approximately 2.0 mCi; source ages were approximately one year.

OPERATING PARAMETERS

Performance parameters shown in this sheet are applicable only when properly operating the instrument using the manufacturer's instructions and procedures described in Chapter 7 of the HUD Guidelines.

XRF CALIBRATION CHECK:

The calibration of the XRF instrument should be checked using the paint film nearest 1.0 mg/cm^2 in the NIST Standard Reference Material (SRM) used (e.g., for NIST SRM 2579, use the 1.02 mg/cm^2 film).

If the average (rounded to 1 decimal place) of three readings is outside the acceptable calibration check range, follow the manufacturer's instructions to bring the instrument into control before XRF testing proceeds.

SUBSTRATE CORRECTION VALUE COMPUTATION:

Chapter 7 of the HUD Guidelines provides guidance on correcting XRF results for substrate bias. Supplemental guidance for using the paint film nearest 1.0 mg/cm^2 for substrate correction is provided:

XRF results are corrected for substrate bias by subtracting from each XRF result a correction value determined separately in each house for single-family housing or in each development for multifamily housing, for each substrate. The correction value is an average of XRF readings taken over the NIST SRM paint film nearest to 1.0 mg/cm^2 at test locations that have been scraped bare of their paint covering. Compute the correction values as follows:

> Using the same XRF instrument, take three readings on a bare substrate area covered with the NIST SRM paint film nearest 1 mg/cm^2. Repeat this procedure by taking three more readings on a second bare substrate area of the same substrate covered with the NIST SRM.
>
> Compute the correction value for each substrate type where XRF readings indicate substrate correction is needed by computing the average of all six readings as shown below.
>
> <u>For each substrate type</u> (the 1.02 mg/cm^2 NIST SRM is shown in this example; use the actual lead loading of the NIST SRM used for substrate correction):
>
> Correction value = (1st + 2nd + 3rd + 4th + 5th + 6th *Reading*)/6 - 1.02 mg/cm^2
>
> Repeat this procedure for each substrate requiring substrate correction in the house or housing development.

EVALUATING THE QUALITY OF XRF TESTING:

Randomly select ten testing combinations for retesting from each house or from two randomly selected units in multifamily housing.

Conduct XRF re-testing at the ten testing combinations selected for retesting.

Determine if the XRF testing in the units or house passed or failed the test by applying the steps below. Compute the Retest Tolerance Limit by the following steps:

Determine XRF results for the original and retest XRF readings. Do not correct the original or retest results for substrate bias. In single-family and multi-family housing, a result is defined as a single reading. Therefore, there will be ten original and ten retest XRF results for each house or for the two selected units.

Calculate the average of the original XRF result and the retest XRF result for each testing combination.

Square the average for each testing combination.

Add the ten squared averages together. Call this quantity C.

Multiply the number C by 0.0072. Call this quantity D.

Add the number 0.032 to D. Call this quantity E.

Take the square root of E. Call this quantity F.

Multiply F by 1.645. The result is the Retest Tolerance Limit.

Compute the average of all ten original XRF readings.

Compute the average of all ten re-test XRF readings.

Find the absolute difference of the two averages.

If the difference is less than the Retest Tolerance Limit, the inspection has passed the retest. If the difference of the overall averages equals or exceeds the Retest Tolerance Limit, this procedure should be repeated with ten new testing combinations. If the difference of the overall averages is equal to or greater than the Retest Tolerance Limit a second time, then the inspection should be considered deficient.

Use of this procedure is estimated to produce a spurious result approximately 1% of the time. That is, results of this procedure will call for further examination when no examination is warranted in approximately 1 out of 100 dwelling units tested.

TESTING TIMES:

In the Action Level paint test mode, the instrument takes the longest time to complete readings close to the Federal standard of 1.0 mg/cm^2. The table below shows the mean and standard deviation of actual reading times by reading level for paint samples during the November 2015 archive testing. The tested instruments reported readings to one decimal place. No significant differences in reading times by substrate were observed. These times apply only to instruments with the same source strength as those tested (2.0 mCi). Instruments with stronger sources will have shorter reading times and those with weaker sources, longer reading times, than those in the table.

Mean and Standard Deviation of Reading Times in Action Level Mode by Reading Level		
Reading (mg/cm^2)	**Mean Reading Time (seconds)**	**Standard Deviation (seconds)**
< 0.7	3.48	0.47
0.7	7.29	1.92
0.8	13.95	1.78
0.9 – 1.2	15.25	0.66
1.3 – 1.4	6.08	2.50
≥ 1.5	3.32	0.05

CLASSIFICATION OF RESULTS:

XRF results are classified as **positive** if they are **greater than or equal** to the stated threshold for the instrument (1.0 mg/cm^2), and *negative* if they are *less than* the threshold.

DOCUMENTATION:

A report titled *Methodology for XRF Performance Characteristic Sheets* (EPA 747-R-95-008) provides an explanation of the statistical methodology used to construct the data in the sheets, and provides empirical results from using the recommended inconclusive ranges or thresholds for specific XRF instruments. The report may be downloaded at http://www2.epa.gov/lead/methodology-xrf-performance-characteristic-sheets-epa-747-r-95-008-september-1997.

This XRF Performance Characteristic Sheet (PCS) was developed by QuanTech, Inc., under a contract with the XRF manufacturer.

A Nonparametric Method for Estimating the 5th and 95th Percentile Curves of Variable-Time XRF Readings Based on Monotone Regression

Prepared for the
HUD Office of Healthy Homes and Lead Hazard Control
by
QuanTech, Inc.

October 24, 2000

For some newer XRF instruments, readings are typically taken in a “variable-time” mode where the reading time depends on the lead level in the paint. As detailed in Appendix B of *Methodology for XRF Performance Characteristic Sheets*(EPA 747-R-95-008, September 1997), it is not appropriate to apply the parametric XRF measurement model to such readings.

Since the underlying distribution is unknown and suspected to be nonnormal, a nonparametric method, based on monotone regression, was developed to obtain estimates of the 5^{th} and 95^{th} percentile XRF readings, as functions of the true lead level. This method applies the assumption that the percentiles are increasing functions of the lead level. Monotone regression is the solution to a quadratic programming problem, and is obtained with the "pool adjacent violators" (PAV) algorithm. The solution takes the form of a step function, formed by percentiles of the data over subgroups in a way that the percentiles do not decrease. Although a monotone regression cannot be "smooth" in appearance, it will approximate the true response if the sample is large, and if the true response is itself a nondecreasing function. A full treatment of monotone regression can be found in *Statistical Inference Under Order Restrictions* (Barlow, Bartholomew, Bremner, and Brunk, Wiley 1972). The nonparametric 5th and 95th percentile curves are applied to determine the threshold/inconclusive range for the PCS for an instrument with variable-time readings. Because the method is nonparametric, there is typically insufficient data to develop thresholds/inconclusive ranges separately by substrate.

Attachment 4: Letter of Engagement

PHASE ENGINEERING

Environmental Consultants May 12, 2025

Overland Property Group
April Engstrom
5341 West 151st Terrace
Leawood, KS 66224
Phone: (785) 212-0810 Email: aengstrom@overlandpg.com

We are pleased to make the following proposal for Professional Environmental Services:

Property/Borrower Name or Reference #: Landmark on Cypress
Current Use: Office - Building - Approximately 0.96 Acre
Address/ Property Location: 301 Cypress Street
City: Abilene County: Taylor State: TX Zip: 79601

Perform a lead inspection following HUD guidelines by a licensed lead inspector to determine the presence of lead-based-paint using X-Ray Fluorescence (XRF). The lead based paint inspection does not include lead contaminated dust or lead contaminated soil as described in the definition of lead based paint hazard in Title X, CFR Vol. 61 No. 169 Subpart L 745.233 or the Texas Environmental Lead Reduction Rules 295.202. No water or air samples will be taken as part of this survey. Although Phase Engineering, LLC uses trained and certified/licensed inspectors in attempting to locate and identify surfaces potentially containing lead based paint, Phase Engineering, LLC does not warrant that all surfaces containing lead based paint hazards will be identified. It is possible that there are surfaces containing lead based paint hazards that were not found because they were not visible or accessible to the inspector, or for various other reasons, were not inspected.
_AE_ Initials

Perform drinking water testing for inorganic lead (LOW) at the subject property. The water testing will be conducted in compliance with EPA sampling protocols. The scope of work will include sampling a minimum of one cold water faucet and/or one dwelling unit from each building or selected dwelling unit, and where the identified cold water faucet(s) have remained inactive for at least 6-8 hours before testing. If any building and/or selected dwelling unit has not been recently occupied, the cold water faucets must be flushed out within 18 hours before sampling. The LDW samples will be analyzed at a lab certified for conducting drinking water testing.
_____ Initials

Quoted Price Lead Based Paint Only:
Quoted Price with Lead In Drinking Water Testing:
we will not be needing a lead in drinking water engagement
Note: The quoted price is for one scheduled testing event at each address. In the case when all buildings/units are not ready for testing at once and additional events will be required an additional charge will be added to the quoted price to cover additional time and travel expenses.

- Includes: Electronic version in PDF with findings, opinions and conclusions.
- Delivery: Final report approximately 15 business days from receipt of signed proposal.
- Terms: Payment of 50% of inspection price due before work commences. Invoice will be provided after inspection for payment. Final payment due prior to release of laboratory results and report.
- Cancellation: Upon written notice of cancellation by client, Phase Engineering, LLC shall cease work on the project. Client will be billed and agrees to promptly pay for the portion of work completed up to receipt of the cancellation notice or hold notice that has not been lifted for 15 continuous business days.

If the above terms and attached Agreement for Professional Environmental Consulting Services are acceptable, please email the signed proposal to proposals@phaseengineering.com to serve as a letter of engagement and notification to proceed. The following information is needed to complete by scheduled delivery date:

PHASE ENGINEERING

Environmental Consultants May 12, 2025

1. Access to all areas to be sampled - contact name / phone number & current owner name / phone number. The contact is responsible for arrangements at the property including access to areas to be sampled and confirming access prior to inspector's arrival.
2. Survey and floor plans prior to inspection.

Thank you for the opportunity to work with you and your environmental needs. If you have any questions, please call me at (832) 485-2238.

Ross Doctoroff P.G.

Accepted By: April Engstrom Date: 9/30/25

Print Name: April Engstrom

Company Name: OPG Cypress Partners, LLC

October 23, 2025

Overland Property Group
April Engstrom
5341 West 151st Terrace
Leawood, Kansas 66224

I. Project Identification

Property Address:
301 Cypress Street
Abilene, Taylor County, Texas 79601

Consultant Name and Project Number:

Phase Engineering, LLC
Report # 202510014

II. Property Use

The subject property consists of approximately 0.9704-acre of land and currently consists of an unoccupied multi-story office building and an unoccupied retail storefront and associated parking.

III. Purpose

The purpose of this Vapor Encroachment Screening assessment is to determine if a vapor encroachment condition exists in association with undocumented releases of petroleum products and/or hazardous substances from historical automotive repair, service, and fueling operations and use of gasoline tanks as well as historical cleaning and pressing activities conducted at the subject property.

Assessment activities at the subject property also included conducting a Phase II Environmental Site Assessment (ESA) to evaluate the potential for impact to soil and/or groundwater at the subject property from the identified environmental concerns. The results of that part of the assessment are reported under separate cover.

IV. Background

Phase Engineering, LLC prepared a Phase I Environmental Site Assessment (ESA) for the subject property dated February 5, 2025. The following is a general summary of the findings and opinion associated with the

recognized environmental condition (REC) identified in connection with the subject property during the Phase I ESA:

"Historical street directories and fire insurance maps indicate that businesses conducting automotive service related activities operated at the subject property, including the following:

- *Gasoline filling and service stations were listed at 1037 and 1051 North 4th Street from the mid-1920s to the mid-1930s under the names Cadillac-LaSalle Service and Hollinshead Service Station. The 1925 and 1929 fire insurance maps show gasoline tanks "GTs" at this facility.*
- *A battery service shop was listed at 1031, 1051 & 1053 North 4th Street from the late-1920s to the early-1950s under the name Exide Battery Service.*
- *An automotive service shop was listed at 1051 & 1053 North 4th Street from the early-1940s to the early-1950s under the name Sears Roebuck service department.*
- *An automotive paint and repair shop was listed at 333 Cypress Street during the early-1920s under the name Western Auto Top & Paint Shop.*
- *Automotive sales and rental facilities and taxi and bus services were listed at 357 Cypress Street from the late-1920s to the early-1940s under the names Capital Motor Company, Rent-A-Car Company, City Service Taxi & Bus and Fielder O B & Sons. The 1925 and 1929 fire insurance maps show gasoline tanks "GTs" at this facility.*
- *A gasoline service station was listed at 389 Cypress Street from the mid-1930s to the early-1940s under the names Connally's Service Station and T&P Service Station.*
- *A bus depot was listed at 389 Cypress Street from the mid-1940s to the mid-1950s under the names American Bus Depot, American Bus Lines, Inc. and Continental Trailways. The 1950 fire insurance map shows an oil storage room at this facility.*

USTs operated at the onsite gasoline filling and service stations prior to the promulgation of UST registration and decommissioning requirements. No records were available which could be used to determine the final status or condition of USTs historically active at this property or the results of any release determination investigations possibly conducted in connection with UST decommissioning. This is a significant data gap. Automotive repair shops are known to store, use and dispose of hazardous substances and petroleum products possibly including degreaser solvents, paints, paint thinners, coolants, oil, hydraulic oil, lubricants, gasoline and diesel.

The subject property has likely been impacted as a result of automotive service and fueling operations conducted onsite based on the duration of operations and lack of information regarding any UST decommissioning investigation activities or the final status and condition of historical USTs, which prevents the environmental professional from verifying that investigation of the former UST systems was adequate to discover any releases. This represents a recognized environmental condition."

V. Scope of Assessment

The investigation consisted of installation of five (5) sub-slab vapor monitoring ports within the surface soil interval extending five feet bgs utilizing Direct Push Technology (DPT) with a track-mounted drill rig, set up of one (1) interior ambient air sampling station, and collection of soil vapor and ambient air samples for laboratory analysis on October 9, 2025. The assessment was conducted to evaluate both the potential for future vapor intrusion as well as potential ongoing vapor intrusion into structures at the

subject property in association with undocumented releases of petroleum products and/or hazardous substances from historical onsite operations of environmental concern as described in Sections III and IV. The sample locations are described in Section VI; the locations were selected to ensure evaluation of areas potentially impacted by past releases as well as migration of impact that could result in current and/or future adverse inhalation exposures.

It is the opinion of Phase Engineering, LLC that the scope and character of the environmental report and services, and the investigation performed, were sufficient to justify the conclusions reached in light of the character of the property and the results of tests performed. Phase Engineering, LLC has used methodologies that conform to standards established by the EPA and appropriate state environmental protection agencies under similar budget and time constraints, good and customary practices, and laboratory standards for this kind of work. Soil vapor and ambient air samples collected and analyzed as part of this limited assessment are indicative of the potentially affected area(s) of the subject property.

VI. Vapor Encroachment Screening Assessment Details

Five (5) vapor monitoring ports were installed sub-slab within the surface soil interval extending five feet bgs utilizing DPT via track-mounted drill rig, and (1) ambient air sampling device (summa canister) was set up in an interior location on October 9, 2025. Sample tubing was inserted into each vapor monitoring port and sealed using a concrete slurry; a summa canister was connected to the sealed tubing at each monitoring port. A leak test was conducted prior to sample collection to ensure that a representative sub-slab sample was able to be collected at an appropriate flow rate (leak test SOP with representative photos included in the attachments). All canisters were verified to have equalized to atmospheric conditions. The soil vapor canisters were each allowed to collect air for a six- to ten-minute period and the ambient air summa canister was allowed to collect air for a two- (2)hour period. At the end of the collection periods, the canisters were sealed and shipped for delivery to Enthalpy Labs in Deer Park, Texas for analysis for volatile organic compounds of concern (chlorinated solvents and petroleum products) via EPA Method TO-15. All canisters were tracked by canister serial number for start and stop times and starting and ending pressures for determination of sample volume for each sample.

The sample locations are summarized in the following table:

SUMMARY OF SAMPLE LOCATIONS	
Sample #	**Location / Rationale**
SV-1	Near northeast corner of subject property / location of historical battery service shop with oil room and proximate to former gasoline filling and service station and associated gas tank
SV-2	East-central portion of subject property, near center of east property boundary / proximate to former automotive sales and service building and former gasoline tank
SV-3	South-central portion of subject property, north exterior of onsite building / evaluation of migration of impact in areas proximate to existing buildings
SV-4	North-central portion of subject property / proximate to cleaning and pressing operations, automotive paint and repair shop, and former gasoline tanks
SV-5	West-central portion of subject property, along west property boundary / proximate to former automotive sales and service and cleaning and pressing operations as well as offsite gasoline tank
AA-1	South-central portion of subject property, interior of existing building / evaluation of migration of impact and potential exposure in existing buildings

Refer to the attached Sample Location Map for depiction of sample locations.

VII. Laboratory Report Review

A review of the laboratory analytical report for quality assurance / quality control indicators reveals that the soil vapor and ambient air data are acceptable and usable for evaluation of vapor intrusion under this assessment. QC sample recoveries were within control limits, and no contaminants were detected in the blank samples. Sample SV-5 was analyzed with a dilution of 3.5 due to suspected high concentrations of non-target analytes; the reported results were not affected as no analytes were detected at concentrations that exceeded the action levels. No anomalies were noted that would affect the outcome of the assessment.

VIII. Findings

The soil vapor and ambient air analytical results were evaluated using the Environmental Protection Agency (EPA) Vapor Intrusion Screening Levels (VISLs) for residential exposure. The VISLs for evaluation of soil vapor are the target sub-slab/near-source soil gas concentrations, while the VISLs for evaluation of ambient air are the target indoor air soil gas concentrations. The VISLs were calculated based on a target hazard quotient (THQ) of 1 for systemic toxicity and a Target Risk of $1X10^{-5}$ for carcinogenic risk (per TCEQ regulatory guidance – RG-366/TRRP-18). The results were evaluated using the VISLs for unrestricted site use for residential exposure scenarios.

SOIL VAPOR LABORATORY RESULTS

Thirteen (13) volatile organic compound (VOC) constituents, specifically vinyl chloride, 2-butanone, n-hexane, benzene, trichloroethene, cyclohexane, n-heptane, toluene, 2-hexanone, tetrachloroethene, ethylbenzene, m,p-xylenes, and o-xylene, were detected in one or more of the soil vapor samples collected for laboratory analysis. All detected concentrations of these constituents of concern are less than their respective EPA VISLs for target sub-slab/near-source soil gas concentrations for unrestricted site use. The remaining VOC constituents were not detected in any of the soil vapor samples collected for laboratory analysis at concentrations greater than their respective laboratory reporting limits (RLs). The soil vapor analytical results are summarized in Table 1 and are presented in the attached laboratory analytical report.

AMBIENT AIR LABORATORY RESULTS

One (1) VOC constituent, specifically toluene, was detected in the ambient air sample collected for laboratory analysis at a concentration that is less than its EPA VISL for unrestricted site use. The remaining VOC constituents were not detected in the ambient air sample collected for laboratory analysis at concentrations greater than their respective laboratory RLs. The ambient air analytical results are summarized in Table 2 and are presented in the attached laboratory analytical report.

IX. Conclusions and Recommendations

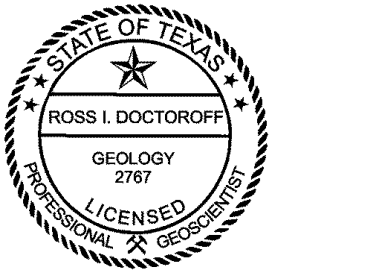
Phase Engineering, LLC is offering the following conclusions and recommendations based on the results of the assessment:

- The assessment results indicate that there is low potential for a vapor encroachment condition resulting in future inhalation exposure under residential exposure scenarios (unrestricted site use) at the subject property, and there is no current vapor intrusion condition that could result in adverse inhalation exposure based on analytical results. **All detected concentrations are less than the most conservative action levels for residential exposure.**
- All soil vapor and ambient air concentrations are less than their respective EPA VISL target concentrations for residential site use; no mitigation plan for vapor intrusion is necessary based on soil vapor and ambient air results.

X. Closing and Signatures

Thank you for using the environmental professional services of Phase Engineering, LLC. If you should have any questions, please contact us at (832) 485-2230.

Ross Doctoroff, Texas P.G. #2767
Vice President



Karly E. Allen, MSPH
Remediation Projects Director

Olivette Sanchez
Environmental Project Manager

PHASE
TRUSTED ENVIRONMENTAL SOLUTIONS

301 Cypress Street
Abilene, Texas 79601
Taylor County

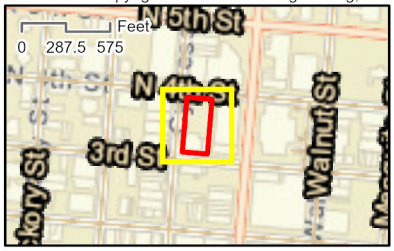


Sources: Esri, HERE, Garmin, (c) OpenStreetMap contributors

0 15 30 60 90 120 Feet

1:700

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Sample Location Map - October 9, 2025

Subject Property
Area of Interest
Soil Vapor Port
Ambient Air Station

Phase Project No: 202510014

ANALYTICAL RESULTS SUMMARY - VES
301 CYPRESS STREET ABILENE

Table 1: Soil Vapor Analytical Results								
Lab Sample ID			**EPA VISL - Residential Exposure**	104575-001	104575-002	104575-003	104575-004	104575-005
Client Sample ID			**Target Sub-slab / Near-Source**	SV-1	SV-2	SV-3	SV-4	SV-5
Date Collected			**Soil Gas Concentration**	10/9/2025	10/9/2025	10/9/2025	10/9/2025	10/9/2025
Method	Analyte	Units	**THQ = 1; TCR = 1E-05**	Result	Result	Result	Result	Result
TO-15	Vinyl Chloride	ug/m3	**55.9**	<0.77	1.3	<0.82	<0.95	<1.8
TO-15	1,1-Dichloroethene	ug/m3	**138**	<1.2	<1.3	<1.3	<1.5	<2.8
TO-15	trans-1,2-Dichloroethene	ug/m3	**1390**	<1.2	<1.3	<1.3	<1.5	<2.8
TO-15	Methyl Tert-Butyl Ether (MTBE)	ug/m3	**3600**	<1.1	<1.2	<1.2	<1.3	<2.5
TO-15	2-Butanone	ug/m3	**174000**	21	15	11	14	<10
TO-15	cis-1,2-Dichloroethene	ug/m3	**1390**	<1.2	<1.3	<1.3	<1.5	<2.8
TO-15	n-Hexane	ug/m3	**24300**	12	22	13	4.8	11
TO-15	Benzene	ug/m3	**120**	12	28	13	17	6.8
TO-15	Cyclohexane	ug/m3	**209000**	2.4	4.9	4.9	1.4	<2.4
TO-15	Trichloroethene	ug/m3	**69.5**	<1.6	<1.8	<1.7	<2.0	15
TO-15	n-Heptane	ug/m3	**13900**	7.3	16	8.8	5.4	8.0
TO-15	Toluene	ug/m3	**174000**	19	35	29	19	29
TO-15	2-Hexanone	ug/m3	**1040**	9.9	6.9	6.0	4.0	<2.8
TO-15	Tetrachloroethene	ug/m3	**1390**	22	38	4.2	300	180
TO-15	Ethylbenzene	ug/m3	**374**	8.4	17	20	8.6	5.0
TO-15	m,p-Xylenes	ug/m3	**3480**	9.8	14	9.4	12	17
TO-15	o-Xylene	ug/m3	**3480**	4.5	6.1	4.3	5.7	7.6
TO-15	Xylene (total)	ug/m3	**3480**	14	20	14	18	24

Less than EPA VISL - residential exposure

Table 2: Ambient Air Analytical Results				
Lab Sample ID			**EPA VISL - Residential Exposure**	104575-006
Client Sample ID			**Target Indoor Air**	AA-1
Date Collected			**Soil Gas Concentration**	10/9/2025
Method	Analyte	Units	**THQ = 1; TCR = 1E-05**	Result
TO-15	Vinyl Chloride	ug/m3	**1.68**	<0.72
TO-15	1,1-Dichloroethene	ug/m3	**4.13**	<1.1
TO-15	trans-1,2-Dichloroethene	ug/m3	**41.7**	<1.1
TO-15	Methyl Tert-Butyl Ether (MTBE)	ug/m3	**108**	<1.0
TO-15	2-Butanone	ug/m3	**5210**	<4.2
TO-15	cis-1,2-Dichloroethene	ug/m3	**41.7**	<1.1
TO-15	n-Hexane	ug/m3	**730**	<1.0
TO-15	Benzene	ug/m3	**3.6**	<0.90
TO-15	Cyclohexane	ug/m3	**6260**	<0.97
TO-15	Trichloroethene	ug/m3	**2.09**	<1.5
TO-15	n-Heptane	ug/m3	**417**	<1.2
TO-15	Toluene	ug/m3	**5210**	1.7
TO-15	2-Hexanone	ug/m3	**31.3**	<1.2
TO-15	Tetrachloroethene	ug/m3	**41.7**	<1.9
TO-15	Ethylbenzene	ug/m3	**11.2**	<1.2
TO-15	m,p-Xylenes	ug/m3	**104**	<2.5
TO-15	o-Xylene	ug/m3	**104**	<1.2
TO-15	Xylene (total)	ug/m3	**104**	<3.7

Less than EPA VISL - residential exposure

Enthalpy Analytical
931 Seaco Ct.
Deer Park, TX 77536
(281) 984-7021

enthalpy.com

Lab Job Number : 104575
Report Level : II
Report Date : 10/17/2025

Analytical Report *prepared for:*

Jaymi Reser
Phase Engineering
5524 Cornish Street
Houston, TX 77007

Project: Soil Vapor/Ambient Air - 202510014 - 301 Cypress Street; Abilene, TX 79601

Authorized for release by:

Erika Garcia, Project Manager
erika.garcia@enthalpy.com

This data package has been reviewed for technical correctness and completeness. Release of this data has been authorized by the Laboratory Manager or the Manager's designee, as verified by the above signature which applies to this PDF file as well as any associated electronic data deliverable files. The results contained in this report meet all requirements of NELAP and pertain only to those samples which were submitted for analysis. This report may be reproduced only in its entirety.

ENTHALPY ANALYTICAL

Sample Summary

Jaymi Reser
Phase Engineering
5524 Cornish Street
Houston, TX 77007

Lab Job #:	104575
Project No:	Soil Vapor/Ambient Air
Location:	202510014 - 301 Cypress Street; Abilene, TX 79601
Date Received:	10/10/25

Sample ID	Lab ID	Collected	Matrix
SV-1	104575-001	10/09/25 08:55	Air
SV-2	104575-002	10/09/25 10:41	Air
SV-3	104575-003	10/09/25 11:34	Air
SV-4	104575-004	10/09/25 13:55	Air
SV-5	104575-005	10/09/25 13:50	Air
AA-1	104575-006	10/09/25 11:22	Air

Case Narrative

Phase Engineering 5524 Cornish Street Houston, TX 77007 Jaymi Reser	Lab Job Number:	104575
	Project No:	Soil Vapor/Ambient Air
	Location:	202510014 - 301 Cypress Street; Abilene, TX 79601
	Date Received:	10/10/25

This data package contains sample and QC results for six air samples, requested for the above referenced project on 10/10/25. The samples were received in good condition.

Volatile Organics in Air by MS (EPA TO-15):

- Results for several targets are reported with high bias or possible high bias due to co-elution and other interferences.
- Sample SV-5 was analyzed at a dilution to avoid contamination of the analytical system due to suspected high concentrations of non-target compounds.
- No other analytical problems were encountered.

ENTHALPY ANALYTICAL

Air Chain of Custody Record

Lab No: 1025-977-104575

Page: 1 of 1

Turn Around Time (rush by advanced notice only)

Standard:		5 Day:	X	3 Day:	
2 Day:		1 Day:		Custom TAT:	

Enthalpy Analytical - Deer Park

931 Seaco Ct., Deer Park, TX 77536

Phone 281-476-9898

CUSTOMER INFORMATION		PROJECT INFORMATION	
Company:	Phase Engineering	Name:	
Report To:	Jaymi Reser	Number:	202510014
Email:	jaymi@phaseengineering.com	P.O. #:	202510014
Address:	300 E Sonterra Blvd, Suite 1140	Address:	301 Cypress Street
	San Antonio, TX 78258		Abilene, TX 79601
Phone:	832.485.2245	Sampled By:	Jaymi Reser

Special Instructions:

Special list of 17 compounds (from 1,1-Dichloroethene to Vinyl Chloride)

+6 FC +1 Nuts & Ferrules +5 Tubing JD 10.10.25

NOtes: AA-1 sat for 2 hrs instead of 1hr + kerry@phaseengineering.com

SV-1 & SV-2 controllers showed pressure in psi instead of Hg

	Sample ID	Type (I) Indoor (A) Ambient (SV) Soil Vapor (S) Source	Equipment Information: Canister ID	Size (1L, 3L, 6L, 15L)	Flow Controller ID	Sampling Information: Sample Collection Date	Sample Start Time	Vacuum Start ("Hg)	Sample End Time	Vacuum End ("Hg)	Analysis Requested: TO-15 special list
001	1 SV-1	SV	C11229	1.4L	A10490	10/9/25	855	25 psi	903	36 psi	X
002	2 SV-2	SV	C11232	1.4L	A10482	10/9/25	1041	9 psi	1047	19 psi	X
003	3 SV-3	SV	C11244	1.4L	A10464	10/9/25	1134	30 Hg	1142	4 Hg	X
004	4 SV-4	SV	C11202	1.4L	A10476	10/9/25	1355	26 Hg	1401	4 Hg	X
005	5 SV-5	SV	C11239	1.4L	A10488	10/9/25	1350	26 Hg	1357	2 Hg	X
006	6 AA-1	A	C70488	6L	A70333	10/9/25	1122	27 Hg	1328	0 Hg	X
~~007~~	7										
~~008~~	8										
~~009~~	9										
~~010~~	10										

	Signature	Print Name	Company / Title	Date / Time
1 Relinquished By:	Jaymi Reser	Jaymi Reser	Phase / Project Mgr	10/9/25 1425
1 Received By:		Jose Orm	Enthalpy	10.10.25 10:30
2 Relinquished By:				
2 Received By:				OCT 10 '25 AM10:30
3 Relinquished By:				
3 Received By:				

JD 10.10.25

ENTHALPY ANALYTICAL

Analysis Results for 104575

Jaymi Reser
Phase Engineering
5524 Cornish Street
Houston, TX 77007

Lab Job #: 104575
Project No: Soil Vapor/Ambient Air
Location: 202510014 - 301 Cypress Street;
Abilene, TX 79601
Date Received: 10/10/25

Sample ID: SV-1 **Lab ID: 104575-001** **Collected: 10/09/25 08:55**
Matrix: Air

104575-001 Analyte	Result	Qual	Units	RL	MDL	DF	Batch	Prepared	Analyzed	Chemist
Method: EPA TO-15										
Vinyl Chloride	ND		ug/m3	0.77		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
1,1-Dichloroethene	ND		ug/m3	1.2		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
trans-1,2-Dichloroethene	ND		ug/m3	1.2		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
MTBE	ND		ug/m3	1.1		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
2-Butanone	**21**		ug/m3	4.4		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
cis-1,2-Dichloroethene	ND		ug/m3	1.2		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
n-Hexane	**12**		ug/m3	1.1		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
Benzene	**12**		ug/m3	0.96		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
Cyclohexane	**2.4**		ug/m3	1.0		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
Trichloroethene	ND		ug/m3	1.6		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
n-Heptane	**7.3**		ug/m3	1.2		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
Toluene	**19**		ug/m3	1.1		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
2-Hexanone	**9.9**		ug/m3	1.2		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
Tetrachloroethene	**22**		ug/m3	2.0		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
Ethylbenzene	**8.4**		ug/m3	1.3		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
m,p-Xylenes	**9.8**		ug/m3	2.6		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
o-Xylene	**4.5**		ug/m3	1.3		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
Xylene (total)	**14**		ug/m3	3.9		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM
Surrogates				**Limits**						
Bromofluorobenzene	104%		%REC	60-140		1.5	104743	10/14/25 21:35	10/14/25 21:35	ARM

Results for any subcontracted analyses are not included in this section.

ENTHALPY ANALYTICAL

Analysis Results for 104575

Sample ID: SV-2 **Lab ID: 104575-002** **Collected: 10/09/25 10:41**
Matrix: Air

104575-002 Analyte	Result	Qual	Units	RL	MDL	DF	Batch	Prepared	Analyzed	Chemist
Method: EPA TO-15										
Vinyl Chloride	**1.3**		ug/m3	0.87		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
1,1-Dichloroethene	ND		ug/m3	1.3		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
trans-1,2-Dichloroethene	ND		ug/m3	1.3		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
MTBE	ND		ug/m3	1.2		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
2-Butanone	**15**		ug/m3	5.0		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
cis-1,2-Dichloroethene	ND		ug/m3	1.3		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
n-Hexane	**22**		ug/m3	1.2		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
Benzene	**28**		ug/m3	1.1		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
Cyclohexane	**4.9**		ug/m3	1.2		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
Trichloroethene	ND		ug/m3	1.8		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
n-Heptane	**16**		ug/m3	1.4		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
Toluene	**35**		ug/m3	1.3		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
2-Hexanone	**6.9**		ug/m3	1.4		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
Tetrachloroethene	**38**		ug/m3	2.3		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
Ethylbenzene	**17**		ug/m3	1.5		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
m,p-Xylenes	**14**		ug/m3	3.0		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
o-Xylene	**6.1**		ug/m3	1.5		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
Xylene (total)	**20**		ug/m3	4.4		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM
Surrogates				**Limits**						
Bromofluorobenzene	103%		%REC	60-140		1.7	104743	10/14/25 22:26	10/14/25 22:26	ARM

Sample ID: SV-3 **Lab ID: 104575-003** **Collected: 10/09/25 11:34**
Matrix: Air

104575-003 Analyte	Result	Qual	Units	RL	MDL	DF	Batch	Prepared	Analyzed	Chemist
Method: EPA TO-15										
Vinyl Chloride	ND		ug/m3	0.82		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
1,1-Dichloroethene	ND		ug/m3	1.3		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
trans-1,2-Dichloroethene	ND		ug/m3	1.3		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
MTBE	ND		ug/m3	1.2		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
2-Butanone	**11**		ug/m3	4.7		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
cis-1,2-Dichloroethene	ND		ug/m3	1.3		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
n-Hexane	**13**		ug/m3	1.1		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
Benzene	**13**		ug/m3	1.0		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
Cyclohexane	**4.9**		ug/m3	1.1		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
Trichloroethene	ND		ug/m3	1.7		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
n-Heptane	**8.8**		ug/m3	1.3		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
Toluene	**29**		ug/m3	1.2		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
2-Hexanone	**6.0**		ug/m3	1.3		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
Tetrachloroethene	**4.2**		ug/m3	2.2		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
Ethylbenzene	**20**		ug/m3	1.4		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
m,p-Xylenes	**9.4**		ug/m3	2.8		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
o-Xylene	**4.3**		ug/m3	1.4		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
Xylene (total)	**14**		ug/m3	4.2		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM
Surrogates				**Limits**						
Bromofluorobenzene	104%		%REC	60-140		1.6	104743	10/14/25 23:16	10/14/25 23:16	ARM

Results for any subcontracted analyses are not included in this section.

ENTHALPY ANALYTICAL

Analysis Results for 104575

Sample ID: SV-4 **Lab ID: 104575-004** **Collected: 10/09/25 13:55**
Matrix: Air

104575-004 Analyte	Result	Qual	Units	RL	MDL	DF	Batch	Prepared	Analyzed	Chemist
Method: EPA TO-15										
Vinyl Chloride	ND		ug/m3	0.95		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
1,1-Dichloroethene	ND		ug/m3	1.5		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
trans-1,2-Dichloroethene	ND		ug/m3	1.5		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
MTBE	ND		ug/m3	1.3		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
2-Butanone	**14**		ug/m3	5.5		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
cis-1,2-Dichloroethene	ND		ug/m3	1.5		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
n-Hexane	**4.8**		ug/m3	1.3		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
Benzene	**17**		ug/m3	1.2		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
Cyclohexane	**1.4**		ug/m3	1.3		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
Trichloroethene	ND		ug/m3	2.0		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
n-Heptane	**5.4**		ug/m3	1.5		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
Toluene	**19**		ug/m3	1.4		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
2-Hexanone	**4.0**		ug/m3	1.5		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
Tetrachloroethene	**300**		ug/m3	2.5		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
Ethylbenzene	**8.6**		ug/m3	1.6		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
m,p-Xylenes	**12**		ug/m3	3.2		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
o-Xylene	**5.7**		ug/m3	1.6		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
Xylene (total)	**18**		ug/m3	4.8		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM
Surrogates				**Limits**						
Bromofluorobenzene	78%		%REC	60-140		1.9	104743	10/15/25 00:06	10/15/25 00:06	ARM

Sample ID: SV-5 **Lab ID: 104575-005** **Collected: 10/09/25 13:50**
Matrix: Air

104575-005 Analyte	Result	Qual	Units	RL	MDL	DF	Batch	Prepared	Analyzed	Chemist
Method: EPA TO-15										
Vinyl Chloride	ND		ug/m3	1.8		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
1,1-Dichloroethene	ND		ug/m3	2.8		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
trans-1,2-Dichloroethene	ND		ug/m3	2.8		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
MTBE	ND		ug/m3	2.5		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
2-Butanone	ND		ug/m3	10		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
cis-1,2-Dichloroethene	ND		ug/m3	2.8		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
n-Hexane	**11**		ug/m3	2.4		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
Benzene	**6.8**		ug/m3	2.2		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
Cyclohexane	ND		ug/m3	2.4		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
Trichloroethene	**15**		ug/m3	3.7		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
n-Heptane	**8.0**		ug/m3	2.8		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
Toluene	**29**		ug/m3	2.6		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
2-Hexanone	ND		ug/m3	2.8		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
Tetrachloroethene	**180**		ug/m3	4.7		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
Ethylbenzene	**5.0**		ug/m3	3.0		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
m,p-Xylenes	**17**		ug/m3	6.0		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
o-Xylene	**7.6**		ug/m3	3.0		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
Xylene (total)	**24**		ug/m3	9.0		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM
Surrogates				**Limits**						
Bromofluorobenzene	79%		%REC	60-140		3.5	104743	10/15/25 00:52	10/15/25 00:52	ARM

Results for any subcontracted analyses are not included in this section.

ENTHALPY ANALYTICAL

Analysis Results for 104575

Sample ID: AA-1	Lab ID: 104575-006	Collected: 10/09/25 11:22
	Matrix: Air	

104575-006 Analyte	Result	Qual	Units	RL	MDL	DF	Batch	Prepared	Analyzed	Chemist
Method: EPA TO-15										
Vinyl Chloride	ND		ug/m3	0.72		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
1,1-Dichloroethene	ND		ug/m3	1.1		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
trans-1,2-Dichloroethene	ND		ug/m3	1.1		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
MTBE	ND		ug/m3	1.0		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
2-Butanone	ND		ug/m3	4.2		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
cis-1,2-Dichloroethene	ND		ug/m3	1.1		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
n-Hexane	ND		ug/m3	1.0		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
Benzene	ND		ug/m3	0.90		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
Cyclohexane	ND		ug/m3	0.97		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
Trichloroethene	ND		ug/m3	1.5		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
n-Heptane	ND		ug/m3	1.2		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
Toluene	**1.7**		ug/m3	1.1		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
2-Hexanone	ND		ug/m3	1.2		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
Tetrachloroethene	ND		ug/m3	1.9		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
Ethylbenzene	ND		ug/m3	1.2		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
m,p-Xylenes	ND		ug/m3	2.5		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
o-Xylene	ND		ug/m3	1.2		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
Xylene (total)	ND		ug/m3	3.7		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM
Surrogates				**Limits**						
Bromofluorobenzene	105%		%REC	60-140		1.4	104743	10/15/25 03:23	10/15/25 03:23	ARM

ND Not Detected

Results for any subcontracted analyses are not included in this section.

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Batch QC

Type:	**Blank**	**Lab ID:**	**QC117009**	**Batch:**	**104743**
Matrix:	**Air**	**Method:**	**EPA TO-15**		

QC117009 Analyte	Result	Qual	Units	RL	MDL	Prepared	Analyzed
Vinyl Chloride	ND		ppbv	0.20		10/14/25 13:34	10/14/25 13:34
1,1-Dichloroethene	ND		ppbv	0.20		10/14/25 13:34	10/14/25 13:34
trans-1,2-Dichloroethene	ND		ppbv	0.20		10/14/25 13:34	10/14/25 13:34
MTBE	ND		ppbv	0.20		10/14/25 13:34	10/14/25 13:34
2-Butanone	ND		ppbv	1.0		10/14/25 13:34	10/14/25 13:34
cis-1,2-Dichloroethene	ND		ppbv	0.20		10/14/25 13:34	10/14/25 13:34
n-Hexane	ND		ppbv	0.20		10/14/25 13:34	10/14/25 13:34
Benzene	ND		ppbv	0.20		10/14/25 13:34	10/14/25 13:34
Cyclohexane	ND		ppbv	0.20		10/14/25 13:34	10/14/25 13:34
Trichloroethene	ND		ppbv	0.20		10/14/25 13:34	10/14/25 13:34
n-Heptane	ND		ppbv	0.20		10/14/25 13:34	10/14/25 13:34
Toluene	ND		ppbv	0.20		10/14/25 13:34	10/14/25 13:34
2-Hexanone	ND		ppbv	0.20		10/14/25 13:34	10/14/25 13:34
Tetrachloroethene	ND		ppbv	0.20		10/14/25 13:34	10/14/25 13:34
Ethylbenzene	ND		ppbv	0.20		10/14/25 13:34	10/14/25 13:34
m,p-Xylenes	ND		ppbv	0.40		10/14/25 13:34	10/14/25 13:34
o-Xylene	ND		ppbv	0.20		10/14/25 13:34	10/14/25 13:34
Xylene (total)	ND		ppbv	0.60		10/14/25 13:34	10/14/25 13:34
Surrogates				**Limits**			
Bromofluorobenzene	106%		%REC	70-130		10/14/25 13:34	10/14/25 13:34

Type:	**Lab Control Sample**	**Lab ID:**	**QC117010**	**Batch:**	**104743**
Matrix:	**Air**	**Method:**	**EPA TO-15**		

QC117010 Analyte	Result	Spiked	Units	Recovery	Qual	Limits
Vinyl Chloride	8.263	10.28	ppbv	80%		70-130
1,1-Dichloroethene	9.543	10.34	ppbv	92%		70-130
trans-1,2-Dichloroethene	9.639	10.58	ppbv	91%		70-130
MTBE	10.32	10.50	ppbv	98%		70-130
2-Butanone	9.961	10.47	ppbv	95%		70-130
cis-1,2-Dichloroethene	10.05	10.33	ppbv	97%		70-130
n-Hexane	9.645	10.48	ppbv	92%		70-130
Benzene	9.549	10.31	ppbv	93%		70-130
Cyclohexane	10.18	10.52	ppbv	97%		70-130
Trichloroethene	10.99	10.44	ppbv	105%		70-130
n-Heptane	10.25	10.48	ppbv	98%		70-130
Toluene	10.16	10.35	ppbv	98%		70-130
2-Hexanone	9.966	10.42	ppbv	96%		70-130
Tetrachloroethene	11.05	10.31	ppbv	107%		70-130
Ethylbenzene	11.57	10.38	ppbv	111%		70-130
m,p-Xylenes	22.71	20.76	ppbv	109%		70-130
o-Xylene	11.56	10.31	ppbv	112%		70-130
Surrogates						
Bromofluorobenzene	4.413	4.212	ppbv	105%		70-130

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Batch QC

Type:	**Lab Control Sample Duplicate**	**Lab ID:**	**QC117011**	**Batch:**	**104743**
Matrix:	**Air**	**Method:**	**EPA TO-15**		

QC117011 Analyte	Result	Spiked	Units	Recovery	Qual	Limits	RPD	RPD Lim
Vinyl Chloride	7.929	10.28	ppbv	77%		70-130	4	25
1,1-Dichloroethene	9.426	10.34	ppbv	91%		70-130	1	25
trans-1,2-Dichloroethene	9.542	10.58	ppbv	90%		70-130	1	25
MTBE	10.27	10.50	ppbv	98%		70-130	1	25
2-Butanone	9.973	10.47	ppbv	95%		70-130	0	25
cis-1,2-Dichloroethene	10.02	10.33	ppbv	97%		70-130	0	25
n-Hexane	9.582	10.48	ppbv	91%		70-130	1	25
Benzene	9.573	10.31	ppbv	93%		70-130	0	25
Cyclohexane	10.26	10.52	ppbv	98%		70-130	1	25
Trichloroethene	11.16	10.44	ppbv	107%		70-130	2	25
n-Heptane	10.33	10.48	ppbv	99%		70-130	1	25
Toluene	10.31	10.35	ppbv	100%		70-130	1	25
2-Hexanone	10.16	10.42	ppbv	97%		70-130	2	25
Tetrachloroethene	11.25	10.31	ppbv	109%		70-130	2	25
Ethylbenzene	11.73	10.38	ppbv	113%		70-130	1	25
m,p-Xylenes	23.16	20.76	ppbv	112%		70-130	2	25
o-Xylene	11.77	10.31	ppbv	114%		70-130	2	25
Surrogates								
Bromofluorobenzene	4.437	4.212	ppbv	105%		70-130		

ND Not Detected

PHASE ENGINEERING,LLC
ENVIRONMENTAL CONSULTANTS
5524 Cornish Street Houston, Texas 77007 Office 713. 476. 9844 Toll Free 800.419.8881 Fax 713-476-9797

Phase Engineering, LLC Standard Operating Procedure (SOP)

Vapor Encroachment Screening – Leak Test and Supply List

Supply List:

- Steel toe boots
- Hearing protection
- Safety glasses
- Nitrile gloves
- Winching wires
- Extension cords
- Hammer Drill
- Drill bits (multi-length) (verify drill compatibility)
- Vapor Pin set with seals and hand tools
- Hammer
- Chain of Custody for Samples
- Field Notebook
- Poly-tubing
- Leak-test kit (syringe & junction valve)
- Decontamination equipment (brush, bucket, & alconox)
- Flex-tubing
- Control valve(s) (calibrated properly for correct collection time)
- Summa cannister(s)
- Wrench (9/16")
- Quick Cement
- Trowel

DOCUMENT ALL PROCEDURES COMPLETED WITH TIMESTAMPS WITHIN FIELD NOTEBOOK

Preparation for Sampling *(document times where (*))*:

1. Verify areas of concern
2. Clear work area of any obvious subsurface features (visual indications and winching wires)
3. Confirm sample locations with property owner*
4. Verify that sample area will stay clear during drilling and sample collection period
5. Photograph general area(s) of sample collection

Drilling and Sampling *(document times where (*))*:

6. Begin drilling with short 24" drill bit (See *Image 1*)*****
7. Ream hole as you drill
8. Penetrate hole with long 39" drill bit (See *Image 2*)
9. Begin vacuuming/sweeping soil cuttings to prevent from entering hole (See *Image 3*)
10. Brush the hole with decontaminated wire brush and vacuum accumulated debris
11. Place new silicone seal on vapor pin
12. Place vapor pin into hand tool (See *Image 4*)
13. Hammer vapor pin into hole using hand tool and hammer until silicone bulges (See *Image 5*)*****
14. Cut new 3 feet of poly-tubing
15. Connect poly-tubing to vapor pin using flex tubing (See *Image 6*)
16. Connect new syringe to junction valve
17. Connect junction valve port to new 3 feet of poly tubing using new flex tubing (See *Image 7*)
18. Connect new poly line to control flow valve using nut and ferrule (HAND TIGHTEN ONLY) (See *Image 8*)

19. Connect straight end of junction valve to poly line in ground/vapor pin
20. Photograph tube/sample assembly
21. Leak test: Pull syringe back with valve turned to the flow valve and then to the vapor pin*****
    a. Poly to vapor pin should offer no resistance
    b. Poly to control valve should offer resistance
    c. If leak test fails, reinstalling the vapor pin with new silicone seal and new polyline may be necessary
    d. See "Leak Testing" discussion on Page 3
22. Purge dead space in hole
    a. Collect a syringe-full of air from hole, and expel the air out of the hole. Repeat.
23. Connect control valves to cannister using 9/16" wrench
24. Open control valve to cannister (note time)*****
    a. Flow valve should read 25-30 hg (See *Image 8*)
25. Note serial numbers (See *Image 9* and *Image 10*) and pressures of flow valves and cannister with location descriptions
26. Double check connections, mitigate tripping hazards, clearly mark area (cone) if necessary
27. Photograph cannister and valve serial numbers and overall sample area

Completion of Sampling *(document times where (*))***:**

28. Check pressure reading on valve
    a. Valve should read between 0-5 hg before ending sampling
29. Close flow valve if sufficient sample has been collected*****
30. Photograph pressure valve reading
31. Disconnect and throw away poly-line, connector tubing, and syringe
32. Store nut and ferrule
33. Disconnect control valves from cannister and store in lab provided boxes
34. Use hand tool to remove vapor pin from surface
35. Throw away silicone sleeve
36. Fill in hole with quick concrete and patch back to surface*****
37. Photograph sealed sample location
38. Return cleared sample area to original state
39. Complete laboratory chain of custody and verify that appropriate constituents have been properly selected
40. Package and deliver cannister(s) and valve(s) to laboratory (delivery varies from lab to lab)

Return to Office:

41. Unload all equipment and supplies
42. Clean supplies as needed
43. Save photographs to project file
44. Scan field notes and save file in project folder
45. Prepare sample location map

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Leak Testing:

When quantitative soil vapor data are desired (such as for risk assessments), leak testing the system as a quality assurance measure is strongly recommended and required by many state agencies. Leaks in the sampling train or leaks of ambient air into the probe tubing can result in diluting the soil vapor samples with ambient air and will result in underestimating actual contaminant concentrations in subsurface soil gas. Excessive vacuum conditions resulting from low porosity soils or high moisture content soils may exacerbate the potential for ambient air leakage. Two methods of leak detection are recommended: (1) performing a “shut-in” test of the sampling train and applying a leak detection compound or water to the vapor probe at the surface or (2) applying a tracer gas over the probe and over the entire sampling apparatus. Review any local VI sampling guidance for specific requirements for leak testing.

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Appendix



Image 1 – Initial drilling activities



Image 2 – Drilling with longer drill bit



Image 3 – Clear and sweep/vacuum sample area



Image 4 – Vapor pin assembly

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Image 5 – Installation of vapor pin



Image 6 – Connection of tubing to vapor pin



Image 7 – Set up leak-test assembly

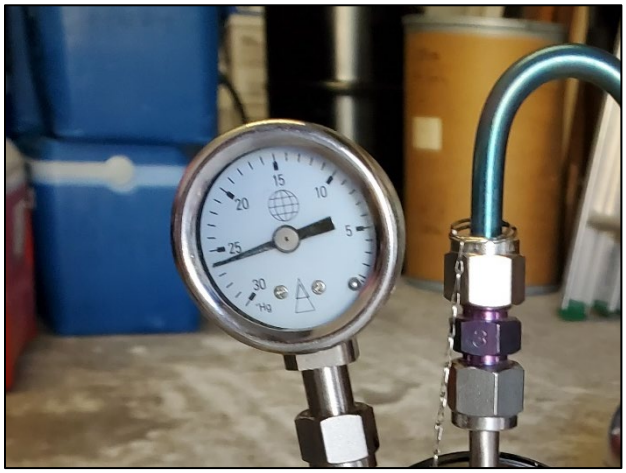


Image 8 – Initial pressure check

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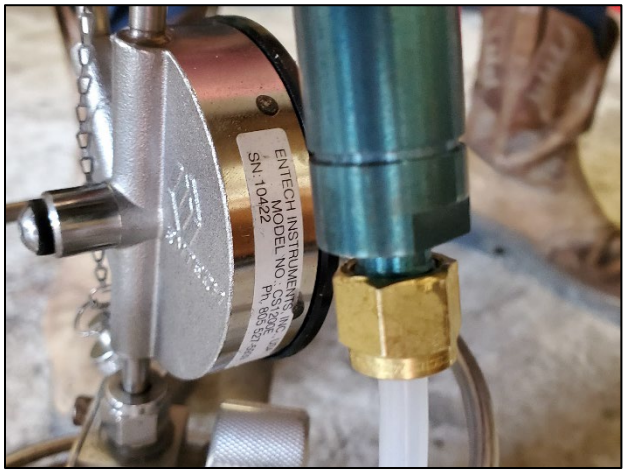


Image 9 – Female connection and valve S/N



Image 10 – Location of cannister ID number



Image 11 – Full sample assembly

PHASE ENGINEERING

Phase II
Environmental Site Assessment

October 23, 2025

PE Project No.: 202510014
301 Cypress Street
Abilene, Texas 79601
Taylor County

Prepared for:
Overland Property Group
5341 West 151st Terrace
Leawood, Kansas 66224

Prepared by:
Phase Engineering, LLC
5524 Cornish Street
Houston, Texas 77007

October 23, 2025

Overland Property Group
5341 West 151st Terrace
Leawood, Kansas 66224

Re: Phase II Environmental Site Assessment
301 Cypress Street
Abilene, Taylor County, Texas 79601
Phase Engineering, LLC Project No. 202510014

To Whom It May Concern,

Phase Engineering, LLC (Phase) has completed a Phase II Environmental Site Assessment of the above-referenced property. The scope of work was conducted in accordance with the executed letter of engagement based on generally accepted industry standards. This report has been released under the authority of Ross Doctoroff (TBPG License #2767) and Phase Engineering, LLC (TBPG Licensed Geoscience Firm #50283) on October 23, 2025.

Thank you for using the professional environmental services of Phase Engineering, LLC. Please contact either of the undersigned if you have any questions regarding this project.

Sincerely,

Ross Doctoroff, Texas P.G. #2767



Vice President



Karly E. Allen, MSPH



Remediation Projects Director

PHASE ENGINEERING

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1.0 Executive Summary

1.1 Subject Property Description

The subject property is located at 301 Cypress Street, Abilene, Taylor County, Texas 79601 and currently consists of an unoccupied multi-story office building and an unoccupied retail storefront and associated parking.

1.2 Purpose of Assignment

The purpose of this Phase II Environmental Site Assessment (ESA) was to investigate the potential for impact to soil and/or groundwater from undocumented releases of hazardous substances and petroleum products in association with historical automotive repair, service, and fueling operations and associated gas tanks as well as historical cleaning and pressing activities conducted at the subject property.

Assessment activities at the subject property also included a Vapor Encroachment Screening (VES) assessment to determine if the potential for vapor intrusion and/or ongoing vapor intrusion exists in association with the historical operations of environmental concern at the subject property. This assessment has been reported under separate cover.

2.0 Background

2.1 Prior Environmental Site Assessments

The following is a summary of findings, opinion, and recommendation associated with the recognized environmental condition (REC) identified in connection with the subject property as reported under the prior ESA related evaluation prepared for the subject property:

Phase Engineering, LLC - Phase I Environmental Site Assessment dated February 5, 2025

FINDINGS AND OPINION

"Historical street directories and fire insurance maps indicate that businesses conducting automotive service related activities operated at the subject property, including the following:

- *Gasoline filling and service stations were listed at 1037 and 1051 North 4th Street from the mid-1920s to the mid-1930s under the names Cadillac-LaSalle Service and Hollinshead Service Station. The 1925 and 1929 fire insurance maps show gasoline tanks "GTs" at this facility.*
- *A battery service shop was listed at 1031, 1051 & 1053 North 4th Street from the late-1920s to the early-1950s under the name Exide Battery Service.*
- *An automotive service shop was listed at 1051 & 1053 North 4th Street from the early-1940s to the early-1950s under the name Sears Roebuck service department.*
- *An automotive paint and repair shop was listed at 333 Cypress Street during the early-1920s under the name Western Auto Top & Paint Shop.*
- *Automotive sales and rental facilities and taxi and bus services were listed at 357 Cypress Street from the late-1920s to the early-1940s under the names Capital Motor Company, Rent-A-Car Company, City Service Taxi & Bus and Fielder O B & Sons. The 1925 and 1929 fire insurance maps show gasoline tanks "GTs" at this facility.*
- *A gasoline service station was listed at 389 Cypress Street from the mid-1930s to the early-1940s under the names Connally's Service Station and T&P Service Station.*
- *A bus depot was listed at 389 Cypress Street from the mid-1940s to the mid-1950s under the names American Bus Depot, American Bus Lines, Inc. and Continental Trailways. The 1950 fire insurance map shows an oil storage room at this facility.*

USTs operated at the onsite gasoline filling and service stations prior to the promulgation of UST registration and decommissioning requirements. No records were available which could be used to determine the final status or condition of USTs historically active at this property or the results of any release determination investigations possibly conducted in connection with UST decommissioning. This is a significant data gap. Automotive repair shops are known to store, use and dispose of hazardous substances and petroleum products possibly including degreaser solvents, paints, paint thinners, coolants, oil, hydraulic oil, lubricants, gasoline and diesel.

The subject property has likely been impacted as a result of automotive service and fueling operations conducted onsite based on the duration of operations and lack of information regarding any UST decommissioning investigation activities or the final status and condition of historical USTs, which prevents the environmental professional from verifying that investigation of the former UST systems was adequate to discover any releases. This represents a recognized environmental condition."

RECOMMENDATION

"The following recommendation is made with respect to the environmental aspects of the subject property:

- *A Phase II Environmental Site Assessment is recommended to investigate the potential environmental impact due to the identified recognized environmental condition."*

3.0 Scope of Investigation

The investigation consisted of installation of five (5) soil borings utilizing direct push technology (DPT), conversion of three (3) of the soil borings into temporary groundwater monitoring wells (TMWs) (the remaining two (2) soil borings were limited to 15 feet in depth for evaluation of surface and near-surface releases), and collection of selected soil and groundwater samples for laboratory analysis on October 9, 2025.

A groundwater bearing unit (GWBU) was encountered during soil boring installation activities at depths ranging from 10 to 13 feet bgs. The soil borings selected for evaulation of groundwater (SB-1, SB-3, and SB-5) were each converted into a temporary groundwater monitoring well.

All samples selected for laboratory analysis during this assessment were submitted to Eurofins Environmental Testing and verification of delivery and transfer of the samples is documented on the enclosed laboratory chain of custody.

3.1 Soil Investigation Details

3.1.1 Soil Sample Handling and Preservation Details

Soil grab samples were collected directly from Shelby tubes with disposable plastic liners and handled with nitrile gloves. Soil samples were collected into containers provided by Eurofins Environmental Testing and preserved utilizing the following methods:

- EPA Method 5035
- Methanol
- Placed on ice at temperatures less than 4º C.

3.1.2 Laboratory Analysis Performed

The following laboratory methods were performed by Eurofins Environmental Testing for soil samples selected during this assessment:

Selected Soil Sample Information	
Type of Analysis	**Analysis Method**
Volatile Organic Compounds (VOCs)	**EPA Method 8260**
Total Petroleum Hydrocarbons (TPH)	**Texas Method 1005**
RCRA 8 Metals	**EPA Method 6020 and 7471**
pH	**EPA Method 9045**

3.1.3 Locations of Areas Assessed

Soil boring locations / rationale are summarized in the following table:

Soil Boring Locations and Rationale		
Sample Location #	**Location Description**	**Rationale**
SB-1	Northeast corner of subject property	Location of historical gasoline filling and service station and proximate to battery service shop with oil room and former gasoline tank
SB-2	Northeast portion of subject property	Location of former battery service shop with oil room
SB-3	East-central portion of subject property, near center of east property boundary	Proximate to historical automotive sales and service building and proximate to former gasoline tank
SB-4	North-central portion of subject property	Proximate to historical cleaning and pressing operations and historical automotive paint and repair shop as well as former gasoline tanks
SB-5	West-central portion of subject property, along west property boundary	Proximate to historical cleaning and pressing operations and automotive sales and service building as well as former offsite gasoline tank

3.1.4 Field Screening Summary

Soil field screening activities were conducted at minimum intervals of two to four feet bgs during advancement of each soil boring. The soil samples were collected into disposable plastic bags and allowed to equilibrate (allowing concentrations between the soil and headspace of the bag to equalize) prior to Organic Vapor Meter (OVM) screening. The field technician additionally noted visual or olfactory observations during the sample event. The following table summarizes screening results noted during investigation activities:

Field Screening Summary			
Sample Location #	**Visual Observation**	**Olfactory Observation**	**OVM Summary**
SB-1	None	None	All ≤ 0.2 ppm
SB-2	None	None	All ≤ 0.3 ppm
SB-3	None	None	All ≤ 0.2 ppm
SB-4	None	None	All ≤ 0.3 ppm
SB-5	None	None	All ≤ 0.7 ppm

3.1.5 Summary of Soil Samples Selected for Laboratory Analysis

The following table summarizes the sample interval depths and the rationale utilized for selection of soil samples for laboratory analysis:

Soil Sample Selection Rationale Summary		
Sample Location #	**Sample Depth (feet bgs)**	**Rationale Description**
SB-1	5-8	Evaluation of potential near-surface releases Lack of elevated OVM readings Depth of source evaluated (former UST tankhold)
SB-2	1-5	Evaluation of potential surface releases Lack of elevated OVM readings Depth of source evaluated (battery service and oil room/storage)
	13-15	Evaluation of potential subsurface releases Termination depth of soil boring
SB-3	5-8	Evaluation of potential near-surface releases Lack of elevated OVM readings Depth of source evaluated (former UST tankhold)
SB-4	3-5	Evaluation of potential near-surface releases Depth of source evaluated (potential drains at repair and cleaning facilities) Lack of elevated OVM readings
	10-12	Evaluation of potential subsurface releases Termination depth of soil boring / boring refusal
SB-5	1-5	Evaluation of potential surface releases Lack of elevated OVM readings

3.2 Groundwater Investigation Details

3.2.1 Groundwater Handling and Preservation Details

Groundwater samples were collected into containers provided by Eurofins Environmental Testing and preserved utilizing the following methods:

- Nitric acid
- Hydrochloric acid
- Placed on ice at temperatures less than 4º C.

3.2.2 Laboratory Analysis Performed

The following laboratory methods were performed by Eurofins Environmental Testing for groundwater samples collected during this assessment:

Groundwater Laboratory Analysis Performed	
Type of Analysis	**Analysis Method**
RCRA 8 Metals	EPA Method 6020 and 7470
Volatile Organic Compounds (VOCs)	EPA Method 8260
Total Petroleum Hydrocarbons (TPH)	Texas Method 1005

3.2.3 Methodology Utilized During Groundwater Sample Collection

Groundwater samples were collected using low-flow techniques with a peristaltic pump and dedicated tubing. Depth to groundwater measurements were collected prior to purging and prior to sample collection. A minimum of three well volumes was attempted to have been purged from each

temporary groundwater monitoring well. Groundwater was allowed to recharge to at least 90% of the initial static water level prior to sample collection. The groundwater samples collected for metals analysis were field-filtered using an inline 10-micron filter prior to filling the sample containers.

4.0 Findings

4.1 Soil Laboratory Results Summary

The following summarizes the results of each analytical suite for the soil samples selected for laboratory analyses during this assessment:

- Arsenic was detected in all soil samples selected for laboratory analysis at concentrations ranging from 2.52 mg/kg to 6.24 mg/kg. All detected arsenic concentrations are less than its Texas Commission on Environmental Quality (TCEQ) Texas Risk Reduction Program (TRRP) Tier 1 Protective Concentration Level (PCL) for direct exposure to soil in a residential setting of 24 mg/kg, but the concentration detected at SB-2 13-15' is greater than its Texas State Background Concentration (TSBC) of 5.9 mg/kg (applicable for the soil to groundwater pathway). The elevated arsenic concentration was further evaluated through calculation of a Tier 2 soil to groundwater PCL using the site-specific pH of the soil and observed site conditions/lithology for fate and transport modeling. The Tier 2 PCL was determined to be 6.22 mg/kg; the arsenic concentration of concern is nearly equivalent to the Tier 2 PCL, suggesting that the concentration is protective of groundwater. The site is subject to a use restriction for groundwater (see Section 5.0).

  Barium, chromium, and lead were detected in all soil samples selected for laboratory analysis at concentrations that are less than their respective TCEQ TRRP Tier 1 PCLs for soil (or TSBC where applicable for the soil to groundwater pathway) for unrestricted site use.

  Mercury was detected in the soil sample selected for laboratory analysis at SB-2 13-15' at a concentration that is less than its TCEQ TRRP Tier 1 PCLs for soil for unrestricted site use.

  Cadmium, selenuium, and silver were not detected in the soil samples selected for laboratory analysis at concentrations greater than their respective laboratory reporting limits (RLs).

- No VOC constituents were detected in the soil samples selected for laboratory analysis at concentrations greater than their respective laboratory RLs.

- TPH in the diesel range was detected in the soil samples selected for laboratory analysis at SB-2 13-15' and SB-4 3-5' at concentrations that are less than its TCEQ TRRP Tier 1 PCLs for soil for unrestricted site use.

  No other TPH ranges were detected in any of the soil samples selected for laboratory analysis at concentrations greater than their respective laboratory RLs.

The soil analytical results are summarized in the attached table and are presented in the attached laboratory analytical report.

4.2 Groundwater Laboratory Results Summary

The following summarizes the results of each analytical suite for the groundwater samples collected for laboratory analyses during this assessment:

- Arsenic, barium, chromium, lead, and selenium were detected in one or more groundwater samples collected for laboratory analysis at concentrations that are less than their respective TCEQ TRRP Tier 1 PCLs for groundwater.

No other metals were detected in the groundwater samples collected for laboratory analysis at concentrations greater than their respective laboratory RLs.

- No VOC constituents were detected in the groundwater samples collected for laboratory analysis at concentrations greater than their respective laboratory RLs.
- No TPH ranges were detected in the groundwater samples collected for laboratory analysis at concentrations greater than their respective laboratory RLs.

The groundwater analytical results are summarized in the attached table and are presented in the attached laboratory analytical report.

5.0 Conclusions and Opinions

The following conclusions are based on laboratory analytical results and field screening observations associated with this assessment:

- No indication of a reportable release to soil or groundwater from petroleum products or hazardous substances was identified in the areas evaluated under this assessment. **All detected concentrations of the contaminants of concern in the soil and groundwater are less than the regulatory action levels for unrestricted / residential site use.** The soil to groundwater pathway is not relevant since the subject property is part of the Pine Street Corridor Municipal Setting Designation (MSD) site, which placed a use restriction on the groundwater at the property. Although all soil concentrations have been determined to be protective of groundwater, there is no potential for exposure to groundwater at the site based on the use restriction and there is no further concern associated with any soil impact.

Based on laboratory analytical results and field screening observations, the assessment does not demonstrate that a reportable release of hazardous substances or petroleum products has occurred at the subject property in connection with historical operations of environmental concern previously conducted at the subject property.

6.0 Recommendations

No further investigation appears to be warranted at this time based on results of soil and groundwater samples that were selected for laboratory analysis as well as from field screening observations noted at areas evaluated during this assessment.

7.0 Laboratory Report Review

A review of the laboratory analytical report for quality assurance/quality control indicators reveals that thesoil and groundwater data are acceptable and usable for the purposes of this Phase II assessment. Some QC sample recoveries were outside of control limits due to matrix interference and some samples required dilution, but none of the reported results were affected. There were no contaminants detected in the blank samples. No anomalies were noted that would affect the outcome of the assessment.

8.0 Summary of General Methodology

It is the opinion of Phase Engineering, LLC that the scope and character of the environmental report and services, and the investigation performed, were sufficient to justify the conclusions reached in light of the character of the property and the results of tests performed. Phase Engineering has used methodologies that conform to standards established by the EPA and appropriate state environmental protection agencies under similar budget and time constraints, good and customary practices, and laboratory standards for this kind of work. The soil and groundwater samples collected and analyzed as part of this limited assessment are indicative of only those areas sampled.

9.0 Signature(s)

The following individual(s) performed this assessment:

Prepared By:



Olivette Sanchez
Environmental Project Manager

Reviewed By:



Karly E. Allen, MSPH
Remediation Projects Director

10.0 Common Acronyms

AAI – All Appropriate Inquiry
ACBM – Asbestos Containing Building Material
AST – Aboveground Storage Tank
ASTM – American Society for Testing and Materials (2001)
AUL – Activity and Usage Limitation
BF – Brownfield
bgs – below ground surface
BTEX – Benzene, Toluene, Ethyl benzene and Xylenes
CDC – Certified Development Corporation
CERCLA – Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS – Comprehensive Environmental Response, Compensation and Liability Information System
CERCLIS NFRAP – Comprehensive Environmental Response, Compensation and Liability Information System with No Further Remedial Action Planned
CLI – Closed Landfill Inventory
CORRACTS – Corrective Action (RCRA)
CREC – Controlled recognized environmental condition
EC – Engineering Control
EPA – Environmental Protection Agency
ERNS – Emergency Response Notification System
FOIA – Freedom of Information Act
GWBZ – Groundwater Bearing Zone
HH – Human Health
HREC – Historical recognized environmental condition
IC – Institutional Control
IHW – Industrial Hazardous Waste
IOP – Innocent Owner / Operator Program
LPST – Leaking Petroleum Storage Tank
MUD – Municipal Utility District
MSD – Municipal Settings Designation
MSL – Mean Sea Level
MTBE – Methyl tert butyl ether
NAPL – Non-aqueous Phase Liquids
NPL – National Priority List
NRCS – Natural Resource Conservation Service
OSHA – Occupational Safety and Health Administration
PAH – Polycyclic Aromatic Hydrocarbons
PCB – Polychlorinated Biphenyls
PCE – Perchloroethene (Tetrachloroethene)
PCL – Protective Concentration Level
PPM – Parts Per Million
PSH – Phase Separated Hydrocarbons
PUD – Public Utility District
RCRA – Resource Conservation and Recovery Act
REC – Recognized environmental condition
RRC – Texas Railroad Commission
SBA – Small Business Administration
SCL – State CERCLIS List
SPL – State Priority List
SVOC – Semi-Volatile Organic Compounds
SWLF – Solid Waste Landfill
TCEQ – Texas Commission on Environmental Quality
TDSHS – Texas Department of State Health Services
TNRCC – Texas Natural Resource Conservation Commission
TNRIS – Texas Natural Resource Information System
TPH – Total Petroleum Hydrocarbons
TRRP – Texas Risk Reduction Program
TSBC – Texas State Background Concentration
TSD – Treatment, Storage and Disposal (RCRA)
TWC – Texas Water Commission
TWDB – Texas Water Development Board
USACOE – United States Army Corps of Engineers
USDA – United States Department of Agriculture
UST – Underground Storage Tank
USGS – United States Geological Survey
VCP – Voluntary Cleanup Program
VEC – Vapor Encroachment Condition
VOC – Volatile Organic Compounds
WMU – Waste Management Unit

APPENDIX I

LABORATORY SUMMARY TABLE(S)

SOIL ANALYTICAL RESULTS SUMMARY
301 CYPRESS STREET ABILENE
PII ESA

ANALYTE	TRRP Tier 1 PCLs $^{TOT}SOIL_{COMB}$ mg/kg	TRRP Tier 1 PCLs $^{GW}SOIL_{ING}$ mg/kg	TSBC $^{GW}SOIL_{ING}$ mg/kg	SB 1 5-8' 10/9/2025 mg/kg	SB 2 1-5' 10/9/2025 mg/kg	SB 2 13-15' 10/9/2025 mg/kg	SB 3 5-8' 10/9/2025 mg/kg	SB 4 3-5' 10/9/2025 mg/kg	SB 4 10-12' 10/9/2025 mg/kg	SB 5 1-5' 10/9/2025 mg/kg
RCRA Metals (EPA 6020, 7471)										
Arsenic	24	5	5.9	3.88	3.93	6.24	2.52	4.28	4.35	3.22
Barium	8100	440	300	33.1	119	233	27.6	129	155	318
Cadmium	52	1.5	N/A	<0.267	<0.310	<0.287	<0.263	<0.264	<0.275	<0.283
Chromium	33000	2400	30	17.3	11.3	23.1	25.2	10.9	8.55	6.47
Lead	500	3	15	5.34	6.07	10.3	7.77	7.96	5.79	4.73
Selenium	310	2.3	0.3	<0.472	<0.549	<0.507	<0.465	<0.468	<0.486	<0.500
Silver	97	0.48	N/A	<0.239	<0.278	<0.257	<0.235	<0.237	<0.246	<0.253
Mercury	3.6	2.1	0.04	<0.00966	0.0117	<0.0102	<0.00950	<0.00993	<0.00904	<0.00948
VOCs (EPA 8260)										
1,1,1 Trichloroethane	53000	1.6	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
1,1,2,2 Tetrachloroethane	30	0.023	N/A	<0.000283	<0.000328	<0.000379	<0.000326	<0.000345	<0.000266	<0.000317
1,1,2 Trichlor 1,2,2 trifluoroethane	74000	80000	N/A	<0.00134	<0.00155	<0.00179	<0.00154	<0.00163	<0.00126	<0.00150
1,1,2 Trichloroethane	18	0.02	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
1,1 Dichloroethane	11000	18	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
1,1 Dichloroethene	2300	0.05	N/A	<0.000460	<0.000533	<0.000617	<0.000529	<0.000561	<0.000433	<0.000515
1,2,4 Trichlorobenzene	120	4.8	N/A	<0.000808	<0.000935	<0.00108	<0.000929	<0.000984	<0.000759	<0.000904
1,2 Dibromo 3 chloropropane	0.15	0.0017	N/A	<0.00200	<0.00232	<0.00268	<0.00230	<0.00244	<0.00188	<0.00224
1,2 Dibromoethane	2.5	0.00021	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
1,2 Dichlorobenzene	720	18	N/A	<0.00117	<0.00135	<0.00156	<0.00134	<0.00142	<0.00110	<0.00131
1,2 Dichloroethane	41	0.014	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
1,2 Dichloropropane	61	0.023	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
1,3 Dichlorobenzene	120	6.7	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
1,4 Dichlorobenzene	250	2.1	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
2 Butanone	40000	29	N/A	<0.00415	<0.00481	<0.00556	<0.00478	<0.00506	<0.00390	<0.00465
2 Hexanone	270	0.32	N/A	<0.00609	<0.00705	<0.00816	<0.00701	<0.00742	<0.00572	<0.00682
4 Methyl 2 pentanone	5900	4.9	N/A	<0.00428	<0.00495	<0.00573	<0.00492	<0.00522	<0.00402	<0.00479
Acetone	66000	43	N/A	<0.000307	<0.0143	<0.0166	<0.0142	<0.0151	<0.0116	<0.0138
Benzene	120	0.026	N/A	<0.000307	<0.000355	<0.000411	<0.000353	<0.000374	<0.000289	<0.000344
Bromodichloromethane	98	0.36	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
Bromoform	400	0.44	N/A	<0.00178	<0.00205	<0.00238	<0.00204	<0.00216	<0.00167	<0.00199
Bromomethane	46	0.13	N/A	<0.000746	<0.000863	<0.000999	<0.000858	<0.000909	<0.000701	<0.000835
Carbon disulfide	4600	14	N/A	<0.000456	<0.000527	<0.000611	<0.000524	<0.000555	<0.000428	<0.000510
Carbon tetrachloride	35	0.062	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
Chlorobenzene	520	1.1	N/A	<0.000500	<0.000579	<0.000670	<0.000575	<0.000610	<0.000470	<0.000560
Chloroethane	27000	31	N/A	<0.00128	<0.00148	<0.00171	<0.00147	<0.00156	<0.00120	<0.00143
Chloroform	16	0.33	N/A	<0.000421	<0.000487	<0.000564	<0.000484	<0.000513	<0.000396	<0.000471
Chloromethane	140	0.41	N/A	<0.000753	<0.000871	<0.00101	<0.000866	<0.000917	<0.000708	<0.000843
cis 1,2 Dichloroethene	140	0.25	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
cis 1,3 Dichloropropene	8	0.0066	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
Cyclohexane	75000	5900	N/A	<0.00145	<0.00167	<0.00194	<0.00166	<0.00176	<0.00136	<0.00162
Dibromochloromethane	72	0.36	N/A	<0.00136	<0.00158	<0.00183	<0.00157	<0.00166	<0.00128	<0.00153
Dichlorodifluoromethane	1400	240	N/A	<0.00154	<0.00178	<0.00206	<0.00177	<0.00187	<0.00144	<0.00172
Ethylbenzene	6400	7.6	N/A	<0.000244	<0.000283	<0.000327	<0.000281	<0.000298	<0.000230	<0.000274
Isopropylbenzene	4300	350	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
m,p Xylene	8900	110	N/A	<0.000348	<0.000402	<0.000465	<0.000400	<0.000423	<0.000327	<0.000389
Methyl acetate	82000	49	N/A	<0.00260	<0.00301	<0.00348	<0.00299	<0.00317	<0.00244	<0.00291
Methyl tert butyl ether	800	0.62	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
Methylcyclohexane	41000	16000	N/A	<0.00120	<0.00139	<0.00160	<0.00138	<0.00146	<0.00113	<0.00134
Methylene chloride	1600	0.013	N/A	<0.00676	<0.00782	<0.00905	<0.00777	<0.00824	<0.00635	<0.00757
o Xylene	48000	71	N/A	<0.000254	<0.000294	<0.000340	<0.000292	<0.000309	<0.000238	<0.000284
Styrene	6700	3.3	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
Tetrachloroethene	710	0.05	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
Toluene	5900	8.2	N/A	<0.000803	<0.00113	<0.00130	<0.00112	<0.00118	<0.000914	<0.00109
trans 1,2 Dichloroethene	590	0.49	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
trans 1,3 Dichloropropene	36	0.036	N/A	<0.00134	<0.00155	<0.00179	<0.00154	<0.00163	<0.00126	<0.00150
Trichloroethene	18	0.034	N/A	<0.000803	<0.000929	<0.00108	<0.000923	<0.000978	<0.000754	<0.000899
Trichlorofluoromethane	25000	130	N/A	<0.00143	<0.00166	<0.00192	<0.00165	<0.00174	<0.00135	<0.00160
Vinyl chloride	3.7	0.022	N/A	<0.000501	<0.000579	<0.000670	<0.000576	<0.000610	<0.000470	<0.000560
Xylenes, Total	6000	120	N/A	<0.000348	<0.000402	<0.000465	<0.000400	<0.000423	<0.000327	<0.000389
TPH (TX 1005)										
>nC12 to nC28	2300	200	N/A	<23.9	<23.3	66.3	<27.2	45.5	<26.3	<27.5
>nC28 to nC35	2300	200	N/A	<23.9	<23.3	<27.0	<27.2	<28.9	<26.3	<27.5
nC6 to nC12	1600	65	N/A	<23.9	<23.3	<27.0	<27.2	<28.9	<26.3	<27.5
pH (EPA 9045)										
pH	N/A	N/A	N/A	8.9	8.7	7.9	8.4	8.9	8.8	8.8

Exceeds TSBC
Less than TRRP Tier 1 PCL and/or TSBC (where applicable)

GROUNDWATER ANALYTICAL RESULTS SUMMARY
301 CYPRESS STREET ABILENE
PII ESA

ANALYTE	TRRP Tier 1 PCLs $^{GW}GW_{ING}$ mg/L	TMW-1 10/9/2025 mg/L	TMW-3 10/9/2025 mg/L	TMW-5 10/9/2025 mg/L
RCRA 8 Metals (EPA 6020, 7470)				
Arsenic	0.01	0.00177	0.00152	0.00264
Barium	2	0.0441	0.0698	0.0344
Cadmium	0.005	<0.000240	<0.000240	<0.000240
Chromium	0.1	0.00321	0.00460	<0.000560
Lead	0.015	<0.000367	<0.000367	0.000422
Selenium	0.05	0.00181	0.00672	<0.000590
Silver	0.12	<0.000390	<0.000390	<0.000390
Mercury	0.002	<0.0000706	<0.0000706	<0.0000706
VOCs (EPA 8260)				
1,1,1 Trichloroethane	0.2	<0.000585	<0.000585	<0.000585
1,1,2,2 Tetrachloroethane	0.0046	<0.000470	<0.000470	<0.000470
1,1,2 Trichlor 1,2,2 trifluoroethane	730	<0.00111	<0.00111	<0.00111
1,1,2 Trichloroethane	0.005	<0.000411	<0.000411	<0.000411
1,1 Dichloroethane	4.9	<0.000635	<0.000635	<0.000635
1,1 Dichloroethene	0.007	<0.000738	<0.000738	<0.000738
1,2,4 Trichlorobenzene	0.07	<0.00175	<0.00175	<0.00175
1,2 Dibromo 3 chloropropane	0.0002	<0.000671	<0.000671	<0.000671
1,2 Dibromoethane	0.00005	<0.000999	<0.000999	<0.000999
1,2 Dichlorobenzene	0.6	<0.000429	<0.000429	<0.000429
1,2 Dichloroethane	0.005	<0.000372	<0.000372	<0.000372
1,2 Dichloropropane	0.005	<0.000556	<0.000556	<0.000556
1,3 Dichlorobenzene	0.73	<0.000413	<0.000413	<0.000413
1,4 Dichlorobenzene	0.075	<0.000449	<0.000449	<0.000449
2 Butanone	15	<0.00828	<0.00828	<0.00828
2 Hexanone	1.2	<0.00500	<0.00500	<0.00500
4 Methyl 2 pentanone	2	<0.00500	<0.00500	<0.00500
Acetone	22	<0.00307	<0.00307	<0.00307
Benzene	0.005	<0.000460	<0.000460	<0.000460
Bromodichloromethane	0.08	<0.000552	<0.000552	<0.000552
Bromoform	0.08	<0.000633	<0.000633	<0.000633
Bromomethane	0.034	<0.00142	<0.00142	<0.00142
Carbon disulfide	2.4	<0.00165	<0.00165	<0.00165
Carbon tetrachloride	0.005	<0.000896	<0.000896	<0.000896
Chlorobenzene	0.1	<0.000455	<0.000455	<0.000455
Chloroethane	9.8	<0.00198	<0.00198	<0.00198
Chloroform	0.08	<0.000464	<0.000464	<0.000464
Chloromethane	0.07	<0.00204	<0.00204	<0.00204
cis 1,2 Dichloroethene	0.07	<0.000457	<0.000457	<0.000457
cis 1,3 Dichloropropene	0.0017	<0.00107	<0.00107	<0.00107
Cyclohexane	120	<0.00129	<0.00129	<0.00129
Dibromochloromethane	0.08	<0.000547	<0.000547	<0.000547
Dichlorodifluoromethane	4.9	<0.000785	<0.000785	<0.000785
Ethylbenzene	0.7	<0.000385	<0.000385	<0.000385
Isopropylbenzene	2.4	<0.000592	<0.000592	<0.000592
m,p Xylene	10	<0.00124	<0.00124	<0.00124
Methyl acetate	24	<0.00401	<0.00401	<0.00401
Methyl tert butyl ether	0.24	<0.00139	<0.00139	<0.00139
Methylcyclohexane	120	<0.000608	<0.000608	<0.000608
Methylene chloride	0.005	<0.00173	<0.00173	<0.00173
o Xylene	10	<0.000502	<0.000502	<0.000502
Styrene	0.1	<0.000619	<0.000619	<0.000619
Tetrachloroethene	0.005	<0.000655	<0.000655	<0.000655
Toluene	1	<0.000475	<0.000475	<0.000475
trans 1,2 Dichloroethene	0.1	<0.000368	<0.000368	<0.000368
trans 1,3 Dichloropropene	0.0091	<0.00127	<0.00127	<0.00127
Trichloroethene	0.005	<0.00150	<0.00150	<0.00150
Trichlorofluoromethane	7.3	<0.000560	<0.000560	<0.000560
Vinyl chloride	0.002	<0.000428	<0.000428	<0.000428
Xylenes, Total	10	<0.00124	<0.00124	<0.00124
TPH (TX 1005)				
>nC12 to nC28	0.98	<0.817	<0.830	<0.825
>nC28 to nC35	0.98	<0.817	<0.830	<0.825
nC6 to nC12	0.98	<0.838	<0.851	<0.846

Less than TRRP Tier 1 PCL

APPENDIX II

MAP(S)

PHASE
TRUSTED ENVIRONMENTAL SOLUTIONS

301 Cypress Street
Abilene, Texas 79601
Taylor County

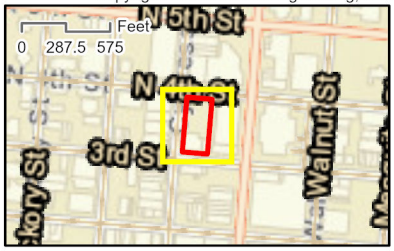


Sources: Esri, HERE, Garmin, (c) OpenStreetMap contributors

0 15 30 60 90 120 Feet

1:700

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Sample Location Map - October 9, 2025

- Subject Property
- Area of Interest
- Soil Boring / Temporary Monitoring Well
- Soil Boring
- Gasoline Tank

Phase Project No: 202510014

APPENDIX III

SOIL BORING LOGS

Phase Engineering
5524 Cornish Street
Houston TX 77007
Telephone: 7134769844

BORING NUMBER SB-1 / TMW-1

CLIENT Overland Property Group
PROJECT NAME
PROJECT NUMBER 202510014
PROJECT LOCATION 301 Cypress Street
DATE STARTED 10/9/25 **COMPLETED** 10/9/25
GROUND ELEVATION **HOLE SIZE** 2 inches
DRILLING CONTRACTOR Pacific West
GROUND WATER LEVELS:
DRILLING METHOD Push Core
AT TIME OF DRILLING 13.00 ft
LOGGED BY Jaymi Reser **CHECKED BY** Ross Doctoroff
AT END OF DRILLING ---
NOTES
AFTER DRILLING 12.10 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					0.5 Concrete (CL-ML) Brown silty clay; hard; dry; no odor	
			PID = 0			
5	ST		PID = 0.1		5.5 (SC) Red clayey sand with gravel; loose; dry; no odor	1" solid PVC riser
10			PID = 0.1			
			PID = 0.2		13.0 (SC) Red clayey sand with gravel; medium dense; moist; no odor	
15			PID = 0.2		15.0 (CL-ML) Tan and grey silty clay; hard; dry; no odor	1" 0.010 gauge slotted PVC
			PID = 0			
20			PID = 0.1		20.0	

Refusal at 20.0 feet.
Bottom of borehole at 20.0 feet.

Ross Doctoroff

10/14/2025

STATE OF TEXAS
ROSS I. DOCTOROFF
GEOLOGY
2767
LICENSED
PROFESSIONAL GEOSCIENTIST

ENVIRONMENTAL BH - GINT STD US LAB.GDT - 10/14/25 10:54 - S:\REMEDIATION_PROJECTS\SOIL BORINGS\BORING LOGS\TEMPORARY WELLS\301 CYPRESS STREET.GPJ

PHASE
Phase Engineering
5524 Cornish Street
Houston TX 77007
Telephone: 7134769844

BORING NUMBER SB-2

CLIENT Overland Property Group
PROJECT NAME
PROJECT NUMBER 202510014
PROJECT LOCATION 301 Cypress Street
DATE STARTED 10/9/25 **COMPLETED** 10/9/25
GROUND ELEVATION **HOLE SIZE** 2 inches
DRILLING CONTRACTOR Pacific West
GROUND WATER LEVELS:
DRILLING METHOD Push Core
AT TIME OF DRILLING ---
LOGGED BY Jaymi Reser **CHECKED BY** Ross Doctoroff
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					0.5 Concrete	
					(CL-ML) Red-brown silty clay with gravel; hard; dry; no odor	
5	ST		PID = 0		5.0	
			PID = 0		(CL) Red and tan sandy clay with gravel; very stiff; dry; no odor	← No well installed
10			PID = 0.1			
			PID = 0.1		12.0	
					(CL) Red and brown sandy clay; medium stiff; moist; dry; no odor	
15	ST		PID = 0.3		13.0 (CL-ML) Tan and grey silty clay; hard; dry; no odor	
					15.0	

Bottom of borehole at 15.0 feet.

Ross Doctoroff

10/14/2025

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Phase Engineering
5524 Cornish Street
Houston TX 77007
Telephone: 7134769844

BORING NUMBER SB-3 / TMW-3

CLIENT Overland Property Group
PROJECT NAME
PROJECT NUMBER 202510014
PROJECT LOCATION 301 Cypress Street
DATE STARTED 10/9/25 **COMPLETED** 10/9/25
GROUND ELEVATION **HOLE SIZE** 2 inches
DRILLING CONTRACTOR Pacific West
GROUND WATER LEVELS:
DRILLING METHOD Push Core
AT TIME OF DRILLING 13.00 ft
LOGGED BY Jaymi Reser **CHECKED BY** Ross Doctoroff
AT END OF DRILLING ---
NOTES
AFTER DRILLING 12.30 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					0.5 Concrete	
			PID = 0.2		(CL-ML) Brown silty clay; hard; dry; no odor	
					3.5	
			PID = 0		(CL) Red and tan sandy clay with gravel; stiff; dry; no odor	
5	ST					1" solid PVC riser
			PID = 0			
			PID = 0.1			
10						
			PID = 0.1		13.0 ▽	
					(SC) Red clayey sand with gravel; dense; wet; no odor	
15					15.0	1" 0.010 gauge slotted PVC
					(CL-ML) Tan and grey silty clay; hard; dry; no odor	
			PID = 0.2			
			PID = 0.2		20.0	
20						

Refusal at 20.0 feet.
Bottom of borehole at 20.0 feet.

Ross Doctoroff

10/14/2025

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Phase Engineering
5524 Cornish Street
Houston TX 77007
Telephone: 7134769844

BORING NUMBER SB-4

CLIENT Overland Property Group
PROJECT NAME
PROJECT NUMBER 202510014
PROJECT LOCATION 301 Cypress Street
DATE STARTED 10/9/25 **COMPLETED** 10/9/25
GROUND ELEVATION **HOLE SIZE** 2 inches
DRILLING CONTRACTOR Pacific West
GROUND WATER LEVELS:
DRILLING METHOD Push Core
AT TIME OF DRILLING ---
LOGGED BY Jaymi Reser **CHECKED BY** Ross Doctoroff
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					0.5 Concrete	
			PID = 0.1		(CL-ML) Brown silty clay; hard; dry; no odor	
					3.0	
5	ST		PID = 0.1		(CL) Tan and red sandy clay with gravel; stiff; dry; no odor	
			PID = 0.2			← No well installed
10			PID = 0.3			
	ST		PID = 0.2		12.0	

Refusal at 12.0 feet.
Bottom of borehole at 12.0 feet.

10/14/2025

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Phase Engineering
5524 Cornish Street
Houston TX 77007
Telephone: 7134769844

BORING NUMBER SB-5 / TMW-5

CLIENT Overland Property Group
PROJECT NAME
PROJECT NUMBER 202510014
PROJECT LOCATION 301 Cypress Street
DATE STARTED 10/9/25 **COMPLETED** 10/9/25
GROUND ELEVATION **HOLE SIZE** 2 inches
DRILLING CONTRACTOR Pacific West
GROUND WATER LEVELS:
DRILLING METHOD Push Core
AT TIME OF DRILLING 5.00 ft
LOGGED BY Jaymi Reser **CHECKED BY** Ross Doctoroff
AT END OF DRILLING ---
NOTES
AFTER DRILLING 8.20 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					0.5 Concrete	1" solid PVC riser
					(CL-ML) Red-brown silty clay; medium stiff; dry; no odor	
5	ST		PID = 0.7		5.0	
					(SC) Red clayey sand; medium dense; moist; no odor	1" 0.010 gauge slotted PVC
10					10.0	
					(GP) Grey, tan, and red sandy gravel; dense; wet; slight hydrocarbon odor	
					12.0	

Refusal at 12.0 feet.
Bottom of borehole at 12.0 feet.

10/14/2025

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APPENDIX IV

LABORATORY REPORT(S)

eurofins | Environment Testing

ANALYTICAL REPORT

PREPARED FOR

Attn: Jaymi Reser
Phase Engineering Inc.
300 East Sonterra Boulevard, Suite 1140
San Antonio, Texas 78258

Generated 10/23/2025 9:19:02 AM Revision 1

JOB DESCRIPTION

PE # 202510014, Abilene, TX

JOB NUMBER

860-113841-1

Eurofins Houston
4145 Greenbriar Dr
Stafford TX 77477

See page two for job notes and contact information.

my EOL

Eurofins Houston

Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

Analytical test results meet all requirements of the associated regulatory program (i.e., NELAC (TNI), DoD, and ISO 17025) unless otherwise noted under the individual analysis.

Authorization



Generated
10/23/2025 9:19:02 AM
Revision 1

Authorized for release by
Sylvia Garza, Project Manager
Sylvia.Garza@et.eurofinsus.com
(832)544-2004

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Qualifiers

GC/MS VOA

Qualifier	Qualifier Description
*1	LCS/LCSD RPD exceeds control limits.
F1	MS and/or MSD recovery exceeds control limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U	Indicates the analyte was analyzed for but not detected.

GC Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U	Indicates the analyte was analyzed for but not detected.

Metals

Qualifier	Qualifier Description
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.
F1	MS and/or MSD recovery exceeds control limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U	Indicates the analyte was analyzed for but not detected.

General Chemistry

Qualifier	Qualifier Description
HF	Parameter with a holding time of 15 minutes. Test performed by laboratory at client's request. Sample was analyzed outside of hold time.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points

Glossary (Continued)

Abbreviation	These commonly used abbreviations may or may not be present in this report.
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Job Narrative
860-113841-1

REVISION

The report being provided is a revision of the original report sent on 10/17/2025. The report (revision 1) is being revised due to including additional volatile cmpds per client request.

The analytical test results presented in this report meet all requirements of the associated regulatory program listed on the Accreditation/Certification Summary Page, unless otherwise noted. Data qualifiers and/or narrative comments are included to explain any exceptions, if applicable. Regulated compliance samples (e.g. SDWA, NPDES) must comply with associated agency requirements/permits.

- Matrix-specific batch QC (e.g., MS, MSD, SD) may not be reported when insufficient sample volume is available or when site-specific QC samples are not submitted. In such cases, a Laboratory Control Sample Duplicate (LCSD) may be analyzed to provide precision data for the batch.
- For samples analyzed using surrogate and/or isotope dilution analytes, any recoveries falling outside of established acceptance criteria are re-prepared and/or re-analyzed to confirm results, unless the deviation is due to sample dilution or otherwise explained in the case narrative.

Receipt
The samples were received on 10/10/2025 9:19 AM. Unless otherwise noted below, the samples arrived in good condition, and, where required, properly preserved and on ice. The temperature of the cooler at receipt time was 3.1°C.

GC/MS VOA
Method 8260D: The following samples were diluted due to it being a thread: (860-113834-A-3-B) and (860-113834-A-3-B MS). Elevated reporting limits (RL) are provided. Sample prepped with methanol from a bulk jar.

Method 8260D: The matrix spike (MS) recoveries for preparation batch 860-268469 and analytical batch 860-268311 were outside control limits. Sample matrix interference is suspected.

Method 8260D: The RPD of the laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) for analytical batch 860-268311 recovered outside control limits for the following analytes: Bromomethane.

Method 8260D: The RPD of the laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) for analytical batch 860-268311 recovered outside control limits for the following analytes: Acetone.

Method 8260D: The continuing calibration verification (CCV) associated with batch 860-268311 recovered outside acceptance criteria, low biased, for Carbon disulfide (-31%). A reporting limit (RL) standard was analyzed, and the target analytes are detected. Since the associated samples were non-detect for the analyte(s), the data are reported.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Hydrocarbons
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Metals
Method 6020B: The matrix spike / matrix spike duplicate (MS/MSD) recoveries for preparation batch 860-268360 and analytical batch 860-268778 were outside control limits. Sample matrix interference is suspected because the associated laboratory control sample (LCS) recovery was within acceptance limits.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

General Chemistry
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Detection Summary

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Client Sample ID: SB-1 5-8' — Lab Sample ID: 860-113841-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	3.88		2.00	0.515	mg/Kg	5	☼	6020B	Total/NA
Barium	33.1		2.00	0.685	mg/Kg	5	☼	6020B	Total/NA
Chromium	17.3		2.00	0.270	mg/Kg	5	☼	6020B	Total/NA
Lead	5.34		0.999	0.317	mg/Kg	5	☼	6020B	Total/NA
pH	8.9	HF			SU	1		9045D	Soluble
Temperature	21.1	HF			Deg. C	1		9045D	Soluble
Corrosivity	8.9	HF			SU	1		9045D	Soluble

Client Sample ID: SB-2 1-5' — Lab Sample ID: 860-113841-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	3.93		2.32	0.598	mg/Kg	5	☼	6020B	Total/NA
Barium	119		2.32	0.795	mg/Kg	5	☼	6020B	Total/NA
Chromium	11.3		2.32	0.314	mg/Kg	5	☼	6020B	Total/NA
Lead	6.07		1.16	0.368	mg/Kg	5	☼	6020B	Total/NA
Mercury	0.0117	J	0.0242	0.0108	mg/Kg	1	☼	7471A	Total/NA
pH	8.7	HF			SU	1		9045D	Soluble
Temperature	21.2	HF			Deg. C	1		9045D	Soluble
Corrosivity	8.7	HF			SU	1		9045D	Soluble

Client Sample ID: SB-2 13-15' — Lab Sample ID: 860-113841-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Over C12-C28	66.3		54.0	27.0	mg/Kg	1	☼	TX 1005	Total/NA
Total Petroleum Hydrocarbons (C6-C35)	66.3		54.0	27.0	mg/Kg	1		TX 1005	Total/NA
Arsenic	6.24		2.15	0.553	mg/Kg	5	☼	6020B	Total/NA
Barium	233		2.15	0.735	mg/Kg	5	☼	6020B	Total/NA
Chromium	23.1		2.15	0.290	mg/Kg	5	☼	6020B	Total/NA
Lead	10.3		1.07	0.340	mg/Kg	5	☼	6020B	Total/NA
pH	7.9	HF			SU	1		9045D	Soluble
Temperature	21.2	HF			Deg. C	1		9045D	Soluble
Corrosivity	7.9	HF			SU	1		9045D	Soluble

Client Sample ID: SB-3 5-8' — Lab Sample ID: 860-113841-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	2.52		1.97	0.506	mg/Kg	5	☼	6020B	Total/NA
Barium	27.6		1.97	0.674	mg/Kg	5	☼	6020B	Total/NA
Chromium	25.2		1.97	0.265	mg/Kg	5	☼	6020B	Total/NA
Lead	7.77		0.983	0.312	mg/Kg	5	☼	6020B	Total/NA
pH	8.4	HF			SU	1		9045D	Soluble
Temperature	21.3	HF			Deg. C	1		9045D	Soluble
Corrosivity	8.4	HF			SU	1		9045D	Soluble

Client Sample ID: SB-4 3-5' — Lab Sample ID: 860-113841-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Over C12-C28	45.5	J	57.7	28.9	mg/Kg	1	☼	TX 1005	Total/NA
Total Petroleum Hydrocarbons (C6-C35)	45.5	J	57.7	28.9	mg/Kg	1		TX 1005	Total/NA
Arsenic	4.28		1.98	0.510	mg/Kg	5	☼	6020B	Total/NA
Barium	129		1.98	0.678	mg/Kg	5	☼	6020B	Total/NA

This Detection Summary does not include radiochemical test results.

Eurofins Houston

Client Sample ID: SB-4 3-5' (Continued) — Lab Sample ID: 860-113841-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chromium	10.9		1.98	0.267	mg/Kg	5	☼	6020B	Total/NA
Lead	7.96		0.990	0.314	mg/Kg	5	☼	6020B	Total/NA
pH	8.9	HF			SU	1		9045D	Soluble
Temperature	21.2	HF			Deg. C	1		9045D	Soluble
Corrosivity	8.9	HF			SU	1		9045D	Soluble

Client Sample ID: SB-4 10-12' — Lab Sample ID: 860-113841-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	4.35		2.06	0.530	mg/Kg	5	☼	6020B	Total/NA
Barium	155		2.06	0.704	mg/Kg	5	☼	6020B	Total/NA
Chromium	8.55		2.06	0.278	mg/Kg	5	☼	6020B	Total/NA
Lead	5.79		1.03	0.326	mg/Kg	5	☼	6020B	Total/NA
pH	8.8	HF			SU	1		9045D	Soluble
Temperature	21.2	HF			Deg. C	1		9045D	Soluble
Corrosivity	8.8	HF			SU	1		9045D	Soluble

Client Sample ID: SB-5 1-5' — Lab Sample ID: 860-113841-7

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	3.22		2.12	0.545	mg/Kg	5	☼	6020B	Total/NA
Barium	318		2.12	0.726	mg/Kg	5	☼	6020B	Total/NA
Chromium	6.47		2.12	0.286	mg/Kg	5	☼	6020B	Total/NA
Lead	4.73		1.06	0.336	mg/Kg	5	☼	6020B	Total/NA
pH	8.8	HF			SU	1		9045D	Soluble
Temperature	21.3	HF			Deg. C	1		9045D	Soluble
Corrosivity	8.8	HF			SU	1		9045D	Soluble

Client Sample ID: TMW-1 — Lab Sample ID: 860-113841-8

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.00177	J	0.00400	0.000690	mg/L	1		6020B	Total/NA
Barium	0.0441		0.00400	0.00134	mg/L	1		6020B	Total/NA
Chromium	0.00321	J	0.00400	0.000560	mg/L	1		6020B	Total/NA
Selenium	0.00181	J	0.00200	0.000590	mg/L	1		6020B	Total/NA

Client Sample ID: TMW-3 — Lab Sample ID: 860-113841-9

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.00152	J	0.00400	0.000690	mg/L	1		6020B	Total/NA
Barium	0.0698		0.00400	0.00134	mg/L	1		6020B	Total/NA
Chromium	0.00460		0.00400	0.000560	mg/L	1		6020B	Total/NA
Selenium	0.00672		0.00200	0.000590	mg/L	1		6020B	Total/NA

Client Sample ID: TMW-5 — Lab Sample ID: 860-113841-10

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.00264	J	0.00400	0.000690	mg/L	1		6020B	Total/NA
Barium	0.0344		0.00400	0.00134	mg/L	1		6020B	Total/NA
Lead	0.000422	J	0.00200	0.000367	mg/L	1		6020B	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: SB-1 5-8'

Date Collected: 10/09/25 08:00
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-1

Matrix: Solid
Percent Solids: 92.7

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.000307	U	0.000803	0.000307	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Bromobenzene	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Bromochloromethane	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Bromodichloromethane	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Bromoform	<0.00178	U	0.00401	0.00178	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Bromomethane	<0.000746	U *1	0.00401	0.000746	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
2-Butanone	<0.00415	U	0.0401	0.00415	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Carbon tetrachloride	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Chlorobenzene	<0.000500	U	0.00401	0.000500	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Chloroethane	<0.00128	U	0.00803	0.00128	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Chloroform	<0.000421	U	0.00401	0.000421	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Chloromethane	<0.000753	U	0.00401	0.000753	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
4-Chlorotoluene	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
cis-1,2-Dichloroethene	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
cis-1,3-Dichloropropene	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Dibromochloromethane	<0.00136	U	0.00401	0.00136	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,2-Dibromo-3-Chloropropane	<0.00200	U	0.00401	0.00200	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,2-Dibromoethane	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,2-Dichlorobenzene	<0.00117	U	0.00401	0.00117	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,3-Dichlorobenzene	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,4-Dichlorobenzene	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Dichlorodifluoromethane	<0.00154	U	0.00401	0.00154	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,1-Dichloroethane	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,2-Dichloroethane	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,1-Dichloroethene	<0.000460	U	0.00401	0.000460	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,2-Dichloropropane	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,3-Dichloropropane	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
2,2-Dichloropropane	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,1-Dichloropropene	<0.000413	U	0.00401	0.000413	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Ethylbenzene	<0.000244	U	0.000803	0.000244	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Hexachlorobutadiene	<0.000558	U	0.00401	0.000558	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Isopropylbenzene	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Methylene Chloride	<0.00676	U	0.0161	0.00676	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
m,p-Xylenes	<0.000348	U	0.00161	0.000348	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
MTBE	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Naphthalene	<0.00161	U	0.00803	0.00161	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
n-Butylbenzene	<0.000441	U	0.00401	0.000441	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
N-Propylbenzene	<0.000796	U	0.00401	0.000796	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
o-Xylene	<0.000254	U	0.000803	0.000254	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
p-Cymene (p-Isopropyltoluene)	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
sec-Butylbenzene	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Styrene	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
tert-Butylbenzene	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,1,1,2-Tetrachloroethane	<0.000471	U	0.00401	0.000471	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,1,2,2-Tetrachloroethane	<0.000283	U	0.00401	0.000283	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Tetrachloroethene	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Toluene	<0.000972	U	0.00401	0.000972	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
trans-1,2-Dichloroethene	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
trans-1,3-Dichloropropene	<0.00134	U	0.00401	0.00134	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1

Client Sample ID: SB-1 5-8'

Date Collected: 10/09/25 08:00
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-1

Matrix: Solid
Percent Solids: 92.7

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2,3-Trichlorobenzene	<0.00109	U	0.00401	0.00109	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,2,4-Trichlorobenzene	<0.000808	U	0.00401	0.000808	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,1,1-Trichloroethane	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,1,2-Trichloroethane	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Trichloroethene	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Trichlorofluoromethane	<0.00143	U	0.00401	0.00143	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,2,3-Trichloropropane	<0.000467	U	0.00401	0.000467	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,2,4-Trimethylbenzene	<0.00126	U	0.00401	0.00126	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,3,5-Trimethylbenzene	<0.000803	U	0.00401	0.000803	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Vinyl chloride	<0.000501	U	0.00401	0.000501	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Xylenes, Total	<0.000348	U	0.00161	0.000348	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Carbon disulfide	<0.000456	U	0.00401	0.000456	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Acetone	<0.0124	U *1	0.0803	0.0124	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Methyl acetate	<0.00260	U	0.0401	0.00260	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
4-Methyl-2-pentanone	<0.00428	U	0.0401	0.00428	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.00134	U	0.00803	0.00134	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
2-Hexanone	<0.00609	U	0.0401	0.00609	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Methylcyclohexane	<0.00120	U	0.00803	0.00120	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1
Cyclohexane	<0.00145	U	0.00401	0.00145	mg/Kg	☼	10/10/25 11:33	10/14/25 12:54	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*113*		*56 - 150*	*10/10/25 11:33*	*10/14/25 12:54*	*1*
4-Bromofluorobenzene (Surr)	*91*		*68 - 152*	*10/10/25 11:33*	*10/14/25 12:54*	*1*
Dibromofluoromethane (Surr)	*105*		*53 - 142*	*10/10/25 11:33*	*10/14/25 12:54*	*1*
Toluene-d8 (Surr)	*98*		*70 - 130*	*10/10/25 11:33*	*10/14/25 12:54*	*1*

Method: TCEQ TX 1005 - Texas - Total Petroleum Hydrocarbon (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C6-C12	<23.9	U	47.9	23.9	mg/Kg	☼	10/15/25 11:47	10/16/25 13:15	1
Over C12-C28	<23.9	U	47.9	23.9	mg/Kg	☼	10/15/25 11:47	10/16/25 13:15	1
Over C28-C35	<23.9	U	47.9	23.9	mg/Kg	☼	10/15/25 11:47	10/16/25 13:15	1
Total Petroleum Hydrocarbons (C6-C35)	<23.9	U	47.9	23.9	mg/Kg			10/16/25 13:15	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctane (Surr)	*79*		*70 - 130*	*10/15/25 11:47*	*10/16/25 13:15*	*1*
o-Terphenyl (Surr)	*79*		*70 - 130*	*10/15/25 11:47*	*10/16/25 13:15*	*1*

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**3.88**		2.00	0.515	mg/Kg	☼	10/14/25 10:30	10/15/25 14:19	5
Barium	**33.1**		2.00	0.685	mg/Kg	☼	10/14/25 10:30	10/15/25 14:19	5
Cadmium	<0.267	U	0.999	0.267	mg/Kg	☼	10/14/25 10:30	10/15/25 14:19	5
Chromium	**17.3**		2.00	0.270	mg/Kg	☼	10/14/25 10:30	10/15/25 14:19	5
Lead	**5.34**		0.999	0.317	mg/Kg	☼	10/14/25 10:30	10/15/25 14:19	5
Selenium	<0.472	U	0.999	0.472	mg/Kg	☼	10/14/25 10:30	10/15/25 14:19	5
Silver	<0.239	U	0.999	0.239	mg/Kg	☼	10/14/25 10:30	10/15/25 14:19	5

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.00966	U	0.0216	0.00966	mg/Kg	☼	10/15/25 10:55	10/15/25 13:44	1

Client Sample ID: SB-1 5-8'
Lab Sample ID: 860-113841-1
Date Collected: 10/09/25 08:00 **Matrix: Solid**
Date Received: 10/10/25 09:19 **Percent Solids: 92.7**

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH (SW846 9045D)	8.9	HF			SU			10/14/25 13:10	1
Temperature (SW846 9045D)	21.1	HF			Deg. C			10/14/25 13:10	1
Corrosivity (SW846 9045D)	8.9	HF			SU			10/14/25 13:10	1

Client Sample ID: SB-2 1-5'
Lab Sample ID: 860-113841-2
Date Collected: 10/09/25 09:16 **Matrix: Solid**
Date Received: 10/10/25 09:19 **Percent Solids: 82.8**

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.000355	U	0.000929	0.000355	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Bromobenzene	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Bromochloromethane	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Bromodichloromethane	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Bromoform	<0.00205	U	0.00465	0.00205	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Bromomethane	<0.000863	U *1	0.00465	0.000863	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
2-Butanone	<0.00481	U	0.0465	0.00481	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Carbon tetrachloride	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Chlorobenzene	<0.000579	U	0.00465	0.000579	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Chloroethane	<0.00148	U	0.00929	0.00148	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Chloroform	<0.000487	U	0.00465	0.000487	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Chloromethane	<0.000871	U	0.00465	0.000871	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
4-Chlorotoluene	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
cis-1,2-Dichloroethene	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
cis-1,3-Dichloropropene	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Dibromochloromethane	<0.00158	U	0.00465	0.00158	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,2-Dibromo-3-Chloropropane	<0.00232	U	0.00465	0.00232	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,2-Dibromoethane	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,2-Dichlorobenzene	<0.00135	U	0.00465	0.00135	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,3-Dichlorobenzene	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,4-Dichlorobenzene	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Dichlorodifluoromethane	<0.00178	U	0.00465	0.00178	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,1-Dichloroethane	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,2-Dichloroethane	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,1-Dichloroethene	<0.000533	U	0.00465	0.000533	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,2-Dichloropropane	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,3-Dichloropropane	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
2,2-Dichloropropane	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,1-Dichloropropene	<0.000478	U	0.00465	0.000478	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Ethylbenzene	<0.000283	U	0.000929	0.000283	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Hexachlorobutadiene	<0.000646	U	0.00465	0.000646	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Isopropylbenzene	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Methylene Chloride	<0.00782	U	0.0186	0.00782	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
m,p-Xylenes	<0.000402	U	0.00186	0.000402	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
MTBE	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Naphthalene	<0.00186	U	0.00929	0.00186	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
n-Butylbenzene	<0.000511	U	0.00465	0.000511	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
N-Propylbenzene	<0.000921	U	0.00465	0.000921	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
o-Xylene	<0.000294	U	0.000929	0.000294	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
p-Cymene (p-Isopropyltoluene)	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1

Client Sample ID: SB-2 1-5'

Date Collected: 10/09/25 09:16
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-2

Matrix: Solid
Percent Solids: 82.8

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
sec-Butylbenzene	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Styrene	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
tert-Butylbenzene	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,1,1,2-Tetrachloroethane	<0.000544	U	0.00465	0.000544	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,1,2,2-Tetrachloroethane	<0.000328	U	0.00465	0.000328	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Tetrachloroethene	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Toluene	<0.00113	U	0.00465	0.00113	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
trans-1,2-Dichloroethene	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
trans-1,3-Dichloropropene	<0.00155	U	0.00465	0.00155	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,2,3-Trichlorobenzene	<0.00126	U	0.00465	0.00126	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,2,4-Trichlorobenzene	<0.000935	U	0.00465	0.000935	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,1,1-Trichloroethane	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,1,2-Trichloroethane	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Trichloroethene	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Trichlorofluoromethane	<0.00166	U	0.00465	0.00166	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,2,3-Trichloropropane	<0.000540	U	0.00465	0.000540	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,2,4-Trimethylbenzene	<0.00146	U	0.00465	0.00146	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,3,5-Trimethylbenzene	<0.000929	U	0.00465	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Vinyl chloride	<0.000579	U	0.00465	0.000579	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Xylenes, Total	<0.000402	U	0.00186	0.000402	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Carbon disulfide	<0.000527	U	0.00465	0.000527	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Acetone	<0.0143	U *1	0.0929	0.0143	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Methyl acetate	<0.00301	U	0.0465	0.00301	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
4-Methyl-2-pentanone	<0.00495	U	0.0465	0.00495	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.00155	U	0.00929	0.00155	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
2-Hexanone	<0.00705	U	0.0465	0.00705	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Methylcyclohexane	<0.00139	U	0.00929	0.00139	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1
Cyclohexane	<0.00167	U	0.00465	0.00167	mg/Kg	☼	10/10/25 11:33	10/14/25 13:18	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*119*		*56 - 150*	*10/10/25 11:33*	*10/14/25 13:18*	*1*
4-Bromofluorobenzene (Surr)	*92*		*68 - 152*	*10/10/25 11:33*	*10/14/25 13:18*	*1*
Dibromofluoromethane (Surr)	*109*		*53 - 142*	*10/10/25 11:33*	*10/14/25 13:18*	*1*
Toluene-d8 (Surr)	*96*		*70 - 130*	*10/10/25 11:33*	*10/14/25 13:18*	*1*

Method: TCEQ TX 1005 - Texas - Total Petroleum Hydrocarbon (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C6-C12	<23.3	U	46.6	23.3	mg/Kg	☼	10/15/25 11:47	10/15/25 16:12	1
Over C12-C28	<23.3	U	46.6	23.3	mg/Kg	☼	10/15/25 11:47	10/15/25 16:12	1
Over C28-C35	<23.3	U	46.6	23.3	mg/Kg	☼	10/15/25 11:47	10/15/25 16:12	1
Total Petroleum Hydrocarbons (C6-C35)	<23.3	U	46.6	23.3	mg/Kg			10/15/25 16:12	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctane (Surr)	*92*		*70 - 130*	*10/15/25 11:47*	*10/15/25 16:12*	*1*
o-Terphenyl (Surr)	*98*		*70 - 130*	*10/15/25 11:47*	*10/15/25 16:12*	*1*

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**3.93**		2.32	0.598	mg/Kg	☼	10/14/25 10:30	10/15/25 14:22	5
Barium	**119**		2.32	0.795	mg/Kg	☼	10/14/25 10:30	10/15/25 14:22	5

Client Sample ID: SB-2 1-5'
Lab Sample ID: 860-113841-2
Date Collected: 10/09/25 09:16 **Matrix: Solid**
Date Received: 10/10/25 09:19 **Percent Solids: 82.8**

Method: SW846 6020B - Metals (ICP/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	<0.310	U	1.16	0.310	mg/Kg	☼	10/14/25 10:30	10/15/25 14:22	5
Chromium	**11.3**		2.32	0.314	mg/Kg	☼	10/14/25 10:30	10/15/25 14:22	5
Lead	**6.07**		1.16	0.368	mg/Kg	☼	10/14/25 10:30	10/15/25 14:22	5
Selenium	<0.549	U	1.16	0.549	mg/Kg	☼	10/14/25 10:30	10/15/25 14:22	5
Silver	<0.278	U	1.16	0.278	mg/Kg	☼	10/14/25 10:30	10/15/25 14:22	5

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.0117**	**J**	0.0242	0.0108	mg/Kg	☼	10/15/25 10:55	10/15/25 13:46	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH (SW846 9045D)	**8.7**	**HF**			SU			10/14/25 13:09	1
Temperature (SW846 9045D)	**21.2**	**HF**			Deg. C			10/14/25 13:09	1
Corrosivity (SW846 9045D)	**8.7**	**HF**			SU			10/14/25 13:09	1

Client Sample ID: SB-2 13-15'
Lab Sample ID: 860-113841-3
Date Collected: 10/09/25 09:28 **Matrix: Solid**
Date Received: 10/10/25 09:19 **Percent Solids: 84.7**

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.000411	U	0.00108	0.000411	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Bromobenzene	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Bromochloromethane	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Bromodichloromethane	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Bromoform	<0.00238	U	0.00538	0.00238	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Bromomethane	<0.000999	U *1	0.00538	0.000999	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
2-Butanone	<0.00556	U	0.0538	0.00556	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Carbon tetrachloride	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Chlorobenzene	<0.000670	U	0.00538	0.000670	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Chloroethane	<0.00171	U	0.0108	0.00171	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Chloroform	<0.000564	U	0.00538	0.000564	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Chloromethane	<0.00101	U	0.00538	0.00101	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
4-Chlorotoluene	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
cis-1,2-Dichloroethene	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
cis-1,3-Dichloropropene	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Dibromochloromethane	<0.00183	U	0.00538	0.00183	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,2-Dibromo-3-Chloropropane	<0.00268	U	0.00538	0.00268	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,2-Dibromoethane	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,2-Dichlorobenzene	<0.00156	U	0.00538	0.00156	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,3-Dichlorobenzene	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,4-Dichlorobenzene	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Dichlorodifluoromethane	<0.00206	U	0.00538	0.00206	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,1-Dichloroethane	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,2-Dichloroethane	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,1-Dichloroethene	<0.000617	U	0.00538	0.000617	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,2-Dichloropropane	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,3-Dichloropropane	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
2,2-Dichloropropane	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1

Client Sample ID: SB-2 13-15'
Date Collected: 10/09/25 09:28
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-3
Matrix: Solid
Percent Solids: 84.7

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1-Dichloropropene	<0.000553	U	0.00538	0.000553	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Ethylbenzene	<0.000327	U	0.00108	0.000327	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Hexachlorobutadiene	<0.000748	U	0.00538	0.000748	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Isopropylbenzene	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Methylene Chloride	<0.00905	U	0.0215	0.00905	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
m,p-Xylenes	<0.000465	U	0.00215	0.000465	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
MTBE	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Naphthalene	<0.00215	U	0.0108	0.00215	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
n-Butylbenzene	<0.000591	U	0.00538	0.000591	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
N-Propylbenzene	<0.00107	U	0.00538	0.00107	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
o-Xylene	<0.000340	U	0.00108	0.000340	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
p-Cymene (p-Isopropyltoluene)	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
sec-Butylbenzene	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Styrene	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
tert-Butylbenzene	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,1,1,2-Tetrachloroethane	<0.000630	U	0.00538	0.000630	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,1,2,2-Tetrachloroethane	<0.000379	U	0.00538	0.000379	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Tetrachloroethene	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Toluene	<0.00130	U	0.00538	0.00130	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
trans-1,2-Dichloroethene	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
trans-1,3-Dichloropropene	<0.00179	U	0.00538	0.00179	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,2,3-Trichlorobenzene	<0.00146	U	0.00538	0.00146	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,2,4-Trichlorobenzene	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,1,1-Trichloroethane	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,1,2-Trichloroethane	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Trichloroethene	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Trichlorofluoromethane	<0.00192	U	0.00538	0.00192	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,2,3-Trichloropropane	<0.000625	U	0.00538	0.000625	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,2,4-Trimethylbenzene	<0.00169	U	0.00538	0.00169	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,3,5-Trimethylbenzene	<0.00108	U	0.00538	0.00108	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Vinyl chloride	<0.000670	U	0.00538	0.000670	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Xylenes, Total	<0.000465	U	0.00215	0.000465	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Carbon disulfide	<0.000611	U	0.00538	0.000611	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Acetone	<0.0166	U *1	0.108	0.0166	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Methyl acetate	<0.00348	U	0.0538	0.00348	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
4-Methyl-2-pentanone	<0.00573	U	0.0538	0.00573	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.00179	U	0.0108	0.00179	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
2-Hexanone	<0.00816	U	0.0538	0.00816	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Methylcyclohexane	<0.00160	U	0.0108	0.00160	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1
Cyclohexane	<0.00194	U	0.00538	0.00194	mg/Kg	☼	10/10/25 11:33	10/14/25 13:42	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*111*		*56 - 150*	*10/10/25 11:33*	*10/14/25 13:42*	*1*
4-Bromofluorobenzene (Surr)	*93*		*68 - 152*	*10/10/25 11:33*	*10/14/25 13:42*	*1*
Dibromofluoromethane (Surr)	*109*		*53 - 142*	*10/10/25 11:33*	*10/14/25 13:42*	*1*
Toluene-d8 (Surr)	*97*		*70 - 130*	*10/10/25 11:33*	*10/14/25 13:42*	*1*

Method: TCEQ TX 1005 - Texas - Total Petroleum Hydrocarbon (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C6-C12	<27.0	U	54.0	27.0	mg/Kg	☼	10/15/25 11:47	10/16/25 13:32	1

Client Sample ID: SB-2 13-15'

Date Collected: 10/09/25 09:28
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-3

Matrix: Solid
Percent Solids: 84.7

Method: TCEQ TX 1005 - Texas - Total Petroleum Hydrocarbon (GC) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Over C12-C28	**66.3**		54.0	27.0	mg/Kg	☼	10/15/25 11:47	10/16/25 13:32	1
Over C28-C35	<27.0	U	54.0	27.0	mg/Kg	☼	10/15/25 11:47	10/16/25 13:32	1
Total Petroleum Hydrocarbons (C6-C35)	**66.3**		54.0	27.0	mg/Kg			10/16/25 13:32	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctane (Surr)	*77*		*70 - 130*	*10/15/25 11:47*	*10/16/25 13:32*	*1*
o-Terphenyl (Surr)	*79*		*70 - 130*	*10/15/25 11:47*	*10/16/25 13:32*	*1*

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**6.24**		2.15	0.553	mg/Kg	☼	10/14/25 10:30	10/15/25 14:25	5
Barium	**233**		2.15	0.735	mg/Kg	☼	10/14/25 10:30	10/15/25 14:25	5
Cadmium	<0.287	U	1.07	0.287	mg/Kg	☼	10/14/25 10:30	10/15/25 14:25	5
Chromium	**23.1**		2.15	0.290	mg/Kg	☼	10/14/25 10:30	10/15/25 14:25	5
Lead	**10.3**		1.07	0.340	mg/Kg	☼	10/14/25 10:30	10/15/25 14:25	5
Selenium	<0.507	U	1.07	0.507	mg/Kg	☼	10/14/25 10:30	10/15/25 14:25	5
Silver	<0.257	U	1.07	0.257	mg/Kg	☼	10/14/25 10:30	10/15/25 14:25	5

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.0102	U	0.0227	0.0102	mg/Kg	☼	10/15/25 10:55	10/15/25 13:47	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH (SW846 9045D)	**7.9**	**HF**			SU			10/14/25 13:09	1
Temperature (SW846 9045D)	**21.2**	**HF**			Deg. C			10/14/25 13:09	1
Corrosivity (SW846 9045D)	**7.9**	**HF**			SU			10/14/25 13:09	1

Client Sample ID: SB-3 5-8'

Date Collected: 10/09/25 10:00
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-4

Matrix: Solid
Percent Solids: 94.2

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.000353	U	0.000923	0.000353	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Bromobenzene	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Bromochloromethane	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Bromodichloromethane	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Bromoform	<0.00204	U	0.00462	0.00204	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Bromomethane	<0.000858	U *1	0.00462	0.000858	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
2-Butanone	<0.00478	U	0.0462	0.00478	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Carbon tetrachloride	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Chlorobenzene	<0.000575	U	0.00462	0.000575	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Chloroethane	<0.00147	U	0.00923	0.00147	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Chloroform	<0.000484	U	0.00462	0.000484	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Chloromethane	<0.000866	U	0.00462	0.000866	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
4-Chlorotoluene	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
cis-1,2-Dichloroethene	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
cis-1,3-Dichloropropene	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Dibromochloromethane	<0.00157	U	0.00462	0.00157	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Client Sample ID: SB-3 5-8'
Date Collected: 10/09/25 10:00
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-4
Matrix: Solid
Percent Solids: 94.2

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	<0.00230	U	0.00462	0.00230	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,2-Dibromoethane	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,2-Dichlorobenzene	<0.00134	U	0.00462	0.00134	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,3-Dichlorobenzene	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,4-Dichlorobenzene	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Dichlorodifluoromethane	<0.00177	U	0.00462	0.00177	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,1-Dichloroethane	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,2-Dichloroethane	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,1-Dichloroethene	<0.000529	U	0.00462	0.000529	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,2-Dichloropropane	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,3-Dichloropropane	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
2,2-Dichloropropane	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,1-Dichloropropene	<0.000475	U	0.00462	0.000475	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Ethylbenzene	<0.000281	U	0.000923	0.000281	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Hexachlorobutadiene	<0.000642	U	0.00462	0.000642	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Isopropylbenzene	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Methylene Chloride	<0.00777	U	0.0185	0.00777	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
m,p-Xylenes	<0.000400	U	0.00185	0.000400	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
MTBE	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Naphthalene	<0.00185	U	0.00923	0.00185	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
n-Butylbenzene	<0.000508	U	0.00462	0.000508	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
N-Propylbenzene	<0.000916	U	0.00462	0.000916	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
o-Xylene	<0.000292	U	0.000923	0.000292	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
p-Cymene (p-Isopropyltoluene)	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
sec-Butylbenzene	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Styrene	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
tert-Butylbenzene	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,1,1,2-Tetrachloroethane	<0.000541	U	0.00462	0.000541	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,1,2,2-Tetrachloroethane	<0.000326	U	0.00462	0.000326	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Tetrachloroethene	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Toluene	<0.00112	U	0.00462	0.00112	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
trans-1,2-Dichloroethene	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
trans-1,3-Dichloropropene	<0.00154	U	0.00462	0.00154	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,2,3-Trichlorobenzene	<0.00125	U	0.00462	0.00125	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,2,4-Trichlorobenzene	<0.000929	U	0.00462	0.000929	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,1,1-Trichloroethane	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,1,2-Trichloroethane	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Trichloroethene	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Trichlorofluoromethane	<0.00165	U	0.00462	0.00165	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,2,3-Trichloropropane	<0.000537	U	0.00462	0.000537	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,2,4-Trimethylbenzene	<0.00145	U	0.00462	0.00145	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,3,5-Trimethylbenzene	<0.000923	U	0.00462	0.000923	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Vinyl chloride	<0.000576	U	0.00462	0.000576	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Xylenes, Total	<0.000400	U	0.00185	0.000400	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Carbon disulfide	<0.000524	U	0.00462	0.000524	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Acetone	<0.0142	U *1	0.0923	0.0142	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Methyl acetate	<0.00299	U	0.0462	0.00299	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
4-Methyl-2-pentanone	<0.00492	U	0.0462	0.00492	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.00154	U	0.00923	0.00154	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1

Client Sample ID: SB-3 5-8' — Lab Sample ID: 860-113841-4

Date Collected: 10/09/25 10:00 — **Matrix: Solid**
Date Received: 10/10/25 09:19 — **Percent Solids: 94.2**

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Hexanone	<0.00701	U	0.0462	0.00701	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Methylcyclohexane	<0.00138	U	0.00923	0.00138	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1
Cyclohexane	<0.00166	U	0.00462	0.00166	mg/Kg	☼	10/10/25 11:33	10/14/25 14:06	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*112*		*56 - 150*	*10/10/25 11:33*	*10/14/25 14:06*	*1*
4-Bromofluorobenzene (Surr)	*92*		*68 - 152*	*10/10/25 11:33*	*10/14/25 14:06*	*1*
Dibromofluoromethane (Surr)	*108*		*53 - 142*	*10/10/25 11:33*	*10/14/25 14:06*	*1*
Toluene-d8 (Surr)	*97*		*70 - 130*	*10/10/25 11:33*	*10/14/25 14:06*	*1*

Method: TCEQ TX 1005 - Texas - Total Petroleum Hydrocarbon (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C6-C12	<27.2	U	54.4	27.2	mg/Kg	☼	10/15/25 11:47	10/15/25 16:42	1
Over C12-C28	<27.2	U	54.4	27.2	mg/Kg	☼	10/15/25 11:47	10/15/25 16:42	1
Over C28-C35	<27.2	U	54.4	27.2	mg/Kg	☼	10/15/25 11:47	10/15/25 16:42	1
Total Petroleum Hydrocarbons (C6-C35)	<27.2	U	54.4	27.2	mg/Kg			10/15/25 16:42	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctane (Surr)	*76*		*70 - 130*	*10/15/25 11:47*	*10/15/25 16:42*	*1*
o-Terphenyl (Surr)	*81*		*70 - 130*	*10/15/25 11:47*	*10/15/25 16:42*	*1*

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**2.52**		1.97	0.506	mg/Kg	☼	10/14/25 10:30	10/15/25 14:28	5
Barium	**27.6**		1.97	0.674	mg/Kg	☼	10/14/25 10:30	10/15/25 14:28	5
Cadmium	<0.263	U	0.983	0.263	mg/Kg	☼	10/14/25 10:30	10/15/25 14:28	5
Chromium	**25.2**		1.97	0.265	mg/Kg	☼	10/14/25 10:30	10/15/25 14:28	5
Lead	**7.77**		0.983	0.312	mg/Kg	☼	10/14/25 10:30	10/15/25 14:28	5
Selenium	<0.465	U	0.983	0.465	mg/Kg	☼	10/14/25 10:30	10/15/25 14:28	5
Silver	<0.235	U	0.983	0.235	mg/Kg	☼	10/14/25 10:30	10/15/25 14:28	5

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.00950	U	0.0212	0.00950	mg/Kg	☼	10/15/25 10:55	10/15/25 13:48	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH (SW846 9045D)	**8.4**	**HF**			SU			10/14/25 13:10	1
Temperature (SW846 9045D)	**21.3**	**HF**			Deg. C			10/14/25 13:10	1
Corrosivity (SW846 9045D)	**8.4**	**HF**			SU			10/14/25 13:10	1

Client Sample ID: SB-4 3-5' — Lab Sample ID: 860-113841-5

Date Collected: 10/09/25 12:02 — **Matrix: Solid**
Date Received: 10/10/25 09:19 — **Percent Solids: 90.2**

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.000374	U	0.000978	0.000374	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Bromobenzene	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Bromochloromethane	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Bromodichloromethane	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Client Sample ID: SB-4 3-5'
Date Collected: 10/09/25 12:02
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-5
Matrix: Solid
Percent Solids: 90.2

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromoform	<0.00216	U	0.00489	0.00216	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Bromomethane	<0.000909	U *1	0.00489	0.000909	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
2-Butanone	<0.00506	U	0.0489	0.00506	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Carbon tetrachloride	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Chlorobenzene	<0.000610	U	0.00489	0.000610	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Chloroethane	<0.00156	U	0.00978	0.00156	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Chloroform	<0.000513	U	0.00489	0.000513	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Chloromethane	<0.000917	U	0.00489	0.000917	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
4-Chlorotoluene	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
cis-1,2-Dichloroethene	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
cis-1,3-Dichloropropene	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Dibromochloromethane	<0.00166	U	0.00489	0.00166	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,2-Dibromo-3-Chloropropane	<0.00244	U	0.00489	0.00244	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,2-Dibromoethane	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,2-Dichlorobenzene	<0.00142	U	0.00489	0.00142	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,3-Dichlorobenzene	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,4-Dichlorobenzene	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Dichlorodifluoromethane	<0.00187	U	0.00489	0.00187	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,1-Dichloroethane	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,2-Dichloroethane	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,1-Dichloroethene	<0.000561	U	0.00489	0.000561	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,2-Dichloropropane	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,3-Dichloropropane	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
2,2-Dichloropropane	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,1-Dichloropropene	<0.000503	U	0.00489	0.000503	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Ethylbenzene	<0.000298	U	0.000978	0.000298	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Hexachlorobutadiene	<0.000680	U	0.00489	0.000680	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Isopropylbenzene	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Methylene Chloride	<0.00824	U	0.0196	0.00824	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
m,p-Xylenes	<0.000423	U	0.00196	0.000423	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
MTBE	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Naphthalene	<0.00196	U	0.00978	0.00196	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
n-Butylbenzene	<0.000538	U	0.00489	0.000538	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
N-Propylbenzene	<0.000970	U	0.00489	0.000970	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
o-Xylene	<0.000309	U	0.000978	0.000309	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
p-Cymene (p-Isopropyltoluene)	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
sec-Butylbenzene	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Styrene	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
tert-Butylbenzene	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,1,1,2-Tetrachloroethane	<0.000573	U	0.00489	0.000573	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,1,2,2-Tetrachloroethane	<0.000345	U	0.00489	0.000345	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Tetrachloroethene	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Toluene	<0.00118	U	0.00489	0.00118	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
trans-1,2-Dichloroethene	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
trans-1,3-Dichloropropene	<0.00163	U	0.00489	0.00163	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,2,3-Trichlorobenzene	<0.00133	U	0.00489	0.00133	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,2,4-Trichlorobenzene	<0.000984	U	0.00489	0.000984	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,1,1-Trichloroethane	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,1,2-Trichloroethane	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1

Client Sample ID: SB-4 3-5'

Date Collected: 10/09/25 12:02
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-5

Matrix: Solid
Percent Solids: 90.2

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Trichloroethene	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Trichlorofluoromethane	<0.00174	U	0.00489	0.00174	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,2,3-Trichloropropane	<0.000569	U	0.00489	0.000569	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,2,4-Trimethylbenzene	<0.00154	U	0.00489	0.00154	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,3,5-Trimethylbenzene	<0.000978	U	0.00489	0.000978	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Vinyl chloride	<0.000610	U	0.00489	0.000610	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Xylenes, Total	<0.000423	U	0.00196	0.000423	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Carbon disulfide	<0.000555	U	0.00489	0.000555	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Acetone	<0.0151	U *1	0.0978	0.0151	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Methyl acetate	<0.00317	U	0.0489	0.00317	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
4-Methyl-2-pentanone	<0.00522	U	0.0489	0.00522	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.00163	U	0.00978	0.00163	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
2-Hexanone	<0.00742	U	0.0489	0.00742	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Methylcyclohexane	<0.00146	U	0.00978	0.00146	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1
Cyclohexane	<0.00176	U	0.00489	0.00176	mg/Kg	☼	10/10/25 11:33	10/14/25 14:30	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*115*		*56 - 150*	*10/10/25 11:33*	*10/14/25 14:30*	*1*
4-Bromofluorobenzene (Surr)	*95*		*68 - 152*	*10/10/25 11:33*	*10/14/25 14:30*	*1*
Dibromofluoromethane (Surr)	*112*		*53 - 142*	*10/10/25 11:33*	*10/14/25 14:30*	*1*
Toluene-d8 (Surr)	*95*		*70 - 130*	*10/10/25 11:33*	*10/14/25 14:30*	*1*

Method: TCEQ TX 1005 - Texas - Total Petroleum Hydrocarbon (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C6-C12	<28.9	U	57.7	28.9	mg/Kg	☼	10/15/25 11:47	10/16/25 13:47	1
Over C12-C28	**45.5**	**J**	57.7	28.9	mg/Kg	☼	10/15/25 11:47	10/16/25 13:47	1
Over C28-C35	<28.9	U	57.7	28.9	mg/Kg	☼	10/15/25 11:47	10/16/25 13:47	1
Total Petroleum Hydrocarbons (C6-C35)	**45.5**	**J**	57.7	28.9	mg/Kg			10/16/25 13:47	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctane (Surr)	*74*		*70 - 130*	*10/15/25 11:47*	*10/16/25 13:47*	*1*
o-Terphenyl (Surr)	*76*		*70 - 130*	*10/15/25 11:47*	*10/16/25 13:47*	*1*

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**4.28**		1.98	0.510	mg/Kg	☼	10/14/25 10:30	10/15/25 14:32	5
Barium	**129**		1.98	0.678	mg/Kg	☼	10/14/25 10:30	10/15/25 14:32	5
Cadmium	<0.264	U	0.990	0.264	mg/Kg	☼	10/14/25 10:30	10/15/25 14:32	5
Chromium	**10.9**		1.98	0.267	mg/Kg	☼	10/14/25 10:30	10/15/25 14:32	5
Lead	**7.96**		0.990	0.314	mg/Kg	☼	10/14/25 10:30	10/15/25 14:32	5
Selenium	<0.468	U	0.990	0.468	mg/Kg	☼	10/14/25 10:30	10/15/25 14:32	5
Silver	<0.237	U	0.990	0.237	mg/Kg	☼	10/14/25 10:30	10/15/25 14:32	5

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.00993	U	0.0222	0.00993	mg/Kg	☼	10/15/25 10:55	10/15/25 13:50	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH (SW846 9045D)	**8.9**	**HF**			SU			10/14/25 13:10	1

Client Sample ID: SB-4 3-5'
Lab Sample ID: 860-113841-5
Date Collected: 10/09/25 12:02 **Matrix: Solid**
Date Received: 10/10/25 09:19 **Percent Solids: 90.2**

General Chemistry - Soluble (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature (SW846 9045D)	21.2	HF			Deg. C			10/14/25 13:10	1
Corrosivity (SW846 9045D)	8.9	HF			SU			10/14/25 13:10	1

Client Sample ID: SB-4 10-12'
Lab Sample ID: 860-113841-6
Date Collected: 10/09/25 12:16 **Matrix: Solid**
Date Received: 10/10/25 09:19 **Percent Solids: 90.0**

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.000289	U	0.000754	0.000289	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Bromobenzene	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Bromochloromethane	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Bromodichloromethane	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Bromoform	<0.00167	U	0.00377	0.00167	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Bromomethane	<0.000701	U *1	0.00377	0.000701	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
2-Butanone	<0.00390	U	0.0377	0.00390	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Carbon tetrachloride	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Chlorobenzene	<0.000470	U	0.00377	0.000470	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Chloroethane	<0.00120	U	0.00754	0.00120	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Chloroform	<0.000396	U	0.00377	0.000396	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Chloromethane	<0.000708	U	0.00377	0.000708	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
4-Chlorotoluene	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
cis-1,2-Dichloroethene	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
cis-1,3-Dichloropropene	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Dibromochloromethane	<0.00128	U	0.00377	0.00128	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,2-Dibromo-3-Chloropropane	<0.00188	U	0.00377	0.00188	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,2-Dibromoethane	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,2-Dichlorobenzene	<0.00110	U	0.00377	0.00110	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,3-Dichlorobenzene	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,4-Dichlorobenzene	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Dichlorodifluoromethane	<0.00144	U	0.00377	0.00144	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,1-Dichloroethane	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,2-Dichloroethane	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,1-Dichloroethene	<0.000433	U	0.00377	0.000433	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,2-Dichloropropane	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,3-Dichloropropane	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
2,2-Dichloropropane	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,1-Dichloropropene	<0.000388	U	0.00377	0.000388	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Ethylbenzene	<0.000230	U	0.000754	0.000230	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Hexachlorobutadiene	<0.000525	U	0.00377	0.000525	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Isopropylbenzene	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Methylene Chloride	<0.00635	U	0.0151	0.00635	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
m,p-Xylenes	<0.000327	U	0.00151	0.000327	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
MTBE	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Naphthalene	<0.00151	U	0.00754	0.00151	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
n-Butylbenzene	<0.000415	U	0.00377	0.000415	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
N-Propylbenzene	<0.000748	U	0.00377	0.000748	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
o-Xylene	<0.000238	U	0.000754	0.000238	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
p-Cymene (p-Isopropyltoluene)	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
sec-Butylbenzene	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Client Sample ID: SB-4 10-12'

Date Collected: 10/09/25 12:16
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-6

Matrix: Solid
Percent Solids: 90.0

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Styrene	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
tert-Butylbenzene	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,1,1,2-Tetrachloroethane	<0.000442	U	0.00377	0.000442	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,1,2,2-Tetrachloroethane	<0.000266	U	0.00377	0.000266	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Tetrachloroethene	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Toluene	<0.000914	U	0.00377	0.000914	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
trans-1,2-Dichloroethene	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
trans-1,3-Dichloropropene	<0.00126	U	0.00377	0.00126	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,2,3-Trichlorobenzene	<0.00102	U	0.00377	0.00102	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,2,4-Trichlorobenzene	<0.000759	U	0.00377	0.000759	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,1,1-Trichloroethane	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,1,2-Trichloroethane	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Trichloroethene	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Trichlorofluoromethane	<0.00135	U	0.00377	0.00135	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,2,3-Trichloropropane	<0.000439	U	0.00377	0.000439	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,2,4-Trimethylbenzene	<0.00119	U	0.00377	0.00119	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,3,5-Trimethylbenzene	<0.000754	U	0.00377	0.000754	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Vinyl chloride	<0.000470	U	0.00377	0.000470	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Xylenes, Total	<0.000327	U	0.00151	0.000327	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Carbon disulfide	<0.000428	U	0.00377	0.000428	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Acetone	<0.0116	U *1	0.0754	0.0116	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Methyl acetate	<0.00244	U	0.0377	0.00244	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
4-Methyl-2-pentanone	<0.00402	U	0.0377	0.00402	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.00126	U	0.00754	0.00126	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
2-Hexanone	<0.00572	U	0.0377	0.00572	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Methylcyclohexane	<0.00113	U	0.00754	0.00113	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1
Cyclohexane	<0.00136	U	0.00377	0.00136	mg/Kg	☼	10/10/25 11:33	10/14/25 14:54	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*115*		*56 - 150*	*10/10/25 11:33*	*10/14/25 14:54*	*1*
4-Bromofluorobenzene (Surr)	*92*		*68 - 152*	*10/10/25 11:33*	*10/14/25 14:54*	*1*
Dibromofluoromethane (Surr)	*109*		*53 - 142*	*10/10/25 11:33*	*10/14/25 14:54*	*1*
Toluene-d8 (Surr)	*96*		*70 - 130*	*10/10/25 11:33*	*10/14/25 14:54*	*1*

Method: TCEQ TX 1005 - Texas - Total Petroleum Hydrocarbon (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C6-C12	<26.3	U	52.6	26.3	mg/Kg	☼	10/15/25 11:47	10/16/25 14:03	1
Over C12-C28	<26.3	U	52.6	26.3	mg/Kg	☼	10/15/25 11:47	10/16/25 14:03	1
Over C28-C35	<26.3	U	52.6	26.3	mg/Kg	☼	10/15/25 11:47	10/16/25 14:03	1
Total Petroleum Hydrocarbons (C6-C35)	<26.3	U	52.6	26.3	mg/Kg			10/16/25 14:03	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctane (Surr)	*74*		*70 - 130*	*10/15/25 11:47*	*10/16/25 14:03*	*1*
o-Terphenyl (Surr)	*75*		*70 - 130*	*10/15/25 11:47*	*10/16/25 14:03*	*1*

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**4.35**		2.06	0.530	mg/Kg	☼	10/14/25 10:30	10/15/25 14:35	5
Barium	**155**		2.06	0.704	mg/Kg	☼	10/14/25 10:30	10/15/25 14:35	5
Cadmium	<0.275	U	1.03	0.275	mg/Kg	☼	10/14/25 10:30	10/15/25 14:35	5

Client Sample ID: SB-4 10-12'

Lab Sample ID: 860-113841-6
Date Collected: 10/09/25 12:16
Matrix: Solid
Date Received: 10/10/25 09:19
Percent Solids: 90.0

Method: SW846 6020B - Metals (ICP/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chromium	8.55		2.06	0.278	mg/Kg	☼	10/14/25 10:30	10/15/25 14:35	5
Lead	5.79		1.03	0.326	mg/Kg	☼	10/14/25 10:30	10/15/25 14:35	5
Selenium	<0.486	U	1.03	0.486	mg/Kg	☼	10/14/25 10:30	10/15/25 14:35	5
Silver	<0.246	U	1.03	0.246	mg/Kg	☼	10/14/25 10:30	10/15/25 14:35	5

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.00904	U	0.0202	0.00904	mg/Kg	☼	10/15/25 10:55	10/15/25 13:51	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH (SW846 9045D)	8.8	HF			SU			10/14/25 13:10	1
Temperature (SW846 9045D)	21.2	HF			Deg. C			10/14/25 13:10	1
Corrosivity (SW846 9045D)	8.8	HF			SU			10/14/25 13:10	1

Client Sample ID: SB-5 1-5'

Lab Sample ID: 860-113841-7
Date Collected: 10/09/25 12:55
Matrix: Solid
Date Received: 10/10/25 09:19
Percent Solids: 84.3

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.000344	U	0.000899	0.000344	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Bromobenzene	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Bromochloromethane	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Bromodichloromethane	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Bromoform	<0.00199	U	0.00449	0.00199	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Bromomethane	<0.000835	U *1	0.00449	0.000835	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
2-Butanone	<0.00465	U	0.0449	0.00465	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Carbon tetrachloride	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Chlorobenzene	<0.000560	U	0.00449	0.000560	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Chloroethane	<0.00143	U	0.00899	0.00143	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Chloroform	<0.000471	U	0.00449	0.000471	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Chloromethane	<0.000843	U	0.00449	0.000843	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
4-Chlorotoluene	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
cis-1,2-Dichloroethene	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
cis-1,3-Dichloropropene	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Dibromochloromethane	<0.00153	U	0.00449	0.00153	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,2-Dibromo-3-Chloropropane	<0.00224	U	0.00449	0.00224	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,2-Dibromoethane	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,2-Dichlorobenzene	<0.00131	U	0.00449	0.00131	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,3-Dichlorobenzene	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,4-Dichlorobenzene	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Dichlorodifluoromethane	<0.00172	U	0.00449	0.00172	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,1-Dichloroethane	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,2-Dichloroethane	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,1-Dichloroethene	<0.000515	U	0.00449	0.000515	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,2-Dichloropropane	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,3-Dichloropropane	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
2,2-Dichloropropane	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,1-Dichloropropene	<0.000463	U	0.00449	0.000463	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Client Sample ID: SB-5 1-5'
Date Collected: 10/09/25 12:55
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-7
Matrix: Solid
Percent Solids: 84.3

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethylbenzene	<0.000274	U	0.000899	0.000274	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Hexachlorobutadiene	<0.000625	U	0.00449	0.000625	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Isopropylbenzene	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Methylene Chloride	<0.00757	U	0.0180	0.00757	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
m,p-Xylenes	<0.000389	U	0.00180	0.000389	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
MTBE	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Naphthalene	<0.00180	U	0.00899	0.00180	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
n-Butylbenzene	<0.000494	U	0.00449	0.000494	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
N-Propylbenzene	<0.000891	U	0.00449	0.000891	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
o-Xylene	<0.000284	U	0.000899	0.000284	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
p-Cymene (p-Isopropyltoluene)	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
sec-Butylbenzene	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Styrene	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
tert-Butylbenzene	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,1,1,2-Tetrachloroethane	<0.000527	U	0.00449	0.000527	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,1,2,2-Tetrachloroethane	<0.000317	U	0.00449	0.000317	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Tetrachloroethene	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Toluene	<0.00109	U	0.00449	0.00109	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
trans-1,2-Dichloroethene	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
trans-1,3-Dichloropropene	<0.00150	U	0.00449	0.00150	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,2,3-Trichlorobenzene	<0.00122	U	0.00449	0.00122	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,2,4-Trichlorobenzene	<0.000904	U	0.00449	0.000904	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,1,1-Trichloroethane	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,1,2-Trichloroethane	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Trichloroethene	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Trichlorofluoromethane	<0.00160	U	0.00449	0.00160	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,2,3-Trichloropropane	<0.000522	U	0.00449	0.000522	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,2,4-Trimethylbenzene	<0.00141	U	0.00449	0.00141	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,3,5-Trimethylbenzene	<0.000899	U	0.00449	0.000899	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Vinyl chloride	<0.000560	U	0.00449	0.000560	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Xylenes, Total	<0.000389	U	0.00180	0.000389	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Carbon disulfide	<0.000510	U	0.00449	0.000510	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Acetone	<0.0138	U *1	0.0899	0.0138	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Methyl acetate	<0.00291	U	0.0449	0.00291	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
4-Methyl-2-pentanone	<0.00479	U	0.0449	0.00479	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.00150	U	0.00899	0.00150	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
2-Hexanone	<0.00682	U	0.0449	0.00682	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Methylcyclohexane	<0.00134	U	0.00899	0.00134	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1
Cyclohexane	<0.00162	U	0.00449	0.00162	mg/Kg	☼	10/10/25 11:33	10/14/25 15:18	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*124*		*56 - 150*	*10/10/25 11:33*	*10/14/25 15:18*	*1*
4-Bromofluorobenzene (Surr)	*95*		*68 - 152*	*10/10/25 11:33*	*10/14/25 15:18*	*1*
Dibromofluoromethane (Surr)	*111*		*53 - 142*	*10/10/25 11:33*	*10/14/25 15:18*	*1*
Toluene-d8 (Surr)	*94*		*70 - 130*	*10/10/25 11:33*	*10/14/25 15:18*	*1*

Method: TCEQ TX 1005 - Texas - Total Petroleum Hydrocarbon (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C6-C12	<27.5	U	55.1	27.5	mg/Kg	☼	10/15/25 11:47	10/15/25 17:44	1
Over C12-C28	<27.5	U	55.1	27.5	mg/Kg	☼	10/15/25 11:47	10/15/25 17:44	1

Client Sample ID: SB-5 1-5'

Date Collected: 10/09/25 12:55
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-7

Matrix: Solid
Percent Solids: 84.3

Method: TCEQ TX 1005 - Texas - Total Petroleum Hydrocarbon (GC) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Over C28-C35	<27.5	U	55.1	27.5	mg/Kg	☼	10/15/25 11:47	10/15/25 17:44	1
Total Petroleum Hydrocarbons (C6-C35)	<27.5	U	55.1	27.5	mg/Kg			10/15/25 17:44	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctane (Surr)	*70*		*70 - 130*	*10/15/25 11:47*	*10/15/25 17:44*	*1*
o-Terphenyl (Surr)	*75*		*70 - 130*	*10/15/25 11:47*	*10/15/25 17:44*	*1*

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**3.22**		2.12	0.545	mg/Kg	☼	10/14/25 10:30	10/15/25 14:38	5
Barium	**318**		2.12	0.726	mg/Kg	☼	10/14/25 10:30	10/15/25 14:38	5
Cadmium	<0.283	U	1.06	0.283	mg/Kg	☼	10/14/25 10:30	10/15/25 14:38	5
Chromium	**6.47**		2.12	0.286	mg/Kg	☼	10/14/25 10:30	10/15/25 14:38	5
Lead	**4.73**		1.06	0.336	mg/Kg	☼	10/14/25 10:30	10/15/25 14:38	5
Selenium	<0.500	U	1.06	0.500	mg/Kg	☼	10/14/25 10:30	10/15/25 14:38	5
Silver	<0.253	U	1.06	0.253	mg/Kg	☼	10/14/25 10:30	10/15/25 14:38	5

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.00948	U	0.0212	0.00948	mg/Kg	☼	10/15/25 10:55	10/15/25 13:53	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH (SW846 9045D)	**8.8**	**HF**			SU			10/14/25 13:10	1
Temperature (SW846 9045D)	**21.3**	**HF**			Deg. C			10/14/25 13:10	1
Corrosivity (SW846 9045D)	**8.8**	**HF**			SU			10/14/25 13:10	1

Client Sample ID: TMW-1

Date Collected: 10/09/25 08:41
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-8

Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.000460	U	0.00100	0.000460	mg/L			10/16/25 12:01	1
Bromobenzene	<0.000486	U	0.00100	0.000486	mg/L			10/16/25 12:01	1
Bromochloromethane	<0.000577	U	0.00100	0.000577	mg/L			10/16/25 12:01	1
Bromodichloromethane	<0.000552	U	0.00100	0.000552	mg/L			10/16/25 12:01	1
Bromoform	<0.000633	U	0.00500	0.000633	mg/L			10/16/25 12:01	1
Bromomethane	<0.00142	U	0.00500	0.00142	mg/L			10/16/25 12:01	1
2-Butanone	<0.00828	U	0.0500	0.00828	mg/L			10/16/25 12:01	1
Carbon tetrachloride	<0.000896	U	0.00200	0.000896	mg/L			10/16/25 12:01	1
Chlorobenzene	<0.000455	U	0.00100	0.000455	mg/L			10/16/25 12:01	1
Chloroethane	<0.00198	U	0.0100	0.00198	mg/L			10/16/25 12:01	1
Chloroform	<0.000464	U	0.00100	0.000464	mg/L			10/16/25 12:01	1
Chloromethane	<0.00204	U	0.0100	0.00204	mg/L			10/16/25 12:01	1
4-Chlorotoluene	<0.000386	U	0.00100	0.000386	mg/L			10/16/25 12:01	1
cis-1,2-Dichloroethene	<0.000457	U	0.00100	0.000457	mg/L			10/16/25 12:01	1
cis-1,3-Dichloropropene	<0.00107	U	0.00500	0.00107	mg/L			10/16/25 12:01	1
Dibromochloromethane	<0.000547	U	0.00500	0.000547	mg/L			10/16/25 12:01	1
1,2-Dibromo-3-Chloropropane	<0.000671	U	0.00500	0.000671	mg/L			10/16/25 12:01	1

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Client Sample ID: TMW-1
Date Collected: 10/09/25 08:41
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-8
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane	<0.000999	U	0.00500	0.000999	mg/L			10/16/25 12:01	1
1,2-Dichlorobenzene	<0.000429	U	0.00100	0.000429	mg/L			10/16/25 12:01	1
1,3-Dichlorobenzene	<0.000413	U	0.00100	0.000413	mg/L			10/16/25 12:01	1
1,4-Dichlorobenzene	<0.000449	U	0.00100	0.000449	mg/L			10/16/25 12:01	1
Dichlorodifluoromethane	<0.000785	U	0.00100	0.000785	mg/L			10/16/25 12:01	1
1,1-Dichloroethane	<0.000635	U	0.00100	0.000635	mg/L			10/16/25 12:01	1
1,2-Dichloroethane	<0.000372	U	0.00100	0.000372	mg/L			10/16/25 12:01	1
1,1-Dichloroethene	<0.000738	U	0.00100	0.000738	mg/L			10/16/25 12:01	1
1,2-Dichloropropane	<0.000556	U	0.00500	0.000556	mg/L			10/16/25 12:01	1
1,3-Dichloropropane	<0.000514	U	0.00500	0.000514	mg/L			10/16/25 12:01	1
2,2-Dichloropropane	<0.000679	U	0.00500	0.000679	mg/L			10/16/25 12:01	1
1,1-Dichloropropene	<0.000624	U	0.00500	0.000624	mg/L			10/16/25 12:01	1
Ethylbenzene	<0.000385	U	0.00100	0.000385	mg/L			10/16/25 12:01	1
Hexachlorobutadiene	<0.000627	U	0.00500	0.000627	mg/L			10/16/25 12:01	1
Isopropylbenzene	<0.000592	U	0.00100	0.000592	mg/L			10/16/25 12:01	1
Methylene Chloride	<0.00173	U	0.00500	0.00173	mg/L			10/16/25 12:01	1
m,p-Xylenes	<0.00124	U	0.00200	0.00124	mg/L			10/16/25 12:01	1
MTBE	<0.00139	U	0.00500	0.00139	mg/L			10/16/25 12:01	1
Naphthalene	<0.00135	U	0.0100	0.00135	mg/L			10/16/25 12:01	1
n-Butylbenzene	<0.000510	U	0.00100	0.000510	mg/L			10/16/25 12:01	1
N-Propylbenzene	<0.000429	U	0.00100	0.000429	mg/L			10/16/25 12:01	1
o-Xylene	<0.000502	U	0.00100	0.000502	mg/L			10/16/25 12:01	1
p-Cymene (p-Isopropyltoluene)	<0.000676	U	0.00100	0.000676	mg/L			10/16/25 12:01	1
sec-Butylbenzene	<0.000468	U	0.00100	0.000468	mg/L			10/16/25 12:01	1
Styrene	<0.000619	U	0.00100	0.000619	mg/L			10/16/25 12:01	1
tert-Butylbenzene	<0.000442	U	0.00100	0.000442	mg/L			10/16/25 12:01	1
1,1,1,2-Tetrachloroethane	<0.000644	U	0.00100	0.000644	mg/L			10/16/25 12:01	1
1,1,2,2-Tetrachloroethane	<0.000470	U	0.00100	0.000470	mg/L			10/16/25 12:01	1
Tetrachloroethene	<0.000655	U	0.00100	0.000655	mg/L			10/16/25 12:01	1
Toluene	<0.000475	U	0.00100	0.000475	mg/L			10/16/25 12:01	1
trans-1,2-Dichloroethene	<0.000368	U	0.00100	0.000368	mg/L			10/16/25 12:01	1
trans-1,3-Dichloropropene	<0.00127	U	0.00500	0.00127	mg/L			10/16/25 12:01	1
1,2,3-Trichlorobenzene	<0.00177	U	0.00500	0.00177	mg/L			10/16/25 12:01	1
1,2,4-Trichlorobenzene	<0.00175	U	0.00500	0.00175	mg/L			10/16/25 12:01	1
1,1,1-Trichloroethane	<0.000585	U	0.00500	0.000585	mg/L			10/16/25 12:01	1
1,1,2-Trichloroethane	<0.000411	U	0.00100	0.000411	mg/L			10/16/25 12:01	1
Trichloroethene	<0.00150	U	0.00500	0.00150	mg/L			10/16/25 12:01	1
Trichlorofluoromethane	<0.000560	U	0.00100	0.000560	mg/L			10/16/25 12:01	1
1,2,3-Trichloropropane	<0.000470	U	0.00100	0.000470	mg/L			10/16/25 12:01	1
1,2,4-Trimethylbenzene	<0.000417	U	0.00100	0.000417	mg/L			10/16/25 12:01	1
1,3,5-Trimethylbenzene	<0.000411	U	0.00100	0.000411	mg/L			10/16/25 12:01	1
Vinyl chloride	<0.000428	U	0.00200	0.000428	mg/L			10/16/25 12:01	1
Xylenes, Total	<0.00124	U	0.00200	0.00124	mg/L			10/16/25 12:01	1
Carbon disulfide	<0.00165	U	0.00500	0.00165	mg/L			10/16/25 12:01	1
Acetone	<0.00307	U	0.100	0.00307	mg/L			10/16/25 12:01	1
Methyl acetate	<0.00401	U	0.0200	0.00401	mg/L			10/16/25 12:01	1
4-Methyl-2-pentanone	<0.00500	U	0.0500	0.00500	mg/L			10/16/25 12:01	1
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.00111	U	0.0100	0.00111	mg/L			10/16/25 12:01	1
2-Hexanone	<0.00500	U	0.0500	0.00500	mg/L			10/16/25 12:01	1

Client Sample ID: TMW-1

Date Collected: 10/09/25 08:41
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-8

Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methylcyclohexane	<0.000608	U	0.0100	0.000608	mg/L			10/16/25 12:01	1
Cyclohexane	<0.00129	U	0.00500	0.00129	mg/L			10/16/25 12:01	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*108*		*63 - 144*		*10/16/25 12:01*	*1*
4-Bromofluorobenzene (Surr)	*100*		*74 - 124*		*10/16/25 12:01*	*1*
Dibromofluoromethane (Surr)	*105*		*75 - 131*		*10/16/25 12:01*	*1*
Toluene-d8 (Surr)	*98*		*80 - 120*		*10/16/25 12:01*	*1*

Method: TCEQ TX 1005 - Texas - Total Petroleum Hydrocarbon (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C6-C12	<0.838	U	4.73	0.838	mg/L		10/14/25 15:27	10/15/25 06:04	1
Over C12-C28	<0.817	U	4.73	0.817	mg/L		10/14/25 15:27	10/15/25 06:04	1
Over C28-C35	<0.817	U	4.73	0.817	mg/L		10/14/25 15:27	10/15/25 06:04	1
Total Petroleum Hydrocarbons (C6-C35)	<0.838	U	4.73	0.838	mg/L			10/15/25 06:04	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctane (Surr)	*86*		*70 - 130*	*10/14/25 15:27*	*10/15/25 06:04*	*1*
o-Terphenyl (Surr)	*94*		*70 - 130*	*10/14/25 15:27*	*10/15/25 06:04*	*1*

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.00177**	**J**	0.00400	0.000690	mg/L		10/14/25 09:00	10/14/25 21:40	1
Barium	**0.0441**		0.00400	0.00134	mg/L		10/14/25 09:00	10/14/25 21:40	1
Cadmium	<0.000240	U	0.00200	0.000240	mg/L		10/14/25 09:00	10/14/25 21:40	1
Chromium	**0.00321**	**J**	0.00400	0.000560	mg/L		10/14/25 09:00	10/14/25 21:40	1
Lead	<0.000367	U	0.00200	0.000367	mg/L		10/14/25 09:00	10/14/25 21:40	1
Selenium	**0.00181**	**J**	0.00200	0.000590	mg/L		10/14/25 09:00	10/14/25 21:40	1
Silver	<0.000390	U	0.00200	0.000390	mg/L		10/14/25 09:00	10/14/25 21:40	1

Method: SW846 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.0000706	U	0.000200	0.0000706	mg/L		10/14/25 14:02	10/14/25 20:58	1

Client Sample ID: TMW-3

Date Collected: 10/09/25 10:24
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-9

Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.000460	U	0.00100	0.000460	mg/L			10/16/25 12:21	1
Bromobenzene	<0.000486	U	0.00100	0.000486	mg/L			10/16/25 12:21	1
Bromochloromethane	<0.000577	U	0.00100	0.000577	mg/L			10/16/25 12:21	1
Bromodichloromethane	<0.000552	U	0.00100	0.000552	mg/L			10/16/25 12:21	1
Bromoform	<0.000633	U	0.00500	0.000633	mg/L			10/16/25 12:21	1
Bromomethane	<0.00142	U	0.00500	0.00142	mg/L			10/16/25 12:21	1
2-Butanone	<0.00828	U	0.0500	0.00828	mg/L			10/16/25 12:21	1
Carbon tetrachloride	<0.000896	U	0.00200	0.000896	mg/L			10/16/25 12:21	1
Chlorobenzene	<0.000455	U	0.00100	0.000455	mg/L			10/16/25 12:21	1
Chloroethane	<0.00198	U	0.0100	0.00198	mg/L			10/16/25 12:21	1

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Client Sample ID: TMW-3
Date Collected: 10/09/25 10:24
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-9
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloroform	<0.000464	U	0.00100	0.000464	mg/L			10/16/25 12:21	1
Chloromethane	<0.00204	U	0.0100	0.00204	mg/L			10/16/25 12:21	1
4-Chlorotoluene	<0.000386	U	0.00100	0.000386	mg/L			10/16/25 12:21	1
cis-1,2-Dichloroethene	<0.000457	U	0.00100	0.000457	mg/L			10/16/25 12:21	1
cis-1,3-Dichloropropene	<0.00107	U	0.00500	0.00107	mg/L			10/16/25 12:21	1
Dibromochloromethane	<0.000547	U	0.00500	0.000547	mg/L			10/16/25 12:21	1
1,2-Dibromo-3-Chloropropane	<0.000671	U	0.00500	0.000671	mg/L			10/16/25 12:21	1
1,2-Dibromoethane	<0.000999	U	0.00500	0.000999	mg/L			10/16/25 12:21	1
1,2-Dichlorobenzene	<0.000429	U	0.00100	0.000429	mg/L			10/16/25 12:21	1
1,3-Dichlorobenzene	<0.000413	U	0.00100	0.000413	mg/L			10/16/25 12:21	1
1,4-Dichlorobenzene	<0.000449	U	0.00100	0.000449	mg/L			10/16/25 12:21	1
Dichlorodifluoromethane	<0.000785	U	0.00100	0.000785	mg/L			10/16/25 12:21	1
1,1-Dichloroethane	<0.000635	U	0.00100	0.000635	mg/L			10/16/25 12:21	1
1,2-Dichloroethane	<0.000372	U	0.00100	0.000372	mg/L			10/16/25 12:21	1
1,1-Dichloroethene	<0.000738	U	0.00100	0.000738	mg/L			10/16/25 12:21	1
1,2-Dichloropropane	<0.000556	U	0.00500	0.000556	mg/L			10/16/25 12:21	1
1,3-Dichloropropane	<0.000514	U	0.00500	0.000514	mg/L			10/16/25 12:21	1
2,2-Dichloropropane	<0.000679	U	0.00500	0.000679	mg/L			10/16/25 12:21	1
1,1-Dichloropropene	<0.000624	U	0.00500	0.000624	mg/L			10/16/25 12:21	1
Ethylbenzene	<0.000385	U	0.00100	0.000385	mg/L			10/16/25 12:21	1
Hexachlorobutadiene	<0.000627	U	0.00500	0.000627	mg/L			10/16/25 12:21	1
Isopropylbenzene	<0.000592	U	0.00100	0.000592	mg/L			10/16/25 12:21	1
Methylene Chloride	<0.00173	U	0.00500	0.00173	mg/L			10/16/25 12:21	1
m,p-Xylenes	<0.00124	U	0.00200	0.00124	mg/L			10/16/25 12:21	1
MTBE	<0.00139	U	0.00500	0.00139	mg/L			10/16/25 12:21	1
Naphthalene	<0.00135	U	0.0100	0.00135	mg/L			10/16/25 12:21	1
n-Butylbenzene	<0.000510	U	0.00100	0.000510	mg/L			10/16/25 12:21	1
N-Propylbenzene	<0.000429	U	0.00100	0.000429	mg/L			10/16/25 12:21	1
o-Xylene	<0.000502	U	0.00100	0.000502	mg/L			10/16/25 12:21	1
p-Cymene (p-Isopropyltoluene)	<0.000676	U	0.00100	0.000676	mg/L			10/16/25 12:21	1
sec-Butylbenzene	<0.000468	U	0.00100	0.000468	mg/L			10/16/25 12:21	1
Styrene	<0.000619	U	0.00100	0.000619	mg/L			10/16/25 12:21	1
tert-Butylbenzene	<0.000442	U	0.00100	0.000442	mg/L			10/16/25 12:21	1
1,1,1,2-Tetrachloroethane	<0.000644	U	0.00100	0.000644	mg/L			10/16/25 12:21	1
1,1,2,2-Tetrachloroethane	<0.000470	U	0.00100	0.000470	mg/L			10/16/25 12:21	1
Tetrachloroethene	<0.000655	U	0.00100	0.000655	mg/L			10/16/25 12:21	1
Toluene	<0.000475	U	0.00100	0.000475	mg/L			10/16/25 12:21	1
trans-1,2-Dichloroethene	<0.000368	U	0.00100	0.000368	mg/L			10/16/25 12:21	1
trans-1,3-Dichloropropene	<0.00127	U	0.00500	0.00127	mg/L			10/16/25 12:21	1
1,2,3-Trichlorobenzene	<0.00177	U	0.00500	0.00177	mg/L			10/16/25 12:21	1
1,2,4-Trichlorobenzene	<0.00175	U	0.00500	0.00175	mg/L			10/16/25 12:21	1
1,1,1-Trichloroethane	<0.000585	U	0.00500	0.000585	mg/L			10/16/25 12:21	1
1,1,2-Trichloroethane	<0.000411	U	0.00100	0.000411	mg/L			10/16/25 12:21	1
Trichloroethene	<0.00150	U	0.00500	0.00150	mg/L			10/16/25 12:21	1
Trichlorofluoromethane	<0.000560	U	0.00100	0.000560	mg/L			10/16/25 12:21	1
1,2,3-Trichloropropane	<0.000470	U	0.00100	0.000470	mg/L			10/16/25 12:21	1
1,2,4-Trimethylbenzene	<0.000417	U	0.00100	0.000417	mg/L			10/16/25 12:21	1
1,3,5-Trimethylbenzene	<0.000411	U	0.00100	0.000411	mg/L			10/16/25 12:21	1
Vinyl chloride	<0.000428	U	0.00200	0.000428	mg/L			10/16/25 12:21	1

Client Sample ID: TMW-3

Date Collected: 10/09/25 10:24
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-9
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Xylenes, Total	<0.00124	U	0.00200	0.00124	mg/L			10/16/25 12:21	1
Carbon disulfide	<0.00165	U	0.00500	0.00165	mg/L			10/16/25 12:21	1
Acetone	<0.00307	U	0.100	0.00307	mg/L			10/16/25 12:21	1
Methyl acetate	<0.00401	U	0.0200	0.00401	mg/L			10/16/25 12:21	1
4-Methyl-2-pentanone	<0.00500	U	0.0500	0.00500	mg/L			10/16/25 12:21	1
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.00111	U	0.0100	0.00111	mg/L			10/16/25 12:21	1
2-Hexanone	<0.00500	U	0.0500	0.00500	mg/L			10/16/25 12:21	1
Methylcyclohexane	<0.000608	U	0.0100	0.000608	mg/L			10/16/25 12:21	1
Cyclohexane	<0.00129	U	0.00500	0.00129	mg/L			10/16/25 12:21	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*110*		*63 - 144*		*10/16/25 12:21*	*1*
4-Bromofluorobenzene (Surr)	*104*		*74 - 124*		*10/16/25 12:21*	*1*
Dibromofluoromethane (Surr)	*105*		*75 - 131*		*10/16/25 12:21*	*1*
Toluene-d8 (Surr)	*98*		*80 - 120*		*10/16/25 12:21*	*1*

Method: TCEQ TX 1005 - Texas - Total Petroleum Hydrocarbon (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C6-C12	<0.851	U	4.81	0.851	mg/L		10/14/25 15:27	10/15/25 06:20	1
Over C12-C28	<0.830	U	4.81	0.830	mg/L		10/14/25 15:27	10/15/25 06:20	1
Over C28-C35	<0.830	U	4.81	0.830	mg/L		10/14/25 15:27	10/15/25 06:20	1
Total Petroleum Hydrocarbons (C6-C35)	<0.851	U	4.81	0.851	mg/L			10/15/25 06:20	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctane (Surr)	*83*		*70 - 130*	*10/14/25 15:27*	*10/15/25 06:20*	*1*
o-Terphenyl (Surr)	*91*		*70 - 130*	*10/14/25 15:27*	*10/15/25 06:20*	*1*

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.00152**	**J**	0.00400	0.000690	mg/L		10/14/25 09:00	10/14/25 21:43	1
Barium	**0.0698**		0.00400	0.00134	mg/L		10/14/25 09:00	10/14/25 21:43	1
Cadmium	<0.000240	U	0.00200	0.000240	mg/L		10/14/25 09:00	10/14/25 21:43	1
Chromium	**0.00460**		0.00400	0.000560	mg/L		10/14/25 09:00	10/14/25 21:43	1
Lead	<0.000367	U	0.00200	0.000367	mg/L		10/14/25 09:00	10/14/25 21:43	1
Selenium	**0.00672**		0.00200	0.000590	mg/L		10/14/25 09:00	10/14/25 21:43	1
Silver	<0.000390	U	0.00200	0.000390	mg/L		10/14/25 09:00	10/14/25 21:43	1

Method: SW846 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.0000706	U	0.000200	0.0000706	mg/L		10/14/25 14:02	10/14/25 21:05	1

Client Sample ID: TMW-5

Date Collected: 10/09/25 13:26
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-10
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.000460	U	0.00100	0.000460	mg/L			10/16/25 12:42	1
Bromobenzene	<0.000486	U	0.00100	0.000486	mg/L			10/16/25 12:42	1
Bromochloromethane	<0.000577	U	0.00100	0.000577	mg/L			10/16/25 12:42	1

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Client Sample ID: TMW-5
Date Collected: 10/09/25 13:26
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-10
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromodichloromethane	<0.000552	U	0.00100	0.000552	mg/L			10/16/25 12:42	1
Bromoform	<0.000633	U	0.00500	0.000633	mg/L			10/16/25 12:42	1
Bromomethane	<0.00142	U	0.00500	0.00142	mg/L			10/16/25 12:42	1
2-Butanone	<0.00828	U	0.0500	0.00828	mg/L			10/16/25 12:42	1
Carbon tetrachloride	<0.000896	U	0.00200	0.000896	mg/L			10/16/25 12:42	1
Chlorobenzene	<0.000455	U	0.00100	0.000455	mg/L			10/16/25 12:42	1
Chloroethane	<0.00198	U	0.0100	0.00198	mg/L			10/16/25 12:42	1
Chloroform	<0.000464	U	0.00100	0.000464	mg/L			10/16/25 12:42	1
Chloromethane	<0.00204	U	0.0100	0.00204	mg/L			10/16/25 12:42	1
4-Chlorotoluene	<0.000386	U	0.00100	0.000386	mg/L			10/16/25 12:42	1
cis-1,2-Dichloroethene	<0.000457	U	0.00100	0.000457	mg/L			10/16/25 12:42	1
cis-1,3-Dichloropropene	<0.00107	U	0.00500	0.00107	mg/L			10/16/25 12:42	1
Dibromochloromethane	<0.000547	U	0.00500	0.000547	mg/L			10/16/25 12:42	1
1,2-Dibromo-3-Chloropropane	<0.000671	U	0.00500	0.000671	mg/L			10/16/25 12:42	1
1,2-Dibromoethane	<0.000999	U	0.00500	0.000999	mg/L			10/16/25 12:42	1
1,2-Dichlorobenzene	<0.000429	U	0.00100	0.000429	mg/L			10/16/25 12:42	1
1,3-Dichlorobenzene	<0.000413	U	0.00100	0.000413	mg/L			10/16/25 12:42	1
1,4-Dichlorobenzene	<0.000449	U	0.00100	0.000449	mg/L			10/16/25 12:42	1
Dichlorodifluoromethane	<0.000785	U	0.00100	0.000785	mg/L			10/16/25 12:42	1
1,1-Dichloroethane	<0.000635	U	0.00100	0.000635	mg/L			10/16/25 12:42	1
1,2-Dichloroethane	<0.000372	U	0.00100	0.000372	mg/L			10/16/25 12:42	1
1,1-Dichloroethene	<0.000738	U	0.00100	0.000738	mg/L			10/16/25 12:42	1
1,2-Dichloropropane	<0.000556	U	0.00500	0.000556	mg/L			10/16/25 12:42	1
1,3-Dichloropropane	<0.000514	U	0.00500	0.000514	mg/L			10/16/25 12:42	1
2,2-Dichloropropane	<0.000679	U	0.00500	0.000679	mg/L			10/16/25 12:42	1
1,1-Dichloropropene	<0.000624	U	0.00500	0.000624	mg/L			10/16/25 12:42	1
Ethylbenzene	<0.000385	U	0.00100	0.000385	mg/L			10/16/25 12:42	1
Hexachlorobutadiene	<0.000627	U	0.00500	0.000627	mg/L			10/16/25 12:42	1
Isopropylbenzene	<0.000592	U	0.00100	0.000592	mg/L			10/16/25 12:42	1
Methylene Chloride	<0.00173	U	0.00500	0.00173	mg/L			10/16/25 12:42	1
m,p-Xylenes	<0.00124	U	0.00200	0.00124	mg/L			10/16/25 12:42	1
MTBE	<0.00139	U	0.00500	0.00139	mg/L			10/16/25 12:42	1
Naphthalene	<0.00135	U	0.0100	0.00135	mg/L			10/16/25 12:42	1
n-Butylbenzene	<0.000510	U	0.00100	0.000510	mg/L			10/16/25 12:42	1
N-Propylbenzene	<0.000429	U	0.00100	0.000429	mg/L			10/16/25 12:42	1
o-Xylene	<0.000502	U	0.00100	0.000502	mg/L			10/16/25 12:42	1
p-Cymene (p-Isopropyltoluene)	<0.000676	U	0.00100	0.000676	mg/L			10/16/25 12:42	1
sec-Butylbenzene	<0.000468	U	0.00100	0.000468	mg/L			10/16/25 12:42	1
Styrene	<0.000619	U	0.00100	0.000619	mg/L			10/16/25 12:42	1
tert-Butylbenzene	<0.000442	U	0.00100	0.000442	mg/L			10/16/25 12:42	1
1,1,1,2-Tetrachloroethane	<0.000644	U	0.00100	0.000644	mg/L			10/16/25 12:42	1
1,1,2,2-Tetrachloroethane	<0.000470	U	0.00100	0.000470	mg/L			10/16/25 12:42	1
Tetrachloroethene	<0.000655	U	0.00100	0.000655	mg/L			10/16/25 12:42	1
Toluene	<0.000475	U	0.00100	0.000475	mg/L			10/16/25 12:42	1
trans-1,2-Dichloroethene	<0.000368	U	0.00100	0.000368	mg/L			10/16/25 12:42	1
trans-1,3-Dichloropropene	<0.00127	U	0.00500	0.00127	mg/L			10/16/25 12:42	1
1,2,3-Trichlorobenzene	<0.00177	U	0.00500	0.00177	mg/L			10/16/25 12:42	1
1,2,4-Trichlorobenzene	<0.00175	U	0.00500	0.00175	mg/L			10/16/25 12:42	1
1,1,1-Trichloroethane	<0.000585	U	0.00500	0.000585	mg/L			10/16/25 12:42	1

Client Sample ID: TMW-5
Date Collected: 10/09/25 13:26
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-10
Matrix: Water

Method: SW846 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,2-Trichloroethane	<0.000411	U	0.00100	0.000411	mg/L			10/16/25 12:42	1
Trichloroethene	<0.00150	U	0.00500	0.00150	mg/L			10/16/25 12:42	1
Trichlorofluoromethane	<0.000560	U	0.00100	0.000560	mg/L			10/16/25 12:42	1
1,2,3-Trichloropropane	<0.000470	U	0.00100	0.000470	mg/L			10/16/25 12:42	1
1,2,4-Trimethylbenzene	<0.000417	U	0.00100	0.000417	mg/L			10/16/25 12:42	1
1,3,5-Trimethylbenzene	<0.000411	U	0.00100	0.000411	mg/L			10/16/25 12:42	1
Vinyl chloride	<0.000428	U	0.00200	0.000428	mg/L			10/16/25 12:42	1
Xylenes, Total	<0.00124	U	0.00200	0.00124	mg/L			10/16/25 12:42	1
Carbon disulfide	<0.00165	U	0.00500	0.00165	mg/L			10/16/25 12:42	1
Acetone	<0.00307	U	0.100	0.00307	mg/L			10/16/25 12:42	1
Methyl acetate	<0.00401	U	0.0200	0.00401	mg/L			10/16/25 12:42	1
4-Methyl-2-pentanone	<0.00500	U	0.0500	0.00500	mg/L			10/16/25 12:42	1
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.00111	U	0.0100	0.00111	mg/L			10/16/25 12:42	1
2-Hexanone	<0.00500	U	0.0500	0.00500	mg/L			10/16/25 12:42	1
Methylcyclohexane	<0.000608	U	0.0100	0.000608	mg/L			10/16/25 12:42	1
Cyclohexane	<0.00129	U	0.00500	0.00129	mg/L			10/16/25 12:42	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*111*		*63 - 144*		*10/16/25 12:42*	*1*
4-Bromofluorobenzene (Surr)	*102*		*74 - 124*		*10/16/25 12:42*	*1*
Dibromofluoromethane (Surr)	*105*		*75 - 131*		*10/16/25 12:42*	*1*
Toluene-d8 (Surr)	*99*		*80 - 120*		*10/16/25 12:42*	*1*

Method: TCEQ TX 1005 - Texas - Total Petroleum Hydrocarbon (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C6-C12	<0.846	U	4.78	0.846	mg/L		10/14/25 15:27	10/15/25 06:36	1
Over C12-C28	<0.825	U	4.78	0.825	mg/L		10/14/25 15:27	10/15/25 06:36	1
Over C28-C35	<0.825	U	4.78	0.825	mg/L		10/14/25 15:27	10/15/25 06:36	1
Total Petroleum Hydrocarbons (C6-C35)	<0.846	U	4.78	0.846	mg/L			10/15/25 06:36	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctane (Surr)	*84*		*70 - 130*	*10/14/25 15:27*	*10/15/25 06:36*	*1*
o-Terphenyl (Surr)	*93*		*70 - 130*	*10/14/25 15:27*	*10/15/25 06:36*	*1*

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.00264**	**J**	0.00400	0.000690	mg/L		10/14/25 09:00	10/14/25 21:46	1
Barium	**0.0344**		0.00400	0.00134	mg/L		10/14/25 09:00	10/14/25 21:46	1
Cadmium	<0.000240	U	0.00200	0.000240	mg/L		10/14/25 09:00	10/14/25 21:46	1
Chromium	<0.000560	U	0.00400	0.000560	mg/L		10/14/25 09:00	10/14/25 21:46	1
Lead	**0.000422**	**J**	0.00200	0.000367	mg/L		10/14/25 09:00	10/14/25 21:46	1
Selenium	<0.000590	U	0.00200	0.000590	mg/L		10/14/25 09:00	10/14/25 21:46	1
Silver	<0.000390	U	0.00200	0.000390	mg/L		10/14/25 09:00	10/14/25 21:46	1

Method: SW846 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.0000706	U	0.000200	0.0000706	mg/L		10/14/25 14:02	10/14/25 21:09	1

Surrogate Summary

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Method: 8260D - Volatile Organic Compounds by GC/MS

Matrix: Solid — **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)			
		DCA	BFB	DBFM	TOL
Lab Sample ID	Client Sample ID	(56-150)	(68-152)	(53-142)	(70-130)
860-113834-A-3-B MS	Matrix Spike	113	97	94	99
860-113841-1	SB-1 5-8'	113	91	105	98
860-113841-2	SB-2 1-5'	119	92	109	96
860-113841-3	SB-2 13-15'	111	93	109	97
860-113841-4	SB-3 5-8'	112	92	108	97
860-113841-5	SB-4 3-5'	115	95	112	95
860-113841-6	SB-4 10-12'	115	92	109	96
860-113841-7	SB-5 1-5'	124	95	111	94
LCS 860-268311/3	Lab Control Sample	107	103	101	99
LCSD 860-268311/4	Lab Control Sample Dup	107	99	100	102
MB 860-268311/8	Method Blank	112	92	107	96

Surrogate Legend

DCA = 1,2-Dichloroethane-d4 (Surr)
BFB = 4-Bromofluorobenzene (Surr)
DBFM = Dibromofluoromethane (Surr)
TOL = Toluene-d8 (Surr)

Method: 8260D - Volatile Organic Compounds by GC/MS

Matrix: Water — **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)			
		DCA	BFB	DBFM	TOL
Lab Sample ID	Client Sample ID	(63-144)	(74-124)	(75-131)	(80-120)
860-113841-8	TMW-1	108	100	105	98
860-113841-9	TMW-3	110	104	105	98
860-113841-10	TMW-5	111	102	105	99
870-40472-C-3 MS	Matrix Spike	99	103	100	101
LCS 860-268883/4	Lab Control Sample	98	100	100	99
LCSD 860-268883/5	Lab Control Sample Dup	98	101	99	101
MB 860-268883/10	Method Blank	109	104	105	99

Surrogate Legend

DCA = 1,2-Dichloroethane-d4 (Surr)
BFB = 4-Bromofluorobenzene (Surr)
DBFM = Dibromofluoromethane (Surr)
TOL = Toluene-d8 (Surr)

Method: TX 1005 - Texas - Total Petroleum Hydrocarbon (GC)

Matrix: Solid — **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)	
		1CO	OTPH
Lab Sample ID	Client Sample ID	(70-130)	(70-130)
860-113841-1	SB-1 5-8'	79	79
860-113841-2	SB-2 1-5'	92	98
860-113841-3	SB-2 13-15'	77	79
860-113841-4	SB-3 5-8'	76	81
860-113841-5	SB-4 3-5'	74	76
860-113841-6	SB-4 10-12'	74	75
860-113841-7	SB-5 1-5'	70	75

Surrogate Summary

Client: Phase Engineering Inc. Job ID: 860-113841-1
Project/Site: PE # 202510014, Abilene, TX

Method: TX 1005 - Texas - Total Petroleum Hydrocarbon (GC) (Continued)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)	
Lab Sample ID	Client Sample ID	1CO (70-130)	OTPH (70-130)
LCS 860-268719/2-A	Lab Control Sample	76	81
LCSD 860-268719/3-A	Lab Control Sample Dup	80	84
MB 860-268719/1-A	Method Blank	82	89

Surrogate Legend

1CO = 1-Chlorooctane (Surr)
OTPH = o-Terphenyl (Surr)

Method: TX 1005 - Texas - Total Petroleum Hydrocarbon (GC)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)	
Lab Sample ID	Client Sample ID	1CO (70-130)	OTPH (70-130)
860-113841-8	TMW-1	86	94
860-113841-9	TMW-3	83	91
860-113841-10	TMW-5	84	93
LCS 860-268476/2-A	Lab Control Sample	105	121
LCSD 860-268476/3-A	Lab Control Sample Dup	105	113
MB 860-268476/1-A	Method Blank	79	84

Surrogate Legend

1CO = 1-Chlorooctane (Surr)
OTPH = o-Terphenyl (Surr)

Method: 8260D - Volatile Organic Compounds by GC/MS

Lab Sample ID: MB 860-268311/8
Matrix: Solid
Analysis Batch: 268311

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.000383	U	0.00100	0.000383	mg/Kg			10/14/25 11:33	1
Bromobenzene	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
Bromochloromethane	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
Bromodichloromethane	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
Bromoform	<0.00221	U	0.00500	0.00221	mg/Kg			10/14/25 11:33	1
Bromomethane	<0.000929	U	0.00500	0.000929	mg/Kg			10/14/25 11:33	1
2-Butanone	<0.00517	U	0.0500	0.00517	mg/Kg			10/14/25 11:33	1
Carbon tetrachloride	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
Chlorobenzene	<0.000623	U	0.00500	0.000623	mg/Kg			10/14/25 11:33	1
Chloroethane	<0.00159	U	0.0100	0.00159	mg/Kg			10/14/25 11:33	1
Chloroform	<0.000525	U	0.00500	0.000525	mg/Kg			10/14/25 11:33	1
Chloromethane	<0.000938	U	0.00500	0.000938	mg/Kg			10/14/25 11:33	1
4-Chlorotoluene	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
cis-1,2-Dichloroethene	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
cis-1,3-Dichloropropene	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
Dibromochloromethane	<0.00170	U	0.00500	0.00170	mg/Kg			10/14/25 11:33	1
1,2-Dibromo-3-Chloropropane	<0.00249	U	0.00500	0.00249	mg/Kg			10/14/25 11:33	1
1,2-Dibromoethane	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
1,2-Dichlorobenzene	<0.00145	U	0.00500	0.00145	mg/Kg			10/14/25 11:33	1
1,3-Dichlorobenzene	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
1,4-Dichlorobenzene	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
Dichlorodifluoromethane	<0.00191	U	0.00500	0.00191	mg/Kg			10/14/25 11:33	1
1,1-Dichloroethane	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
1,2-Dichloroethane	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
1,1-Dichloroethene	<0.000573	U	0.00500	0.000573	mg/Kg			10/14/25 11:33	1
1,2-Dichloropropane	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
1,3-Dichloropropane	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
2,2-Dichloropropane	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
1,1-Dichloropropene	<0.000515	U	0.00500	0.000515	mg/Kg			10/14/25 11:33	1
Ethylbenzene	<0.000304	U	0.00100	0.000304	mg/Kg			10/14/25 11:33	1
Hexachlorobutadiene	<0.000695	U	0.00500	0.000695	mg/Kg			10/14/25 11:33	1
Isopropylbenzene	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
Methylene Chloride	<0.00842	U	0.0200	0.00842	mg/Kg			10/14/25 11:33	1
m,p-Xylenes	<0.000433	U	0.00200	0.000433	mg/Kg			10/14/25 11:33	1
MTBE	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
Naphthalene	<0.00200	U	0.0100	0.00200	mg/Kg			10/14/25 11:33	1
n-Butylbenzene	<0.000550	U	0.00500	0.000550	mg/Kg			10/14/25 11:33	1
N-Propylbenzene	<0.000992	U	0.00500	0.000992	mg/Kg			10/14/25 11:33	1
o-Xylene	<0.000316	U	0.00100	0.000316	mg/Kg			10/14/25 11:33	1
p-Cymene (p-Isopropyltoluene)	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
sec-Butylbenzene	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
Styrene	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
tert-Butylbenzene	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
1,1,1,2-Tetrachloroethane	<0.000586	U	0.00500	0.000586	mg/Kg			10/14/25 11:33	1
1,1,2,2-Tetrachloroethane	<0.000353	U	0.00500	0.000353	mg/Kg			10/14/25 11:33	1
Tetrachloroethene	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
Toluene	<0.00121	U	0.00500	0.00121	mg/Kg			10/14/25 11:33	1
trans-1,2-Dichloroethene	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: MB 860-268311/8
Matrix: Solid
Analysis Batch: 268311

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
trans-1,3-Dichloropropene	<0.00167	U	0.00500	0.00167	mg/Kg			10/14/25 11:33	1
1,2,3-Trichlorobenzene	<0.00136	U	0.00500	0.00136	mg/Kg			10/14/25 11:33	1
1,2,4-Trichlorobenzene	<0.00101	U	0.00500	0.00101	mg/Kg			10/14/25 11:33	1
1,1,1-Trichloroethane	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
1,1,2-Trichloroethane	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
Trichloroethene	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
Trichlorofluoromethane	<0.00178	U	0.00500	0.00178	mg/Kg			10/14/25 11:33	1
1,2,3-Trichloropropane	<0.000581	U	0.00500	0.000581	mg/Kg			10/14/25 11:33	1
1,2,4-Trimethylbenzene	<0.00157	U	0.00500	0.00157	mg/Kg			10/14/25 11:33	1
1,3,5-Trimethylbenzene	<0.00100	U	0.00500	0.00100	mg/Kg			10/14/25 11:33	1
Vinyl chloride	<0.000624	U	0.00500	0.000624	mg/Kg			10/14/25 11:33	1
Xylenes, Total	<0.000433	U	0.00200	0.000433	mg/Kg			10/14/25 11:33	1
Carbon disulfide	<0.000568	U	0.00500	0.000568	mg/Kg			10/14/25 11:33	1
Acetone	<0.0154	U	0.100	0.0154	mg/Kg			10/14/25 11:33	1
Methyl acetate	<0.00324	U	0.0500	0.00324	mg/Kg			10/14/25 11:33	1
4-Methyl-2-pentanone	<0.00533	U	0.0500	0.00533	mg/Kg			10/14/25 11:33	1
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.00167	U	0.0100	0.00167	mg/Kg			10/14/25 11:33	1
2-Hexanone	<0.00759	U	0.0500	0.00759	mg/Kg			10/14/25 11:33	1
Methylcyclohexane	<0.00149	U	0.0100	0.00149	mg/Kg			10/14/25 11:33	1
Cyclohexane	<0.00180	U	0.00500	0.00180	mg/Kg			10/14/25 11:33	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*112*		*56 - 150*		*10/14/25 11:33*	*1*
4-Bromofluorobenzene (Surr)	*92*		*68 - 152*		*10/14/25 11:33*	*1*
Dibromofluoromethane (Surr)	*107*		*53 - 142*		*10/14/25 11:33*	*1*
Toluene-d8 (Surr)	*96*		*70 - 130*		*10/14/25 11:33*	*1*

Lab Sample ID: LCS 860-268311/3
Matrix: Solid
Analysis Batch: 268311

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Benzene	0.0500	0.04717		mg/Kg		94	66 - 130
Bromobenzene	0.0500	0.05041		mg/Kg		101	70 - 130
Bromochloromethane	0.0500	0.04866		mg/Kg		97	70 - 130
Bromodichloromethane	0.0500	0.05193		mg/Kg		104	70 - 130
Bromoform	0.0500	0.05119		mg/Kg		102	70 - 136
Bromomethane	0.0500	0.05871		mg/Kg		117	60 - 140
2-Butanone	0.250	0.2490		mg/Kg		100	68 - 134
Carbon tetrachloride	0.0500	0.05297		mg/Kg		106	63 - 135
Chlorobenzene	0.0500	0.04770		mg/Kg		95	70 - 130
Chloroethane	0.0500	0.05124		mg/Kg		102	57 - 150
Chloroform	0.0500	0.04879		mg/Kg		98	70 - 130
Chloromethane	0.0500	0.05393		mg/Kg		108	58 - 145
4-Chlorotoluene	0.0500	0.05415		mg/Kg		108	70 - 130
cis-1,2-Dichloroethene	0.0500	0.04977		mg/Kg		100	70 - 131
cis-1,3-Dichloropropene	0.0500	0.04931		mg/Kg		99	70 - 135
Dibromochloromethane	0.0500	0.05260		mg/Kg		105	70 - 130

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 860-268311/3
Matrix: Solid
Analysis Batch: 268311

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
1,2-Dibromo-3-Chloropropane	0.0500	0.04664		mg/Kg		93	67 - 138
1,2-Dibromoethane	0.0500	0.04630		mg/Kg		93	70 - 130
1,2-Dichlorobenzene	0.0500	0.05181		mg/Kg		104	70 - 130
1,3-Dichlorobenzene	0.0500	0.05052		mg/Kg		101	70 - 130
1,4-Dichlorobenzene	0.0500	0.04921		mg/Kg		98	70 - 130
Dichlorodifluoromethane	0.0500	0.05012		mg/Kg		100	40 - 150
1,1-Dichloroethane	0.0500	0.04886		mg/Kg		98	67 - 130
1,2-Dichloroethane	0.0500	0.04821		mg/Kg		96	70 - 130
1,1-Dichloroethene	0.0500	0.05027		mg/Kg		101	57 - 130
1,2-Dichloropropane	0.0500	0.05138		mg/Kg		103	70 - 130
1,3-Dichloropropane	0.0500	0.05020		mg/Kg		100	70 - 131
2,2-Dichloropropane	0.0500	0.05582		mg/Kg		112	67 - 137
1,1-Dichloropropene	0.0500	0.05362		mg/Kg		107	70 - 130
Ethylbenzene	0.0500	0.04981		mg/Kg		100	70 - 130
Hexachlorobutadiene	0.0500	0.05592		mg/Kg		112	70 - 146
Isopropylbenzene	0.0500	0.05247		mg/Kg		105	70 - 131
Methylene Chloride	0.0500	0.04977		mg/Kg		100	57 - 134
m,p-Xylenes	0.0500	0.04985		mg/Kg		100	70 - 130
MTBE	0.0500	0.05309		mg/Kg		106	64 - 130
Naphthalene	0.0500	0.05200		mg/Kg		104	70 - 150
n-Butylbenzene	0.0500	0.05916		mg/Kg		118	82 - 130
N-Propylbenzene	0.0500	0.05492		mg/Kg		110	70 - 131
o-Xylene	0.0500	0.04946		mg/Kg		99	70 - 130
p-Cymene (p-Isopropyltoluene)	0.0500	0.05472		mg/Kg		109	70 - 130
sec-Butylbenzene	0.0500	0.05634		mg/Kg		113	70 - 131
Styrene	0.0500	0.05342		mg/Kg		107	70 - 130
tert-Butylbenzene	0.0500	0.05600		mg/Kg		112	70 - 132
1,1,1,2-Tetrachloroethane	0.0500	0.05272		mg/Kg		105	70 - 130
1,1,2,2-Tetrachloroethane	0.0500	0.04988		mg/Kg		100	70 - 133
Tetrachloroethene	0.0500	0.04751		mg/Kg		95	70 - 130
Toluene	0.0500	0.04518		mg/Kg		90	70 - 130
trans-1,2-Dichloroethene	0.0500	0.05040		mg/Kg		101	63 - 130
trans-1,3-Dichloropropene	0.0500	0.04859		mg/Kg		97	73 - 130
1,2,3-Trichlorobenzene	0.0500	0.05580		mg/Kg		112	70 - 144
1,2,4-Trichlorobenzene	0.0500	0.05601		mg/Kg		112	70 - 130
1,1,1-Trichloroethane	0.0500	0.05377		mg/Kg		108	70 - 130
1,1,2-Trichloroethane	0.0500	0.05058		mg/Kg		101	70 - 131
Trichloroethene	0.0500	0.05025		mg/Kg		101	70 - 130
Trichlorofluoromethane	0.0500	0.06093		mg/Kg		122	70 - 148
1,2,3-Trichloropropane	0.0500	0.05077		mg/Kg		102	70 - 131
1,2,4-Trimethylbenzene	0.0500	0.05320		mg/Kg		106	70 - 130
1,3,5-Trimethylbenzene	0.0500	0.05367		mg/Kg		107	70 - 130
Vinyl chloride	0.0500	0.05711		mg/Kg		114	60 - 149
Carbon disulfide	0.0500	0.04021		mg/Kg		80	65 - 135
Acetone	0.250	0.2438		mg/Kg		98	50 - 150
Methyl acetate	0.100	0.07754		mg/Kg		78	58 - 135
4-Methyl-2-pentanone	0.250	0.2633		mg/Kg		105	60 - 140
1,1,2-Trichloro-1,2,2-trifluoroethane	0.0500	0.05439		mg/Kg		109	65 - 135

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 860-268311/3
Matrix: Solid
Analysis Batch: 268311

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
2-Hexanone			0.250	0.2555		mg/Kg		102	75 - 130		
Methylcyclohexane			0.0500	0.05095		mg/Kg		102	65 - 135		
Cyclohexane			0.0500	0.04668		mg/Kg		93	63 - 130		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*107*		*56 - 150*
4-Bromofluorobenzene (Surr)	*103*		*68 - 152*
Dibromofluoromethane (Surr)	*101*		*53 - 142*
Toluene-d8 (Surr)	*99*		*70 - 130*

Lab Sample ID: LCSD 860-268311/4
Matrix: Solid
Analysis Batch: 268311

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Benzene			0.0500	0.04282		mg/Kg		86	66 - 130	10	25
Bromobenzene			0.0500	0.04410		mg/Kg		88	70 - 130	13	25
Bromochloromethane			0.0500	0.04416		mg/Kg		88	70 - 130	10	25
Bromodichloromethane			0.0500	0.04692		mg/Kg		94	70 - 130	10	25
Bromoform			0.0500	0.04795		mg/Kg		96	70 - 136	7	25
Bromomethane			0.0500	0.04044	*1	mg/Kg		81	60 - 140	37	25
2-Butanone			0.250	0.2283		mg/Kg		91	68 - 134	9	25
Carbon tetrachloride			0.0500	0.04713		mg/Kg		94	63 - 135	12	25
Chlorobenzene			0.0500	0.04449		mg/Kg		89	70 - 130	7	25
Chloroethane			0.0500	0.05298		mg/Kg		106	57 - 150	3	25
Chloroform			0.0500	0.04408		mg/Kg		88	70 - 130	10	25
Chloromethane			0.0500	0.05738		mg/Kg		115	58 - 145	6	25
4-Chlorotoluene			0.0500	0.04826		mg/Kg		97	70 - 130	11	25
cis-1,2-Dichloroethene			0.0500	0.04572		mg/Kg		91	70 - 131	8	25
cis-1,3-Dichloropropene			0.0500	0.04529		mg/Kg		91	70 - 135	9	25
Dibromochloromethane			0.0500	0.04859		mg/Kg		97	70 - 130	8	25
1,2-Dibromo-3-Chloropropane			0.0500	0.04228		mg/Kg		85	67 - 138	10	25
1,2-Dibromoethane			0.0500	0.04300		mg/Kg		86	70 - 130	7	25
1,2-Dichlorobenzene			0.0500	0.04571		mg/Kg		91	70 - 130	13	25
1,3-Dichlorobenzene			0.0500	0.04436		mg/Kg		89	70 - 130	13	25
1,4-Dichlorobenzene			0.0500	0.04308		mg/Kg		86	70 - 130	13	25
Dichlorodifluoromethane			0.0500	0.05381		mg/Kg		108	40 - 150	7	25
1,1-Dichloroethane			0.0500	0.04408		mg/Kg		88	67 - 130	10	25
1,2-Dichloroethane			0.0500	0.04421		mg/Kg		88	70 - 130	9	25
1,1-Dichloroethene			0.0500	0.04495		mg/Kg		90	57 - 130	11	25
1,2-Dichloropropane			0.0500	0.04669		mg/Kg		93	70 - 130	10	25
1,3-Dichloropropane			0.0500	0.04669		mg/Kg		93	70 - 131	7	25
2,2-Dichloropropane			0.0500	0.05048		mg/Kg		101	67 - 137	10	25
1,1-Dichloropropene			0.0500	0.04813		mg/Kg		96	70 - 130	11	25
Ethylbenzene			0.0500	0.04613		mg/Kg		92	70 - 130	8	25
Hexachlorobutadiene			0.0500	0.04817		mg/Kg		96	70 - 146	15	25
Isopropylbenzene			0.0500	0.04846		mg/Kg		97	70 - 131	8	25
Methylene Chloride			0.0500	0.04524		mg/Kg		90	57 - 134	10	25

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCSD 860-268311/4
Matrix: Solid
Analysis Batch: 268311

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
m,p-Xylenes	0.0500	0.04613		mg/Kg		92	70 - 130	8	25
MTBE	0.0500	0.04871		mg/Kg		97	64 - 130	9	25
Naphthalene	0.0500	0.04669		mg/Kg		93	70 - 150	11	25
n-Butylbenzene	0.0500	0.05122		mg/Kg		102	82 - 130	14	25
N-Propylbenzene	0.0500	0.04811		mg/Kg		96	70 - 131	13	25
o-Xylene	0.0500	0.04595		mg/Kg		92	70 - 130	7	25
p-Cymene (p-Isopropyltoluene)	0.0500	0.04795		mg/Kg		96	70 - 130	13	25
sec-Butylbenzene	0.0500	0.04910		mg/Kg		98	70 - 131	14	25
Styrene	0.0500	0.04910		mg/Kg		98	70 - 130	8	25
tert-Butylbenzene	0.0500	0.04892		mg/Kg		98	70 - 132	13	25
1,1,1,2-Tetrachloroethane	0.0500	0.04794		mg/Kg		96	70 - 130	10	25
1,1,2,2-Tetrachloroethane	0.0500	0.04424		mg/Kg		88	70 - 133	12	25
Tetrachloroethene	0.0500	0.04394		mg/Kg		88	70 - 130	8	25
Toluene	0.0500	0.04134		mg/Kg		83	70 - 130	9	25
trans-1,2-Dichloroethene	0.0500	0.04572		mg/Kg		91	63 - 130	10	25
trans-1,3-Dichloropropene	0.0500	0.04558		mg/Kg		91	73 - 130	6	25
1,2,3-Trichlorobenzene	0.0500	0.04932		mg/Kg		99	70 - 144	12	25
1,2,4-Trichlorobenzene	0.0500	0.04978		mg/Kg		100	70 - 130	12	25
1,1,1-Trichloroethane	0.0500	0.04888		mg/Kg		98	70 - 130	10	25
1,1,2-Trichloroethane	0.0500	0.04710		mg/Kg		94	70 - 131	7	25
Trichloroethene	0.0500	0.04561		mg/Kg		91	70 - 130	10	25
Trichlorofluoromethane	0.0500	0.06375		mg/Kg		127	70 - 148	5	25
1,2,3-Trichloropropane	0.0500	0.04462		mg/Kg		89	70 - 131	13	25
1,2,4-Trimethylbenzene	0.0500	0.04715		mg/Kg		94	70 - 130	12	25
1,3,5-Trimethylbenzene	0.0500	0.04762		mg/Kg		95	70 - 130	12	25
Vinyl chloride	0.0500	0.05952		mg/Kg		119	60 - 149	4	25
Carbon disulfide	0.0500	0.03583		mg/Kg		72	65 - 135	12	25
Acetone	0.250	0.1811	*1	mg/Kg		72	50 - 150	30	25
Methyl acetate	0.100	0.07774		mg/Kg		78	58 - 135	0	25
4-Methyl-2-pentanone	0.250	0.2461		mg/Kg		98	60 - 140	7	25
1,1,2-Trichloro-1,2,2-trifluoroethane	0.0500	0.04788		mg/Kg		96	65 - 135	13	25
2-Hexanone	0.250	0.2400		mg/Kg		96	75 - 130	6	25
Methylcyclohexane	0.0500	0.04576		mg/Kg		92	65 - 135	11	25
Cyclohexane	0.0500	0.04262		mg/Kg		85	63 - 130	9	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*107*		*56 - 150*
4-Bromofluorobenzene (Surr)	*99*		*68 - 152*
Dibromofluoromethane (Surr)	*100*		*53 - 142*
Toluene-d8 (Surr)	*102*		*70 - 130*

Lab Sample ID: 860-113834-A-3-B MS
Matrix: Solid
Analysis Batch: 268311

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 268469

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Benzene	<0.161	U	21.1	20.61		mg/Kg	☼	98	66 - 130
Bromobenzene	<0.422	U	21.1	20.55		mg/Kg	☼	97	70 - 130

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: 860-113834-A-3-B MS
Matrix: Solid
Analysis Batch: 268311

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 268469

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Bromochloromethane	<0.422	U	21.1	20.98		mg/Kg	☼	99	70 - 130
Bromodichloromethane	<0.422	U	21.1	21.41		mg/Kg	☼	101	70 - 130
Bromoform	<0.933	U	21.1	20.70		mg/Kg	☼	98	70 - 136
Bromomethane	<0.392	U F1 *1	21.1	5.193	F1	mg/Kg	☼	25	60 - 140
2-Butanone	<2.18	U	106	116.4		mg/Kg	☼	110	68 - 134
Carbon tetrachloride	<0.422	U	21.1	18.56		mg/Kg	☼	88	63 - 135
Chlorobenzene	<0.263	U	21.1	20.91		mg/Kg	☼	99	70 - 130
Chloroethane	<0.673	U F1	21.1	3.511	J F1	mg/Kg	☼	17	57 - 150
Chloroform	<0.221	U	21.1	20.16		mg/Kg	☼	96	70 - 130
Chloromethane	<0.396	U	21.1	20.42		mg/Kg	☼	97	58 - 145
4-Chlorotoluene	<0.422	U	21.1	21.05		mg/Kg	☼	100	70 - 130
cis-1,2-Dichloroethene	<0.422	U	21.1	20.60		mg/Kg	☼	98	70 - 131
cis-1,3-Dichloropropene	<0.422	U	21.1	22.08		mg/Kg	☼	105	70 - 135
Dibromochloromethane	<0.717	U	21.1	21.71		mg/Kg	☼	103	70 - 130
1,2-Dibromo-3-Chloropropane	<1.05	U	21.1	17.86		mg/Kg	☼	85	67 - 138
1,2-Dibromoethane	<0.422	U	21.1	21.09		mg/Kg	☼	100	70 - 130
1,2-Dichlorobenzene	<0.613	U	21.1	21.30		mg/Kg	☼	101	70 - 130
1,3-Dichlorobenzene	<0.422	U	21.1	20.20		mg/Kg	☼	96	70 - 130
1,4-Dichlorobenzene	<0.422	U	21.1	19.89		mg/Kg	☼	94	70 - 130
Dichlorodifluoromethane	<0.808	U	21.1	17.22		mg/Kg	☼	82	40 - 150
1,1-Dichloroethane	<0.422	U	21.1	20.12		mg/Kg	☼	95	67 - 130
1,2-Dichloroethane	<0.422	U	21.1	21.84		mg/Kg	☼	103	70 - 130
1,1-Dichloroethene	<0.242	U	21.1	14.01		mg/Kg	☼	66	57 - 130
1,2-Dichloropropane	<0.422	U	21.1	22.95		mg/Kg	☼	109	70 - 130
1,3-Dichloropropane	<0.422	U	21.1	23.13		mg/Kg	☼	110	70 - 131
2,2-Dichloropropane	<0.422	U	21.1	20.89		mg/Kg	☼	99	67 - 137
1,1-Dichloropropene	<0.217	U	21.1	20.53		mg/Kg	☼	97	70 - 130
Ethylbenzene	<0.128	U	21.1	21.01		mg/Kg	☼	100	70 - 130
Hexachlorobutadiene	<0.293	U	21.1	19.59		mg/Kg	☼	93	70 - 146
Isopropylbenzene	<0.422	U	21.1	21.66		mg/Kg	☼	103	70 - 131
Methylene Chloride	<3.55	U	21.1	21.66		mg/Kg	☼	103	57 - 134
m,p-Xylenes	<0.183	U	21.1	20.83		mg/Kg	☼	99	70 - 130
MTBE	<0.422	U	21.1	23.51		mg/Kg	☼	111	64 - 130
Naphthalene	<0.844	U	21.1	18.77		mg/Kg	☼	89	70 - 150
n-Butylbenzene	<0.232	U	21.1	21.46		mg/Kg	☼	102	82 - 130
N-Propylbenzene	<0.419	U	21.1	20.58		mg/Kg	☼	98	70 - 131
o-Xylene	<0.133	U	21.1	21.29		mg/Kg	☼	101	70 - 130
p-Cymene (p-Isopropyltoluene)	<0.422	U	21.1	20.57		mg/Kg	☼	97	70 - 130
sec-Butylbenzene	<0.422	U	21.1	21.05		mg/Kg	☼	100	70 - 131
Styrene	<0.422	U	21.1	23.38		mg/Kg	☼	111	70 - 130
tert-Butylbenzene	<0.422	U	21.1	21.10		mg/Kg	☼	100	70 - 132
1,1,1,2-Tetrachloroethane	<0.247	U	21.1	22.18		mg/Kg	☼	105	70 - 130
1,1,2,2-Tetrachloroethane	<0.149	U	21.1	20.92		mg/Kg	☼	99	70 - 133
Tetrachloroethene	<0.422	U	21.1	19.37		mg/Kg	☼	92	70 - 130
Toluene	<0.511	U	21.1	19.36		mg/Kg	☼	92	70 - 130
trans-1,2-Dichloroethene	<0.422	U	21.1	16.16		mg/Kg	☼	77	63 - 130
trans-1,3-Dichloropropene	<0.703	U	21.1	21.41		mg/Kg	☼	101	73 - 130
1,2,3-Trichlorobenzene	<0.572	U	21.1	19.36		mg/Kg	☼	92	70 - 144
1,2,4-Trichlorobenzene	<0.425	U	21.1	20.37		mg/Kg	☼	96	70 - 130

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: 860-113834-A-3-B MS
Matrix: Solid
Analysis Batch: 268311

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 268469

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
1,1,1-Trichloroethane	<0.422	U	21.1	20.42		mg/Kg	☼	97	70 - 130
1,1,2-Trichloroethane	<0.422	U	21.1	23.28		mg/Kg	☼	110	70 - 131
Trichloroethene	<0.422	U	21.1	21.35		mg/Kg	☼	101	70 - 130
Trichlorofluoromethane	<0.753	U F1	21.1	1.940	J F1	mg/Kg	☼	9	70 - 148
1,2,3-Trichloropropane	<0.245	U	21.1	21.53		mg/Kg	☼	102	70 - 131
1,2,4-Trimethylbenzene	<0.664	U	21.1	20.77		mg/Kg	☼	98	70 - 130
1,3,5-Trimethylbenzene	<0.422	U	21.1	20.71		mg/Kg	☼	98	70 - 130
Vinyl chloride	<0.263	U	21.1	22.72		mg/Kg	☼	108	60 - 149
Carbon disulfide	<0.240	U F1	21.1	13.08	F1	mg/Kg	☼	62	65 - 135
Acetone	<6.50	U *1	106	59.54		mg/Kg	☼	56	50 - 150
Methyl acetate	<1.37	U	42.2	53.68		mg/Kg	☼	127	58 - 135
4-Methyl-2-pentanone	<2.25	U	106	127.4		mg/Kg	☼	121	60 - 140
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.704	U	21.1	14.13		mg/Kg	☼	67	65 - 135
2-Hexanone	<3.20	U	106	125.7		mg/Kg	☼	119	75 - 130
Methylcyclohexane	<0.630	U	21.1	20.38		mg/Kg	☼	97	65 - 135
Cyclohexane	<0.760	U	21.1	17.66		mg/Kg	☼	84	63 - 130

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*113*		*56 - 150*
4-Bromofluorobenzene (Surr)	*97*		*68 - 152*
Dibromofluoromethane (Surr)	*94*		*53 - 142*
Toluene-d8 (Surr)	*99*		*70 - 130*

Lab Sample ID: MB 860-268883/10
Matrix: Water
Analysis Batch: 268883

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.000460	U	0.00100	0.000460	mg/L			10/16/25 11:20	1
Bromobenzene	<0.000486	U	0.00100	0.000486	mg/L			10/16/25 11:20	1
Bromochloromethane	<0.000577	U	0.00100	0.000577	mg/L			10/16/25 11:20	1
Bromodichloromethane	<0.000552	U	0.00100	0.000552	mg/L			10/16/25 11:20	1
Bromoform	<0.000633	U	0.00500	0.000633	mg/L			10/16/25 11:20	1
Bromomethane	<0.00142	U	0.00500	0.00142	mg/L			10/16/25 11:20	1
2-Butanone	<0.00828	U	0.0500	0.00828	mg/L			10/16/25 11:20	1
Carbon tetrachloride	<0.000896	U	0.00200	0.000896	mg/L			10/16/25 11:20	1
Chlorobenzene	<0.000455	U	0.00100	0.000455	mg/L			10/16/25 11:20	1
Chloroethane	<0.00198	U	0.0100	0.00198	mg/L			10/16/25 11:20	1
Chloroform	<0.000464	U	0.00100	0.000464	mg/L			10/16/25 11:20	1
Chloromethane	<0.00204	U	0.0100	0.00204	mg/L			10/16/25 11:20	1
4-Chlorotoluene	<0.000386	U	0.00100	0.000386	mg/L			10/16/25 11:20	1
cis-1,2-Dichloroethene	<0.000457	U	0.00100	0.000457	mg/L			10/16/25 11:20	1
cis-1,3-Dichloropropene	<0.00107	U	0.00500	0.00107	mg/L			10/16/25 11:20	1
Dibromochloromethane	<0.000547	U	0.00500	0.000547	mg/L			10/16/25 11:20	1
1,2-Dibromo-3-Chloropropane	<0.000671	U	0.00500	0.000671	mg/L			10/16/25 11:20	1
1,2-Dibromoethane	<0.000999	U	0.00500	0.000999	mg/L			10/16/25 11:20	1
1,2-Dichlorobenzene	<0.000429	U	0.00100	0.000429	mg/L			10/16/25 11:20	1
1,3-Dichlorobenzene	<0.000413	U	0.00100	0.000413	mg/L			10/16/25 11:20	1

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: MB 860-268883/10
Matrix: Water
Analysis Batch: 268883

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,4-Dichlorobenzene	<0.000449	U	0.00100	0.000449	mg/L			10/16/25 11:20	1
Dichlorodifluoromethane	<0.000785	U	0.00100	0.000785	mg/L			10/16/25 11:20	1
1,1-Dichloroethane	<0.000635	U	0.00100	0.000635	mg/L			10/16/25 11:20	1
1,2-Dichloroethane	<0.000372	U	0.00100	0.000372	mg/L			10/16/25 11:20	1
1,1-Dichloroethene	<0.000738	U	0.00100	0.000738	mg/L			10/16/25 11:20	1
1,2-Dichloropropane	<0.000556	U	0.00500	0.000556	mg/L			10/16/25 11:20	1
1,3-Dichloropropane	<0.000514	U	0.00500	0.000514	mg/L			10/16/25 11:20	1
2,2-Dichloropropane	<0.000679	U	0.00500	0.000679	mg/L			10/16/25 11:20	1
1,1-Dichloropropene	<0.000624	U	0.00500	0.000624	mg/L			10/16/25 11:20	1
Ethylbenzene	<0.000385	U	0.00100	0.000385	mg/L			10/16/25 11:20	1
Hexachlorobutadiene	<0.000627	U	0.00500	0.000627	mg/L			10/16/25 11:20	1
Isopropylbenzene	<0.000592	U	0.00100	0.000592	mg/L			10/16/25 11:20	1
Methylene Chloride	<0.00173	U	0.00500	0.00173	mg/L			10/16/25 11:20	1
m,p-Xylenes	<0.00124	U	0.00200	0.00124	mg/L			10/16/25 11:20	1
MTBE	<0.00139	U	0.00500	0.00139	mg/L			10/16/25 11:20	1
Naphthalene	<0.00135	U	0.0100	0.00135	mg/L			10/16/25 11:20	1
n-Butylbenzene	<0.000510	U	0.00100	0.000510	mg/L			10/16/25 11:20	1
N-Propylbenzene	<0.000429	U	0.00100	0.000429	mg/L			10/16/25 11:20	1
o-Xylene	<0.000502	U	0.00100	0.000502	mg/L			10/16/25 11:20	1
p-Cymene (p-Isopropyltoluene)	<0.000676	U	0.00100	0.000676	mg/L			10/16/25 11:20	1
sec-Butylbenzene	<0.000468	U	0.00100	0.000468	mg/L			10/16/25 11:20	1
Styrene	<0.000619	U	0.00100	0.000619	mg/L			10/16/25 11:20	1
tert-Butylbenzene	<0.000442	U	0.00100	0.000442	mg/L			10/16/25 11:20	1
1,1,1,2-Tetrachloroethane	<0.000644	U	0.00100	0.000644	mg/L			10/16/25 11:20	1
1,1,2,2-Tetrachloroethane	<0.000470	U	0.00100	0.000470	mg/L			10/16/25 11:20	1
Tetrachloroethene	<0.000655	U	0.00100	0.000655	mg/L			10/16/25 11:20	1
Toluene	<0.000475	U	0.00100	0.000475	mg/L			10/16/25 11:20	1
trans-1,2-Dichloroethene	<0.000368	U	0.00100	0.000368	mg/L			10/16/25 11:20	1
trans-1,3-Dichloropropene	<0.00127	U	0.00500	0.00127	mg/L			10/16/25 11:20	1
1,2,3-Trichlorobenzene	<0.00177	U	0.00500	0.00177	mg/L			10/16/25 11:20	1
1,2,4-Trichlorobenzene	<0.00175	U	0.00500	0.00175	mg/L			10/16/25 11:20	1
1,1,1-Trichloroethane	<0.000585	U	0.00500	0.000585	mg/L			10/16/25 11:20	1
1,1,2-Trichloroethane	<0.000411	U	0.00100	0.000411	mg/L			10/16/25 11:20	1
Trichloroethene	<0.00150	U	0.00500	0.00150	mg/L			10/16/25 11:20	1
Trichlorofluoromethane	<0.000560	U	0.00100	0.000560	mg/L			10/16/25 11:20	1
1,2,3-Trichloropropane	<0.000470	U	0.00100	0.000470	mg/L			10/16/25 11:20	1
1,2,4-Trimethylbenzene	<0.000417	U	0.00100	0.000417	mg/L			10/16/25 11:20	1
1,3,5-Trimethylbenzene	<0.000411	U	0.00100	0.000411	mg/L			10/16/25 11:20	1
Vinyl chloride	<0.000428	U	0.00200	0.000428	mg/L			10/16/25 11:20	1
Xylenes, Total	<0.00124	U	0.00200	0.00124	mg/L			10/16/25 11:20	1
Carbon disulfide	<0.00165	U	0.00500	0.00165	mg/L			10/16/25 11:20	1
Acetone	<0.00307	U	0.100	0.00307	mg/L			10/16/25 11:20	1
Methyl acetate	<0.00401	U	0.0200	0.00401	mg/L			10/16/25 11:20	1
4-Methyl-2-pentanone	<0.00500	U	0.0500	0.00500	mg/L			10/16/25 11:20	1
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.00111	U	0.0100	0.00111	mg/L			10/16/25 11:20	1
2-Hexanone	<0.00500	U	0.0500	0.00500	mg/L			10/16/25 11:20	1
Methylcyclohexane	<0.000608	U	0.0100	0.000608	mg/L			10/16/25 11:20	1
Cyclohexane	<0.00129	U	0.00500	0.00129	mg/L			10/16/25 11:20	1

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: MB 860-268883/10
Matrix: Water
Analysis Batch: 268883

Client Sample ID: Method Blank
Prep Type: Total/NA

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	109		63 - 144		10/16/25 11:20	1
4-Bromofluorobenzene (Surr)	104		74 - 124		10/16/25 11:20	1
Dibromofluoromethane (Surr)	105		75 - 131		10/16/25 11:20	1
Toluene-d8 (Surr)	99		80 - 120		10/16/25 11:20	1

Lab Sample ID: LCS 860-268883/4
Matrix: Water
Analysis Batch: 268883

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Benzene	0.0500	0.05089		mg/L		102	70 - 130
Bromobenzene	0.0500	0.04862		mg/L		97	70 - 130
Bromochloromethane	0.0500	0.05109		mg/L		102	70 - 130
Bromodichloromethane	0.0500	0.05013		mg/L		100	65 - 135
Bromoform	0.0500	0.04712		mg/L		94	70 - 130
Bromomethane	0.0500	0.04272		mg/L		85	49 - 140
2-Butanone	0.250	0.2545		mg/L		102	67 - 140
Carbon tetrachloride	0.0500	0.05324		mg/L		106	70 - 130
Chlorobenzene	0.0500	0.05057		mg/L		101	65 - 135
Chloroethane	0.0500	0.04845		mg/L		97	60 - 140
Chloroform	0.0500	0.05066		mg/L		101	70 - 130
Chloromethane	0.0500	0.04806		mg/L		96	60 - 140
4-Chlorotoluene	0.0500	0.05064		mg/L		101	70 - 130
cis-1,2-Dichloroethene	0.0500	0.05152		mg/L		103	70 - 130
cis-1,3-Dichloropropene	0.0500	0.05096		mg/L		102	70 - 130
Dibromochloromethane	0.0500	0.04908		mg/L		98	70 - 130
1,2-Dibromo-3-Chloropropane	0.0500	0.04616		mg/L		92	59 - 130
1,2-Dibromoethane	0.0500	0.04955		mg/L		99	70 - 130
1,2-Dichlorobenzene	0.0500	0.04820		mg/L		96	70 - 130
1,3-Dichlorobenzene	0.0500	0.04869		mg/L		97	70 - 130
1,4-Dichlorobenzene	0.0500	0.04869		mg/L		97	70 - 130
Dichlorodifluoromethane	0.0500	0.04911		mg/L		98	50 - 150
1,1-Dichloroethane	0.0500	0.05117		mg/L		102	70 - 130
1,2-Dichloroethane	0.0500	0.04972		mg/L		99	70 - 130
1,1-Dichloroethene	0.0500	0.04910		mg/L		98	67 - 130
1,2-Dichloropropane	0.0500	0.05072		mg/L		101	70 - 130
1,3-Dichloropropane	0.0500	0.04957		mg/L		99	70 - 130
2,2-Dichloropropane	0.0500	0.05443		mg/L		109	70 - 130
1,1-Dichloropropene	0.0500	0.05142		mg/L		103	70 - 130
Ethylbenzene	0.0500	0.05212		mg/L		104	70 - 130
Hexachlorobutadiene	0.0500	0.04751		mg/L		95	60 - 142
Isopropylbenzene	0.0500	0.05217		mg/L		104	70 - 130
Methylene Chloride	0.0500	0.04598		mg/L		92	71 - 125
m,p-Xylenes	0.0500	0.05241		mg/L		105	70 - 130
MTBE	0.0500	0.05060		mg/L		101	70 - 135
Naphthalene	0.0500	0.04119		mg/L		82	65 - 135
n-Butylbenzene	0.0500	0.05155		mg/L		103	70 - 130
N-Propylbenzene	0.0500	0.05173		mg/L		103	70 - 130

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 860-268883/4
Matrix: Water
Analysis Batch: 268883

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
o-Xylene	0.0500	0.05205		mg/L		104	70 - 130
p-Cymene (p-Isopropyltoluene)	0.0500	0.05212		mg/L		104	70 - 130
sec-Butylbenzene	0.0500	0.05181		mg/L		104	70 - 130
Styrene	0.0500	0.05247		mg/L		105	70 - 130
tert-Butylbenzene	0.0500	0.05086		mg/L		102	70 - 130
1,1,1,2-Tetrachloroethane	0.0500	0.04924		mg/L		98	70 - 130
1,1,2,2-Tetrachloroethane	0.0500	0.04710		mg/L		94	70 - 130
Tetrachloroethene	0.0500	0.05042		mg/L		101	70 - 130
Toluene	0.0500	0.05034		mg/L		101	70 - 130
trans-1,2-Dichloroethene	0.0500	0.05077		mg/L		102	70 - 130
trans-1,3-Dichloropropene	0.0500	0.04896		mg/L		98	70 - 130
1,2,3-Trichlorobenzene	0.0500	0.04803		mg/L		96	63 - 137
1,2,4-Trichlorobenzene	0.0500	0.04757		mg/L		95	70 - 135
1,1,1-Trichloroethane	0.0500	0.05125		mg/L		102	70 - 130
1,1,2-Trichloroethane	0.0500	0.04824		mg/L		96	70 - 130
Trichloroethene	0.0500	0.05035		mg/L		101	70 - 135
Trichlorofluoromethane	0.0500	0.05248		mg/L		105	60 - 140
1,2,3-Trichloropropane	0.0500	0.04757		mg/L		95	70 - 130
1,2,4-Trimethylbenzene	0.0500	0.05278		mg/L		106	70 - 130
1,3,5-Trimethylbenzene	0.0500	0.05139		mg/L		103	70 - 130
Vinyl chloride	0.0500	0.04913		mg/L		98	60 - 140
Carbon disulfide	0.0500	0.04976		mg/L		100	60 - 130
Acetone	0.250	0.2443		mg/L		98	60 - 140
Methyl acetate	0.100	0.09426		mg/L		94	50 - 141
4-Methyl-2-pentanone	0.250	0.2564		mg/L		103	60 - 140
1,1,2-Trichloro-1,2,2-trifluoroethane	0.0500	0.05371		mg/L		107	60 - 140
2-Hexanone	0.250	0.2542		mg/L		102	60 - 140
Methylcyclohexane	0.0500	0.05395		mg/L		108	70 - 130
Cyclohexane	0.0500	0.05105		mg/L		102	65 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*98*		*63 - 144*
4-Bromofluorobenzene (Surr)	*100*		*74 - 124*
Dibromofluoromethane (Surr)	*100*		*75 - 131*
Toluene-d8 (Surr)	*99*		*80 - 120*

Lab Sample ID: LCSD 860-268883/5
Matrix: Water
Analysis Batch: 268883

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Benzene	0.0500	0.05139		mg/L		103	70 - 130	1	25
Bromobenzene	0.0500	0.05067		mg/L		101	70 - 130	4	25
Bromochloromethane	0.0500	0.05108		mg/L		102	70 - 130	0	25
Bromodichloromethane	0.0500	0.05126		mg/L		103	65 - 135	2	25
Bromoform	0.0500	0.05036		mg/L		101	70 - 130	7	25
Bromomethane	0.0500	0.04202		mg/L		84	49 - 140	2	25
2-Butanone	0.250	0.2624		mg/L		105	67 - 140	3	25

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCSD 860-268883/5
Matrix: Water
Analysis Batch: 268883

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Carbon tetrachloride	0.0500	0.05307		mg/L		106	70 - 130	0	25
Chlorobenzene	0.0500	0.05152		mg/L		103	65 - 135	2	25
Chloroethane	0.0500	0.04579		mg/L		92	60 - 140	6	25
Chloroform	0.0500	0.05216		mg/L		104	70 - 130	3	25
Chloromethane	0.0500	0.04686		mg/L		94	60 - 140	3	25
4-Chlorotoluene	0.0500	0.05279		mg/L		106	70 - 130	4	25
cis-1,2-Dichloroethene	0.0500	0.05237		mg/L		105	70 - 130	2	25
cis-1,3-Dichloropropene	0.0500	0.05263		mg/L		105	70 - 130	3	25
Dibromochloromethane	0.0500	0.05016		mg/L		100	70 - 130	2	25
1,2-Dibromo-3-Chloropropane	0.0500	0.04824		mg/L		96	59 - 130	4	25
1,2-Dibromoethane	0.0500	0.05093		mg/L		102	70 - 130	3	25
1,2-Dichlorobenzene	0.0500	0.04971		mg/L		99	70 - 130	3	25
1,3-Dichlorobenzene	0.0500	0.05034		mg/L		101	70 - 130	3	25
1,4-Dichlorobenzene	0.0500	0.05035		mg/L		101	70 - 130	3	25
Dichlorodifluoromethane	0.0500	0.04706		mg/L		94	50 - 150	4	25
1,1-Dichloroethane	0.0500	0.05295		mg/L		106	70 - 130	3	25
1,2-Dichloroethane	0.0500	0.05152		mg/L		103	70 - 130	4	25
1,1-Dichloroethene	0.0500	0.05013		mg/L		100	67 - 130	2	25
1,2-Dichloropropane	0.0500	0.05078		mg/L		102	70 - 130	0	25
1,3-Dichloropropane	0.0500	0.05109		mg/L		102	70 - 130	3	25
2,2-Dichloropropane	0.0500	0.05496		mg/L		110	70 - 130	1	25
1,1-Dichloropropene	0.0500	0.05140		mg/L		103	70 - 130	0	25
Ethylbenzene	0.0500	0.05323		mg/L		106	70 - 130	2	25
Hexachlorobutadiene	0.0500	0.05038		mg/L		101	60 - 142	6	25
Isopropylbenzene	0.0500	0.05377		mg/L		108	70 - 130	3	25
Methylene Chloride	0.0500	0.04799		mg/L		96	71 - 125	4	25
m,p-Xylenes	0.0500	0.05367		mg/L		107	70 - 130	2	25
MTBE	0.0500	0.05303		mg/L		106	70 - 135	5	25
Naphthalene	0.0500	0.04426		mg/L		89	65 - 135	7	25
n-Butylbenzene	0.0500	0.05331		mg/L		107	70 - 130	3	25
N-Propylbenzene	0.0500	0.05265		mg/L		105	70 - 130	2	25
o-Xylene	0.0500	0.05350		mg/L		107	70 - 130	3	25
p-Cymene (p-Isopropyltoluene)	0.0500	0.05406		mg/L		108	70 - 130	4	25
sec-Butylbenzene	0.0500	0.05306		mg/L		106	70 - 130	2	25
Styrene	0.0500	0.05461		mg/L		109	70 - 130	4	25
tert-Butylbenzene	0.0500	0.05212		mg/L		104	70 - 130	2	25
1,1,1,2-Tetrachloroethane	0.0500	0.05147		mg/L		103	70 - 130	4	25
1,1,2,2-Tetrachloroethane	0.0500	0.04902		mg/L		98	70 - 130	4	25
Tetrachloroethene	0.0500	0.05146		mg/L		103	70 - 130	2	25
Toluene	0.0500	0.05127		mg/L		103	70 - 130	2	25
trans-1,2-Dichloroethene	0.0500	0.05273		mg/L		105	70 - 130	4	25
trans-1,3-Dichloropropene	0.0500	0.05165		mg/L		103	70 - 130	5	25
1,2,3-Trichlorobenzene	0.0500	0.05213		mg/L		104	63 - 137	8	25
1,2,4-Trichlorobenzene	0.0500	0.05083		mg/L		102	70 - 135	7	25
1,1,1-Trichloroethane	0.0500	0.05222		mg/L		104	70 - 130	2	25
1,1,2-Trichloroethane	0.0500	0.05038		mg/L		101	70 - 130	4	25
Trichloroethene	0.0500	0.05153		mg/L		103	70 - 135	2	25
Trichlorofluoromethane	0.0500	0.05031		mg/L		101	60 - 140	4	25
1,2,3-Trichloropropane	0.0500	0.04903		mg/L		98	70 - 130	3	25

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCSD 860-268883/5
Matrix: Water
Analysis Batch: 268883

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
1,2,4-Trimethylbenzene			0.0500	0.05459		mg/L		109	70 - 130	3	25
1,3,5-Trimethylbenzene			0.0500	0.05376		mg/L		108	70 - 130	5	25
Vinyl chloride			0.0500	0.04860		mg/L		97	60 - 140	1	25
Carbon disulfide			0.0500	0.04985		mg/L		100	60 - 130	0	25
Acetone			0.250	0.2456		mg/L		98	60 - 140	1	25
Methyl acetate			0.100	0.09915		mg/L		99	50 - 141	5	25
4-Methyl-2-pentanone			0.250	0.2644		mg/L		106	60 - 140	3	25
1,1,2-Trichloro-1,2,2-trifluoroethane			0.0500	0.05070		mg/L		101	60 - 140	6	25
2-Hexanone			0.250	0.2683		mg/L		107	60 - 140	5	25
Methylcyclohexane			0.0500	0.05457		mg/L		109	70 - 130	1	25
Cyclohexane			0.0500	0.05160		mg/L		103	65 - 130	1	25

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*98*		*63 - 144*
4-Bromofluorobenzene (Surr)	*101*		*74 - 124*
Dibromofluoromethane (Surr)	*99*		*75 - 131*
Toluene-d8 (Surr)	*101*		*80 - 120*

Lab Sample ID: 870-40472-C-3 MS
Matrix: Water
Analysis Batch: 268883

Client Sample ID: Matrix Spike
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Benzene	<0.000460	U	0.0500	0.05114		mg/L		102	70 - 130
Bromobenzene	<0.000486	U	0.0500	0.05264		mg/L		105	70 - 130
Bromochloromethane	<0.000577	U	0.0500	0.05160		mg/L		103	70 - 130
Bromodichloromethane	<0.000552	U	0.0500	0.05085		mg/L		102	65 - 135
Bromoform	<0.000633	U	0.0500	0.04968		mg/L		99	70 - 130
Bromomethane	<0.00142	U	0.0500	0.04151		mg/L		83	49 - 140
2-Butanone	<0.00828	U	0.250	0.2462		mg/L		98	67 - 140
Carbon tetrachloride	<0.000896	U	0.0500	0.05313		mg/L		106	70 - 130
Chlorobenzene	<0.000455	U	0.0500	0.05191		mg/L		104	65 - 135
Chloroethane	<0.00198	U	0.0500	0.04859		mg/L		97	60 - 140
Chloroform	<0.000464	U	0.0500	0.05186		mg/L		104	70 - 130
Chloromethane	<0.00204	U	0.0500	0.04654		mg/L		93	60 - 140
4-Chlorotoluene	<0.000386	U	0.0500	0.05475		mg/L		110	70 - 130
cis-1,2-Dichloroethene	<0.000457	U	0.0500	0.05301		mg/L		106	70 - 130
cis-1,3-Dichloropropene	<0.00107	U	0.0500	0.05203		mg/L		104	70 - 130
Dibromochloromethane	<0.000547	U	0.0500	0.05080		mg/L		102	70 - 130
1,2-Dibromo-3-Chloropropane	<0.000671	U	0.0500	0.05067		mg/L		101	59 - 130
1,2-Dibromoethane	<0.000999	U	0.0500	0.05060		mg/L		101	70 - 130
1,2-Dichlorobenzene	<0.000429	U	0.0500	0.05213		mg/L		104	70 - 130
1,3-Dichlorobenzene	<0.000413	U	0.0500	0.05193		mg/L		104	70 - 130
1,4-Dichlorobenzene	<0.000449	U	0.0500	0.05168		mg/L		103	70 - 130
Dichlorodifluoromethane	<0.000785	U	0.0500	0.04449		mg/L		89	50 - 150
1,1-Dichloroethane	<0.000635	U	0.0500	0.04988		mg/L		100	70 - 130
1,2-Dichloroethane	<0.000372	U	0.0500	0.05048		mg/L		101	70 - 130
1,1-Dichloroethene	<0.000738	U	0.0500	0.05069		mg/L		101	67 - 130

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: 870-40472-C-3 MS
Matrix: Water
Analysis Batch: 268883

Client Sample ID: Matrix Spike
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
1,2-Dichloropropane	<0.000556	U	0.0500	0.05100		mg/L		102	70 - 130
1,3-Dichloropropane	<0.000514	U	0.0500	0.05168		mg/L		103	70 - 130
2,2-Dichloropropane	<0.000679	U	0.0500	0.05549		mg/L		111	70 - 130
1,1-Dichloropropene	<0.000624	U	0.0500	0.05223		mg/L		104	70 - 130
Ethylbenzene	<0.000385	U	0.0500	0.05381		mg/L		108	70 - 130
Hexachlorobutadiene	<0.000627	U	0.0500	0.05272		mg/L		105	60 - 142
Isopropylbenzene	<0.000592	U	0.0500	0.05441		mg/L		109	70 - 130
Methylene Chloride	<0.00173	U	0.0500	0.04630		mg/L		93	71 - 125
m,p-Xylenes	<0.00124	U	0.0500	0.05429		mg/L		109	70 - 130
MTBE	<0.00139	U	0.0500	0.05110		mg/L		102	70 - 135
Naphthalene	<0.00135	U	0.0500	0.04559		mg/L		91	65 - 135
n-Butylbenzene	<0.000510	U	0.0500	0.05569		mg/L		111	70 - 130
N-Propylbenzene	<0.000429	U	0.0500	0.05504		mg/L		110	70 - 130
o-Xylene	<0.000502	U	0.0500	0.05399		mg/L		108	70 - 130
p-Cymene (p-Isopropyltoluene)	<0.000676	U	0.0500	0.05637		mg/L		113	70 - 130
sec-Butylbenzene	<0.000468	U	0.0500	0.05551		mg/L		111	70 - 130
Styrene	<0.000619	U	0.0500	0.05526		mg/L		111	70 - 130
tert-Butylbenzene	<0.000442	U	0.0500	0.05540		mg/L		111	70 - 130
1,1,1,2-Tetrachloroethane	<0.000644	U	0.0500	0.05216		mg/L		104	70 - 130
1,1,2,2-Tetrachloroethane	<0.000470	U	0.0500	0.05156		mg/L		103	70 - 130
Tetrachloroethene	<0.000655	U	0.0500	0.05118		mg/L		102	70 - 130
Toluene	<0.000475	U	0.0500	0.05187		mg/L		104	70 - 130
trans-1,2-Dichloroethene	<0.000368	U	0.0500	0.05210		mg/L		104	70 - 130
trans-1,3-Dichloropropene	<0.00127	U	0.0500	0.05204		mg/L		104	70 - 130
1,2,3-Trichlorobenzene	<0.00177	U	0.0500	0.05425		mg/L		108	63 - 137
1,2,4-Trichlorobenzene	<0.00175	U	0.0500	0.05301		mg/L		106	70 - 135
1,1,1-Trichloroethane	<0.000585	U	0.0500	0.05224		mg/L		104	70 - 130
1,1,2-Trichloroethane	<0.000411	U	0.0500	0.05025		mg/L		100	70 - 130
Trichloroethene	<0.00150	U	0.0500	0.04913		mg/L		98	70 - 135
Trichlorofluoromethane	<0.000560	U	0.0500	0.05134		mg/L		103	60 - 140
1,2,3-Trichloropropane	<0.000470	U	0.0500	0.05154		mg/L		103	70 - 130
1,2,4-Trimethylbenzene	<0.000417	U	0.0500	0.05711		mg/L		114	70 - 130
1,3,5-Trimethylbenzene	<0.000411	U	0.0500	0.05558		mg/L		111	70 - 130
Vinyl chloride	<0.000428	U	0.0500	0.04993		mg/L		100	60 - 140
Carbon disulfide	<0.00165	U	0.0500	0.05020		mg/L		100	60 - 130
Acetone	<0.00307	U	0.250	0.2374		mg/L		95	60 - 140
Methyl acetate	<0.00401	U	0.100	0.09176		mg/L		92	50 - 141
4-Methyl-2-pentanone	<0.00500	U	0.250	0.2555		mg/L		102	60 - 140
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.00111	U	0.0500	0.05127		mg/L		103	60 - 140
2-Hexanone	<0.00500	U	0.250	0.2596		mg/L		104	60 - 140
Methylcyclohexane	<0.000608	U	0.0500	0.05394		mg/L		108	70 - 130
Cyclohexane	<0.00129	U	0.0500	0.05092		mg/L		102	65 - 130

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*99*		*63 - 144*
4-Bromofluorobenzene (Surr)	*103*		*74 - 124*
Dibromofluoromethane (Surr)	*100*		*75 - 131*

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: 870-40472-C-3 MS
Matrix: Water
Analysis Batch: 268883

Client Sample ID: Matrix Spike
Prep Type: Total/NA

Surrogate	MS %Recovery	MS Qualifier	Limits
Toluene-d8 (Surr)	101		80 - 120

Method: TX 1005 - Texas - Total Petroleum Hydrocarbon (GC)

Lab Sample ID: MB 860-268476/1-A
Matrix: Water
Analysis Batch: 268299

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 268476

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C6-C12	<0.885	U	5.00	0.885	mg/L		10/14/25 15:27	10/15/25 00:11	1
Over C12-C28	<0.863	U	5.00	0.863	mg/L		10/14/25 15:27	10/15/25 00:11	1
Over C28-C35	<0.863	U	5.00	0.863	mg/L		10/14/25 15:27	10/15/25 00:11	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
1-Chlorooctane (Surr)	79		70 - 130	10/14/25 15:27	10/15/25 00:11	1
o-Terphenyl (Surr)	84		70 - 130	10/14/25 15:27	10/15/25 00:11	1

Lab Sample ID: LCS 860-268476/2-A
Matrix: Water
Analysis Batch: 268299

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 268476

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
C6-C12			100	94.76		mg/L		95	75 - 125		
Over C12-C28			100	108.0		mg/L		108	75 - 125		

Surrogate	LCS %Recovery	LCS Qualifier	Limits
1-Chlorooctane (Surr)	105		70 - 130
o-Terphenyl (Surr)	121		70 - 130

Lab Sample ID: LCSD 860-268476/3-A
Matrix: Water
Analysis Batch: 268299

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 268476

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
C6-C12			100	94.32		mg/L		94	75 - 125	0	20
Over C12-C28			100	110.9		mg/L		111	75 - 125	3	20

Surrogate	LCSD %Recovery	LCSD Qualifier	Limits
1-Chlorooctane (Surr)	105		70 - 130
o-Terphenyl (Surr)	113		70 - 130

Lab Sample ID: MB 860-268719/1-A
Matrix: Solid
Analysis Batch: 268606

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 268719

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C6-C12	<25.0	U	50.0	25.0	mg/Kg		10/15/25 11:47	10/15/25 15:10	1
Over C12-C28	<25.0	U	50.0	25.0	mg/Kg		10/15/25 11:47	10/15/25 15:10	1

Method: TX 1005 - Texas - Total Petroleum Hydrocarbon (GC) (Continued)

Lab Sample ID: MB 860-268719/1-A
Matrix: Solid
Analysis Batch: 268606

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 268719

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Over C28-C35	<25.0	U	50.0	25.0	mg/Kg		10/15/25 11:47	10/15/25 15:10	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1-Chlorooctane (Surr)	*82*		*70 - 130*	*10/15/25 11:47*	*10/15/25 15:10*	*1*
o-Terphenyl (Surr)	*89*		*70 - 130*	*10/15/25 11:47*	*10/15/25 15:10*	*1*

Lab Sample ID: LCS 860-268719/2-A
Matrix: Solid
Analysis Batch: 268606

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 268719

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
C6-C12			1000	842.8		mg/Kg		84	75 - 125		
Over C12-C28			1000	947.3		mg/Kg		95	75 - 125		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1-Chlorooctane (Surr)	*76*		*70 - 130*
o-Terphenyl (Surr)	*81*		*70 - 130*

Lab Sample ID: LCSD 860-268719/3-A
Matrix: Solid
Analysis Batch: 268606

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 268719

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
C6-C12			1000	846.0		mg/Kg		85	75 - 125	0	20
Over C12-C28			1000	933.2		mg/Kg		93	75 - 125	2	20

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
1-Chlorooctane (Surr)	*80*		*70 - 130*
o-Terphenyl (Surr)	*84*		*70 - 130*

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 860-268321/1-A
Matrix: Water
Analysis Batch: 268623

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 268321

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.000690	U	0.00400	0.000690	mg/L		10/14/25 09:00	10/14/25 20:56	1
Barium	<0.00134	U	0.00400	0.00134	mg/L		10/14/25 09:00	10/14/25 20:56	1
Cadmium	<0.000240	U	0.00200	0.000240	mg/L		10/14/25 09:00	10/14/25 20:56	1
Chromium	<0.000560	U	0.00400	0.000560	mg/L		10/14/25 09:00	10/14/25 20:56	1
Lead	<0.000367	U	0.00200	0.000367	mg/L		10/14/25 09:00	10/14/25 20:56	1
Selenium	<0.000590	U	0.00200	0.000590	mg/L		10/14/25 09:00	10/14/25 20:56	1
Silver	<0.000390	U	0.00200	0.000390	mg/L		10/14/25 09:00	10/14/25 20:56	1

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 860-268321/2-A
Matrix: Water
Analysis Batch: 268623

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 268321

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Arsenic			0.100	0.09695		mg/L		97	80 - 120		
Barium			0.100	0.09647		mg/L		96	80 - 120		
Cadmium			0.100	0.09695		mg/L		97	80 - 120		
Chromium			0.100	0.09843		mg/L		98	80 - 120		
Lead			0.100	0.09678		mg/L		97	80 - 120		
Selenium			0.100	0.09452		mg/L		95	80 - 120		
Silver			0.0500	0.05245		mg/L		105	80 - 120		

Lab Sample ID: LCSD 860-268321/3-A
Matrix: Water
Analysis Batch: 268623

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 268321

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic			0.100	0.09731		mg/L		97	80 - 120	0	20
Barium			0.100	0.09657		mg/L		97	80 - 120	0	20
Cadmium			0.100	0.09659		mg/L		97	80 - 120	0	20
Chromium			0.100	0.09800		mg/L		98	80 - 120	0	20
Lead			0.100	0.09597		mg/L		96	80 - 120	1	20
Selenium			0.100	0.09466		mg/L		95	80 - 120	0	20
Silver			0.0500	0.05193		mg/L		104	80 - 120	1	20

Lab Sample ID: 400-283857-C-3-B MS
Matrix: Water
Analysis Batch: 268623

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 268321

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
Arsenic	0.000731	J	0.100	0.09443		mg/L		94	75 - 125		
Barium	0.0136		0.100	0.1093		mg/L		96	75 - 125		
Cadmium	<0.000240	U	0.100	0.09634		mg/L		96	75 - 125		
Chromium	0.00352	J	0.100	0.1022		mg/L		99	75 - 125		
Lead	0.00288		0.100	0.1032		mg/L		100	75 - 125		
Selenium	<0.000590	U	0.100	0.08680		mg/L		87	75 - 125		
Silver	<0.000390	U	0.0500	0.05353		mg/L		107	75 - 125		

Lab Sample ID: 400-283857-C-3-C MSD
Matrix: Water
Analysis Batch: 268623

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA
Prep Batch: 268321

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic	0.000731	J	0.100	0.09242		mg/L		92	75 - 125	2	20
Barium	0.0136		0.100	0.1063		mg/L		93	75 - 125	3	20
Cadmium	<0.000240	U	0.100	0.09340		mg/L		93	75 - 125	3	20
Chromium	0.00352	J	0.100	0.1001		mg/L		97	75 - 125	2	20
Lead	0.00288		0.100	0.1014		mg/L		99	75 - 125	2	20
Selenium	<0.000590	U	0.100	0.08458		mg/L		85	75 - 125	3	20
Silver	<0.000390	U	0.0500	0.05253		mg/L		105	75 - 125	2	20

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: MB 860-268360/1-A
Matrix: Solid
Analysis Batch: 268778

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 268360

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.103	U	0.400	0.103	mg/Kg		10/14/25 10:30	10/15/25 12:55	1
Barium	<0.137	U	0.400	0.137	mg/Kg		10/14/25 10:30	10/15/25 12:55	1
Cadmium	<0.0534	U	0.200	0.0534	mg/Kg		10/14/25 10:30	10/15/25 12:55	1
Chromium	<0.0540	U	0.400	0.0540	mg/Kg		10/14/25 10:30	10/15/25 12:55	1
Lead	<0.0634	U	0.200	0.0634	mg/Kg		10/14/25 10:30	10/15/25 12:55	1
Selenium	<0.0945	U	0.200	0.0945	mg/Kg		10/14/25 10:30	10/15/25 12:55	1
Silver	<0.0478	U	0.200	0.0478	mg/Kg		10/14/25 10:30	10/15/25 12:55	1

Lab Sample ID: LCS 860-268360/2-A
Matrix: Solid
Analysis Batch: 268778

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 268360

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	10.0	9.775		mg/Kg		98	80 - 120
Barium	10.0	9.757		mg/Kg		98	80 - 120
Cadmium	10.0	9.769		mg/Kg		98	80 - 120
Chromium	10.0	9.892		mg/Kg		99	80 - 120
Lead	10.0	9.733		mg/Kg		97	80 - 120
Selenium	10.0	9.442		mg/Kg		94	80 - 120
Silver	5.00	5.249		mg/Kg		105	80 - 120

Lab Sample ID: LCSD 860-268360/3-A
Matrix: Solid
Analysis Batch: 268778

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 268360

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic	10.0	9.762		mg/Kg		98	80 - 120	0	20
Barium	10.0	9.732		mg/Kg		97	80 - 120	0	20
Cadmium	10.0	9.812		mg/Kg		98	80 - 120	0	20
Chromium	10.0	9.887		mg/Kg		99	80 - 120	0	20
Lead	10.0	9.809		mg/Kg		98	80 - 120	1	20
Selenium	10.0	9.414		mg/Kg		94	80 - 120	0	20
Silver	5.00	5.276		mg/Kg		106	80 - 120	1	20

Lab Sample ID: 860-113897-G-1-B MS
Matrix: Solid
Analysis Batch: 268778

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 268360

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	4.11		9.09	13.25		mg/Kg		100	75 - 125
Barium	196		9.09	396.1	4	mg/Kg		2202	75 - 125
Cadmium	<0.226	U	9.09	8.845		mg/Kg		97	75 - 125
Chromium	15.0	F1	9.09	21.64	F1	mg/Kg		73	75 - 125
Lead	8.60		9.09	17.98		mg/Kg		103	75 - 125
Selenium	<0.400	U	9.09	7.386		mg/Kg		81	75 - 125
Silver	<0.203	U	4.55	4.069		mg/Kg		90	75 - 125

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: 860-113897-G-1-C MSD
Matrix: Solid
Analysis Batch: 268778

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA
Prep Batch: 268360

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic	4.11		9.26	13.41		mg/Kg		100	75 - 125	1	20
Barium	196		9.26	373.5	4	mg/Kg		1917	75 - 125	6	20
Cadmium	<0.226	U	9.26	8.992		mg/Kg		97	75 - 125	2	20
Chromium	15.0	F1	9.26	22.18		mg/Kg		77	75 - 125	2	20
Lead	8.60		9.26	18.21		mg/Kg		104	75 - 125	1	20
Selenium	<0.400	U	9.26	7.482		mg/Kg		81	75 - 125	1	20
Silver	<0.203	U	4.63	4.115		mg/Kg		89	75 - 125	1	20

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 860-268450/10-A
Matrix: Water
Analysis Batch: 268571

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 268450

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.0000706	U	0.000200	0.0000706	mg/L		10/14/25 14:02	10/14/25 20:54	1

Lab Sample ID: LCS 860-268450/11-A
Matrix: Water
Analysis Batch: 268571

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 268450

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Mercury	0.00200	0.001951		mg/L		98	80 - 120

Lab Sample ID: LCSD 860-268450/12-A
Matrix: Water
Analysis Batch: 268571

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 268450

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury	0.00200	0.001940		mg/L		97	80 - 120	1	20

Lab Sample ID: 860-113841-8 MS
Matrix: Water
Analysis Batch: 268571

Client Sample ID: TMW-1
Prep Type: Total/NA
Prep Batch: 268450

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Mercury	<0.0000706	U	0.00200	0.001979		mg/L		99	75 - 125

Lab Sample ID: 860-113841-8 MSD
Matrix: Water
Analysis Batch: 268571

Client Sample ID: TMW-1
Prep Type: Total/NA
Prep Batch: 268450

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury	<0.0000706	U	0.00200	0.001928		mg/L		96	75 - 125	3	20

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Method: 7471A - Mercury (CVAA)

Lab Sample ID: MB 860-268683/10-A
Matrix: Solid
Analysis Batch: 268768

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 268683

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.00895	U	0.0200	0.00895	mg/Kg		10/15/25 10:54	10/15/25 13:16	1

Lab Sample ID: LCS 860-268683/11-A
Matrix: Solid
Analysis Batch: 268768

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 268683

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Mercury			0.200	0.1939		mg/Kg		97	80 - 120		

Lab Sample ID: LCSD 860-268683/12-A
Matrix: Solid
Analysis Batch: 268768

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 268683

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury			0.200	0.1950		mg/Kg		97	80 - 120	1	20

Lab Sample ID: 870-40601-A-11-C MS
Matrix: Solid
Analysis Batch: 268768

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 268683

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
Mercury	0.00938	J	0.213	0.2059		mg/Kg	☼	92	75 - 125		

Lab Sample ID: 870-40601-A-11-D MSD
Matrix: Solid
Analysis Batch: 268768

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA
Prep Batch: 268683

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury	0.00938	J	0.229	0.2300		mg/Kg	☼	96	75 - 125	11	20

Method: 9045D - pH

Lab Sample ID: 860-113841-3 DU
Matrix: Solid
Analysis Batch: 268427

Client Sample ID: SB-2 13-15'
Prep Type: Soluble

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
pH	7.9	HF		7.8		SU				0.5	20
Temperature	21.2	HF		21.2		Deg. C				0	25
Corrosivity	7.9	HF		7.8		SU				0.5	20

QC Association Summary

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

GC/MS VOA

Prep Batch: 268107

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-1	SB-1 5-8'	Total/NA	Solid	5035	
860-113841-2	SB-2 1-5'	Total/NA	Solid	5035	
860-113841-3	SB-2 13-15'	Total/NA	Solid	5035	
860-113841-4	SB-3 5-8'	Total/NA	Solid	5035	
860-113841-5	SB-4 3-5'	Total/NA	Solid	5035	
860-113841-6	SB-4 10-12'	Total/NA	Solid	5035	
860-113841-7	SB-5 1-5'	Total/NA	Solid	5035	

Analysis Batch: 268311

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-1	SB-1 5-8'	Total/NA	Solid	8260D	268107
860-113841-2	SB-2 1-5'	Total/NA	Solid	8260D	268107
860-113841-3	SB-2 13-15'	Total/NA	Solid	8260D	268107
860-113841-4	SB-3 5-8'	Total/NA	Solid	8260D	268107
860-113841-5	SB-4 3-5'	Total/NA	Solid	8260D	268107
860-113841-6	SB-4 10-12'	Total/NA	Solid	8260D	268107
860-113841-7	SB-5 1-5'	Total/NA	Solid	8260D	268107
MB 860-268311/8	Method Blank	Total/NA	Solid	8260D	
LCS 860-268311/3	Lab Control Sample	Total/NA	Solid	8260D	
LCSD 860-268311/4	Lab Control Sample Dup	Total/NA	Solid	8260D	
860-113834-A-3-B MS	Matrix Spike	Total/NA	Solid	8260D	268469

Prep Batch: 268469

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113834-A-3-B MS	Matrix Spike	Total/NA	Solid	5035	

Analysis Batch: 268883

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-8	TMW-1	Total/NA	Water	8260D	
860-113841-9	TMW-3	Total/NA	Water	8260D	
860-113841-10	TMW-5	Total/NA	Water	8260D	
MB 860-268883/10	Method Blank	Total/NA	Water	8260D	
LCS 860-268883/4	Lab Control Sample	Total/NA	Water	8260D	
LCSD 860-268883/5	Lab Control Sample Dup	Total/NA	Water	8260D	
870-40472-C-3 MS	Matrix Spike	Total/NA	Water	8260D	

GC Semi VOA

Analysis Batch: 268299

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-8	TMW-1	Total/NA	Water	TX 1005	268476
860-113841-9	TMW-3	Total/NA	Water	TX 1005	268476
860-113841-10	TMW-5	Total/NA	Water	TX 1005	268476
MB 860-268476/1-A	Method Blank	Total/NA	Water	TX 1005	268476
LCS 860-268476/2-A	Lab Control Sample	Total/NA	Water	TX 1005	268476
LCSD 860-268476/3-A	Lab Control Sample Dup	Total/NA	Water	TX 1005	268476

Prep Batch: 268476

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-8	TMW-1	Total/NA	Water	TX_1005_W_Prep	

GC Semi VOA (Continued)

Prep Batch: 268476 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-9	TMW-3	Total/NA	Water	TX_1005_W_Prep	
860-113841-10	TMW-5	Total/NA	Water	TX_1005_W_Prep	
MB 860-268476/1-A	Method Blank	Total/NA	Water	TX_1005_W_Prep	
LCS 860-268476/2-A	Lab Control Sample	Total/NA	Water	TX_1005_W_Prep	
LCSD 860-268476/3-A	Lab Control Sample Dup	Total/NA	Water	TX_1005_W_Prep	

Analysis Batch: 268606

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-2	SB-2 1-5'	Total/NA	Solid	TX 1005	268719
860-113841-4	SB-3 5-8'	Total/NA	Solid	TX 1005	268719
860-113841-7	SB-5 1-5'	Total/NA	Solid	TX 1005	268719
MB 860-268719/1-A	Method Blank	Total/NA	Solid	TX 1005	268719
LCS 860-268719/2-A	Lab Control Sample	Total/NA	Solid	TX 1005	268719
LCSD 860-268719/3-A	Lab Control Sample Dup	Total/NA	Solid	TX 1005	268719

Analysis Batch: 268682

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-1	SB-1 5-8'	Total/NA	Solid	TX 1005	
860-113841-2	SB-2 1-5'	Total/NA	Solid	TX 1005	
860-113841-3	SB-2 13-15'	Total/NA	Solid	TX 1005	
860-113841-4	SB-3 5-8'	Total/NA	Solid	TX 1005	
860-113841-5	SB-4 3-5'	Total/NA	Solid	TX 1005	
860-113841-6	SB-4 10-12'	Total/NA	Solid	TX 1005	
860-113841-7	SB-5 1-5'	Total/NA	Solid	TX 1005	
860-113841-8	TMW-1	Total/NA	Water	TX 1005	
860-113841-9	TMW-3	Total/NA	Water	TX 1005	
860-113841-10	TMW-5	Total/NA	Water	TX 1005	

Prep Batch: 268719

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-1	SB-1 5-8'	Total/NA	Solid	TX_1005_S_Prep	
860-113841-2	SB-2 1-5'	Total/NA	Solid	TX_1005_S_Prep	
860-113841-3	SB-2 13-15'	Total/NA	Solid	TX_1005_S_Prep	
860-113841-4	SB-3 5-8'	Total/NA	Solid	TX_1005_S_Prep	
860-113841-5	SB-4 3-5'	Total/NA	Solid	TX_1005_S_Prep	
860-113841-6	SB-4 10-12'	Total/NA	Solid	TX_1005_S_Prep	
860-113841-7	SB-5 1-5'	Total/NA	Solid	TX_1005_S_Prep	
MB 860-268719/1-A	Method Blank	Total/NA	Solid	TX_1005_S_Prep	
LCS 860-268719/2-A	Lab Control Sample	Total/NA	Solid	TX_1005_S_Prep	
LCSD 860-268719/3-A	Lab Control Sample Dup	Total/NA	Solid	TX_1005_S_Prep	

GC Semi VOA

Analysis Batch: 268946

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-1	SB-1 5-8'	Total/NA	Solid	TX 1005	268719
860-113841-3	SB-2 13-15'	Total/NA	Solid	TX 1005	268719
860-113841-5	SB-4 3-5'	Total/NA	Solid	TX 1005	268719
860-113841-6	SB-4 10-12'	Total/NA	Solid	TX 1005	268719

Metals

Prep Batch: 268321

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-8	TMW-1	Total/NA	Water	3010A	
860-113841-9	TMW-3	Total/NA	Water	3010A	
860-113841-10	TMW-5	Total/NA	Water	3010A	
MB 860-268321/1-A	Method Blank	Total/NA	Water	3010A	
LCS 860-268321/2-A	Lab Control Sample	Total/NA	Water	3010A	
LCSD 860-268321/3-A	Lab Control Sample Dup	Total/NA	Water	3010A	
400-283857-C-3-B MS	Matrix Spike	Total/NA	Water	3010A	
400-283857-C-3-C MSD	Matrix Spike Duplicate	Total/NA	Water	3010A	

Prep Batch: 268360

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-1	SB-1 5-8'	Total/NA	Solid	3051A	
860-113841-2	SB-2 1-5'	Total/NA	Solid	3051A	
860-113841-3	SB-2 13-15'	Total/NA	Solid	3051A	
860-113841-4	SB-3 5-8'	Total/NA	Solid	3051A	
860-113841-5	SB-4 3-5'	Total/NA	Solid	3051A	
860-113841-6	SB-4 10-12'	Total/NA	Solid	3051A	
860-113841-7	SB-5 1-5'	Total/NA	Solid	3051A	
MB 860-268360/1-A	Method Blank	Total/NA	Solid	3051A	
LCS 860-268360/2-A	Lab Control Sample	Total/NA	Solid	3051A	
LCSD 860-268360/3-A	Lab Control Sample Dup	Total/NA	Solid	3051A	
860-113897-G-1-B MS	Matrix Spike	Total/NA	Solid	3051A	
860-113897-G-1-C MSD	Matrix Spike Duplicate	Total/NA	Solid	3051A	

Prep Batch: 268450

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-8	TMW-1	Total/NA	Water	7470A	
860-113841-9	TMW-3	Total/NA	Water	7470A	
860-113841-10	TMW-5	Total/NA	Water	7470A	
MB 860-268450/10-A	Method Blank	Total/NA	Water	7470A	
LCS 860-268450/11-A	Lab Control Sample	Total/NA	Water	7470A	
LCSD 860-268450/12-A	Lab Control Sample Dup	Total/NA	Water	7470A	
860-113841-8 MS	TMW-1	Total/NA	Water	7470A	
860-113841-8 MSD	TMW-1	Total/NA	Water	7470A	

Analysis Batch: 268571

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-8	TMW-1	Total/NA	Water	7470A	268450
860-113841-9	TMW-3	Total/NA	Water	7470A	268450
860-113841-10	TMW-5	Total/NA	Water	7470A	268450
MB 860-268450/10-A	Method Blank	Total/NA	Water	7470A	268450
LCS 860-268450/11-A	Lab Control Sample	Total/NA	Water	7470A	268450

Metals (Continued)

Analysis Batch: 268571 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCSD 860-268450/12-A	Lab Control Sample Dup	Total/NA	Water	7470A	268450
860-113841-8 MS	TMW-1	Total/NA	Water	7470A	268450
860-113841-8 MSD	TMW-1	Total/NA	Water	7470A	268450

Analysis Batch: 268623

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-8	TMW-1	Total/NA	Water	6020B	268321
860-113841-9	TMW-3	Total/NA	Water	6020B	268321
860-113841-10	TMW-5	Total/NA	Water	6020B	268321
MB 860-268321/1-A	Method Blank	Total/NA	Water	6020B	268321
LCS 860-268321/2-A	Lab Control Sample	Total/NA	Water	6020B	268321
LCSD 860-268321/3-A	Lab Control Sample Dup	Total/NA	Water	6020B	268321
400-283857-C-3-B MS	Matrix Spike	Total/NA	Water	6020B	268321
400-283857-C-3-C MSD	Matrix Spike Duplicate	Total/NA	Water	6020B	268321

Prep Batch: 268683

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-1	SB-1 5-8'	Total/NA	Solid	7471A	
860-113841-2	SB-2 1-5'	Total/NA	Solid	7471A	
860-113841-3	SB-2 13-15'	Total/NA	Solid	7471A	
860-113841-4	SB-3 5-8'	Total/NA	Solid	7471A	
860-113841-5	SB-4 3-5'	Total/NA	Solid	7471A	
860-113841-6	SB-4 10-12'	Total/NA	Solid	7471A	
860-113841-7	SB-5 1-5'	Total/NA	Solid	7471A	
MB 860-268683/10-A	Method Blank	Total/NA	Solid	7471A	
LCS 860-268683/11-A	Lab Control Sample	Total/NA	Solid	7471A	
LCSD 860-268683/12-A	Lab Control Sample Dup	Total/NA	Solid	7471A	
870-40601-A-11-C MS	Matrix Spike	Total/NA	Solid	7471A	
870-40601-A-11-D MSD	Matrix Spike Duplicate	Total/NA	Solid	7471A	

Analysis Batch: 268768

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-1	SB-1 5-8'	Total/NA	Solid	7471A	268683
860-113841-2	SB-2 1-5'	Total/NA	Solid	7471A	268683
860-113841-3	SB-2 13-15'	Total/NA	Solid	7471A	268683
860-113841-4	SB-3 5-8'	Total/NA	Solid	7471A	268683
860-113841-5	SB-4 3-5'	Total/NA	Solid	7471A	268683
860-113841-6	SB-4 10-12'	Total/NA	Solid	7471A	268683
860-113841-7	SB-5 1-5'	Total/NA	Solid	7471A	268683
MB 860-268683/10-A	Method Blank	Total/NA	Solid	7471A	268683
LCS 860-268683/11-A	Lab Control Sample	Total/NA	Solid	7471A	268683
LCSD 860-268683/12-A	Lab Control Sample Dup	Total/NA	Solid	7471A	268683
870-40601-A-11-C MS	Matrix Spike	Total/NA	Solid	7471A	268683
870-40601-A-11-D MSD	Matrix Spike Duplicate	Total/NA	Solid	7471A	268683

Analysis Batch: 268778

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-1	SB-1 5-8'	Total/NA	Solid	6020B	268360
860-113841-2	SB-2 1-5'	Total/NA	Solid	6020B	268360
860-113841-3	SB-2 13-15'	Total/NA	Solid	6020B	268360
860-113841-4	SB-3 5-8'	Total/NA	Solid	6020B	268360

Metals (Continued)

Analysis Batch: 268778 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-5	SB-4 3-5'	Total/NA	Solid	6020B	268360
860-113841-6	SB-4 10-12'	Total/NA	Solid	6020B	268360
860-113841-7	SB-5 1-5'	Total/NA	Solid	6020B	268360
MB 860-268360/1-A	Method Blank	Total/NA	Solid	6020B	268360
LCS 860-268360/2-A	Lab Control Sample	Total/NA	Solid	6020B	268360
LCSD 860-268360/3-A	Lab Control Sample Dup	Total/NA	Solid	6020B	268360
860-113897-G-1-B MS	Matrix Spike	Total/NA	Solid	6020B	268360
860-113897-G-1-C MSD	Matrix Spike Duplicate	Total/NA	Solid	6020B	268360

General Chemistry

Leach Batch: 268382

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-1	SB-1 5-8'	Soluble	Solid	DI Leach	
860-113841-2	SB-2 1-5'	Soluble	Solid	DI Leach	
860-113841-3	SB-2 13-15'	Soluble	Solid	DI Leach	
860-113841-4	SB-3 5-8'	Soluble	Solid	DI Leach	
860-113841-5	SB-4 3-5'	Soluble	Solid	DI Leach	
860-113841-6	SB-4 10-12'	Soluble	Solid	DI Leach	
860-113841-7	SB-5 1-5'	Soluble	Solid	DI Leach	
860-113841-3 DU	SB-2 13-15'	Soluble	Solid	DI Leach	

Analysis Batch: 268427

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-1	SB-1 5-8'	Soluble	Solid	9045D	268382
860-113841-2	SB-2 1-5'	Soluble	Solid	9045D	268382
860-113841-3	SB-2 13-15'	Soluble	Solid	9045D	268382
860-113841-4	SB-3 5-8'	Soluble	Solid	9045D	268382
860-113841-5	SB-4 3-5'	Soluble	Solid	9045D	268382
860-113841-6	SB-4 10-12'	Soluble	Solid	9045D	268382
860-113841-7	SB-5 1-5'	Soluble	Solid	9045D	268382
860-113841-3 DU	SB-2 13-15'	Soluble	Solid	9045D	268382

Analysis Batch: 268793

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
860-113841-1	SB-1 5-8'	Total/NA	Solid	Moisture	
860-113841-2	SB-2 1-5'	Total/NA	Solid	Moisture	
860-113841-3	SB-2 13-15'	Total/NA	Solid	Moisture	
860-113841-4	SB-3 5-8'	Total/NA	Solid	Moisture	
860-113841-5	SB-4 3-5'	Total/NA	Solid	Moisture	
860-113841-6	SB-4 10-12'	Total/NA	Solid	Moisture	
860-113841-7	SB-5 1-5'	Total/NA	Solid	Moisture	
MB 860-268793/1	Method Blank	Total/NA	Solid	Moisture	
870-40656-A-4 DU	Duplicate	Total/NA	Solid	Moisture	

Lab Chronicle

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Client Sample ID: SB-1 5-8'
Date Collected: 10/09/25 08:00
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-1
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TX 1005		1			268682	10/16/25 13:15	RJT	EET HOU
Soluble	Leach	DI Leach			20 g	20 mL	268382	10/14/25 10:53	MK	EET HOU
Soluble	Analysis	9045D		1	20 g	20 mL	268427	10/14/25 13:10	MK	EET HOU
Total/NA	Analysis	Moisture		1			268793	10/15/25 14:48	JC	EET HOU

Client Sample ID: SB-1 5-8'
Date Collected: 10/09/25 08:00
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-1
Matrix: Solid
Percent Solids: 92.7

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			6.72 g	5 mL	268107	10/10/25 11:33	MTMG	EET HOU
Total/NA	Analysis	8260D		1	5 mL	5 mL	268311	10/14/25 12:54	MTMG	EET HOU
Total/NA	Prep	TX_1005_S_Prep			11.27 g	10 mL	268719	10/15/25 11:47	TB	EET HOU
Total/NA	Analysis	TX 1005		1			268946	10/16/25 13:15	WP	EET HOU
Total/NA	Prep	3051A			.54 g	50 mL	268360	10/14/25 10:30	PB	EET HOU
Total/NA	Analysis	6020B		5			268778	10/15/25 14:19	DP	EET HOU
Total/NA	Prep	7471A			0.50 g	50 mL	268683	10/15/25 10:55	PB	EET HOU
Total/NA	Analysis	7471A		1			268768	10/15/25 13:44	JDM	EET HOU

Client Sample ID: SB-2 1-5'
Date Collected: 10/09/25 09:16
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-2
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TX 1005		1			268682	10/15/25 16:12	RJT	EET HOU
Soluble	Leach	DI Leach			20.7 g	20 mL	268382	10/14/25 10:53	MK	EET HOU
Soluble	Analysis	9045D		1	20 g	20 mL	268427	10/14/25 13:09	MK	EET HOU
Total/NA	Analysis	Moisture		1			268793	10/15/25 14:48	JC	EET HOU

Client Sample ID: SB-2 1-5'
Date Collected: 10/09/25 09:16
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-2
Matrix: Solid
Percent Solids: 82.8

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			6.5 g	5 mL	268107	10/10/25 11:33	MTMG	EET HOU
Total/NA	Analysis	8260D		1	5 mL	5 mL	268311	10/14/25 13:18	MTMG	EET HOU
Total/NA	Prep	TX_1005_S_Prep			12.95 g	10 mL	268719	10/15/25 11:47	TB	EET HOU
Total/NA	Analysis	TX 1005		1			268606	10/15/25 16:12	MS	EET HOU
Total/NA	Prep	3051A			.52 g	50 mL	268360	10/14/25 10:30	PB	EET HOU
Total/NA	Analysis	6020B		5			268778	10/15/25 14:22	DP	EET HOU
Total/NA	Prep	7471A			0.50 g	50 mL	268683	10/15/25 10:55	PB	EET HOU
Total/NA	Analysis	7471A		1			268768	10/15/25 13:46	JDM	EET HOU

Lab Chronicle

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Client Sample ID: SB-2 13-15'
Date Collected: 10/09/25 09:28
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-3
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TX 1005		1			268682	10/16/25 13:32	RJT	EET HOU
Soluble	Leach	DI Leach			20 g	20 mL	268382	10/14/25 10:53	MK	EET HOU
Soluble	Analysis	9045D		1	20 g	20 mL	268427	10/14/25 13:09	MK	EET HOU
Total/NA	Analysis	Moisture		1			268793	10/15/25 14:48	JC	EET HOU

Client Sample ID: SB-2 13-15'
Date Collected: 10/09/25 09:28
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-3
Matrix: Solid
Percent Solids: 84.7

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			5.49 g	5 mL	268107	10/10/25 11:33	MTMG	EET HOU
Total/NA	Analysis	8260D		1	5 mL	5 mL	268311	10/14/25 13:42	MTMG	EET HOU
Total/NA	Prep	TX_1005_S_Prep			10.93 g	10 mL	268719	10/15/25 11:47	TB	EET HOU
Total/NA	Analysis	TX 1005		1			268946	10/16/25 13:32	WP	EET HOU
Total/NA	Prep	3051A			.55 g	50 mL	268360	10/14/25 10:30	PB	EET HOU
Total/NA	Analysis	6020B		5			268778	10/15/25 14:25	DP	EET HOU
Total/NA	Prep	7471A			0.52 g	50 mL	268683	10/15/25 10:55	PB	EET HOU
Total/NA	Analysis	7471A		1			268768	10/15/25 13:47	JDM	EET HOU

Client Sample ID: SB-3 5-8'
Date Collected: 10/09/25 10:00
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-4
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TX 1005		1			268682	10/15/25 16:42	RJT	EET HOU
Soluble	Leach	DI Leach			20 g	20 mL	268382	10/14/25 10:53	MK	EET HOU
Soluble	Analysis	9045D		1	20 g	20 mL	268427	10/14/25 13:10	MK	EET HOU
Total/NA	Analysis	Moisture		1			268793	10/15/25 14:48	JC	EET HOU

Client Sample ID: SB-3 5-8'
Date Collected: 10/09/25 10:00
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-4
Matrix: Solid
Percent Solids: 94.2

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			5.75 g	5 mL	268107	10/10/25 11:33	MTMG	EET HOU
Total/NA	Analysis	8260D		1	5 mL	5 mL	268311	10/14/25 14:06	MTMG	EET HOU
Total/NA	Prep	TX_1005_S_Prep			9.76 g	10 mL	268719	10/15/25 11:47	TB	EET HOU
Total/NA	Analysis	TX 1005		1			268606	10/15/25 16:42	MS	EET HOU
Total/NA	Prep	3051A			.54 g	50 mL	268360	10/14/25 10:30	PB	EET HOU
Total/NA	Analysis	6020B		5			268778	10/15/25 14:28	DP	EET HOU
Total/NA	Prep	7471A			0.50 g	50 mL	268683	10/15/25 10:55	PB	EET HOU
Total/NA	Analysis	7471A		1			268768	10/15/25 13:48	JDM	EET HOU

Lab Chronicle

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Client Sample ID: SB-4 3-5'
Date Collected: 10/09/25 12:02
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-5
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TX 1005		1			268682	10/16/25 13:47	RJT	EET HOU
Soluble	Leach	DI Leach			20 g	20 mL	268382	10/14/25 10:53	MK	EET HOU
Soluble	Analysis	9045D		1	20 g	20 mL	268427	10/14/25 13:10	MK	EET HOU
Total/NA	Analysis	Moisture		1			268793	10/15/25 14:48	JC	EET HOU

Client Sample ID: SB-4 3-5'
Date Collected: 10/09/25 12:02
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-5
Matrix: Solid
Percent Solids: 90.2

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			5.67 g	5 mL	268107	10/10/25 11:33	MTMG	EET HOU
Total/NA	Analysis	8260D		1	5 mL	5 mL	268311	10/14/25 14:30	MTMG	EET HOU
Total/NA	Prep	TX_1005_S_Prep			9.61 g	10 mL	268719	10/15/25 11:47	TB	EET HOU
Total/NA	Analysis	TX 1005		1			268946	10/16/25 13:47	WP	EET HOU
Total/NA	Prep	3051A			.56 g	50 mL	268360	10/14/25 10:30	PB	EET HOU
Total/NA	Analysis	6020B		5			268778	10/15/25 14:32	DP	EET HOU
Total/NA	Prep	7471A			0.50 g	50 mL	268683	10/15/25 10:55	PB	EET HOU
Total/NA	Analysis	7471A		1			268768	10/15/25 13:50	JDM	EET HOU

Client Sample ID: SB-4 10-12'
Date Collected: 10/09/25 12:16
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-6
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TX 1005		1			268682	10/16/25 14:03	RJT	EET HOU
Soluble	Leach	DI Leach			20 g	20 mL	268382	10/14/25 10:53	MK	EET HOU
Soluble	Analysis	9045D		1	20 g	20 mL	268427	10/14/25 13:10	MK	EET HOU
Total/NA	Analysis	Moisture		1			268793	10/15/25 14:48	JC	EET HOU

Client Sample ID: SB-4 10-12'
Date Collected: 10/09/25 12:16
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-6
Matrix: Solid
Percent Solids: 90.0

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			7.36 g	5 mL	268107	10/10/25 11:33	MTMG	EET HOU
Total/NA	Analysis	8260D		1	5 mL	5 mL	268311	10/14/25 14:54	MTMG	EET HOU
Total/NA	Prep	TX_1005_S_Prep			10.55 g	10 mL	268719	10/15/25 11:47	TB	EET HOU
Total/NA	Analysis	TX 1005		1			268946	10/16/25 14:03	WP	EET HOU
Total/NA	Prep	3051A			.54 g	50 mL	268360	10/14/25 10:30	PB	EET HOU
Total/NA	Analysis	6020B		5			268778	10/15/25 14:35	DP	EET HOU
Total/NA	Prep	7471A			0.55 g	50 mL	268683	10/15/25 10:55	PB	EET HOU
Total/NA	Analysis	7471A		1			268768	10/15/25 13:51	JDM	EET HOU

Lab Chronicle

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Client Sample ID: SB-5 1-5'
Date Collected: 10/09/25 12:55
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-7
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	TX 1005		1			268682	10/15/25 17:44	RJT	EET HOU
Soluble	Leach	DI Leach			20 g	20 mL	268382	10/14/25 10:53	MK	EET HOU
Soluble	Analysis	9045D		1	20 g	20 mL	268427	10/14/25 13:10	MK	EET HOU
Total/NA	Analysis	Moisture		1			268793	10/15/25 14:48	JC	EET HOU

Client Sample ID: SB-5 1-5'
Date Collected: 10/09/25 12:55
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-7
Matrix: Solid
Percent Solids: 84.3

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			6.6 g	5 mL	268107	10/10/25 11:33	MTMG	EET HOU
Total/NA	Analysis	8260D		1	5 mL	5 mL	268311	10/14/25 15:18	MTMG	EET HOU
Total/NA	Prep	TX_1005_S_Prep			10.77 g	10 mL	268719	10/15/25 11:47	TB	EET HOU
Total/NA	Analysis	TX 1005		1			268606	10/15/25 17:44	MS	EET HOU
Total/NA	Prep	3051A			.56 g	50 mL	268360	10/14/25 10:30	PB	EET HOU
Total/NA	Analysis	6020B		5			268778	10/15/25 14:38	DP	EET HOU
Total/NA	Prep	7471A			.56 g	50 mL	268683	10/15/25 10:55	PB	EET HOU
Total/NA	Analysis	7471A		1			268768	10/15/25 13:53	JDM	EET HOU

Client Sample ID: TMW-1
Date Collected: 10/09/25 08:41
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-8
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260D		1	5 mL	5 mL	268883	10/16/25 12:01	NA	EET HOU
Total/NA	Prep	TX_1005_W_Prep			31.7 mL	3 mL	268476	10/14/25 15:27	IS	EET HOU
Total/NA	Analysis	TX 1005		1			268299	10/15/25 06:04	IS	EET HOU
Total/NA	Analysis	TX 1005		1			268682	10/15/25 06:04	RJT	EET HOU
Total/NA	Prep	3010A			50 mL	50 mL	268321	10/14/25 09:00	MD	EET HOU
Total/NA	Analysis	6020B		1			268623	10/14/25 21:40	DP	EET HOU
Total/NA	Prep	7470A			50 mL	50 mL	268450	10/14/25 14:02	PB	EET HOU
Total/NA	Analysis	7470A		1			268571	10/14/25 20:58	SHZ	EET HOU

Client Sample ID: TMW-3
Date Collected: 10/09/25 10:24
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-9
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260D		1	5 mL	5 mL	268883	10/16/25 12:21	NA	EET HOU
Total/NA	Prep	TX_1005_W_Prep			31.2 mL	3 mL	268476	10/14/25 15:27	IS	EET HOU
Total/NA	Analysis	TX 1005		1			268299	10/15/25 06:20	IS	EET HOU
Total/NA	Analysis	TX 1005		1			268682	10/15/25 06:20	RJT	EET HOU
Total/NA	Prep	3010A			50 mL	50 mL	268321	10/14/25 09:00	MD	EET HOU
Total/NA	Analysis	6020B		1			268623	10/14/25 21:43	DP	EET HOU

Lab Chronicle

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Client Sample ID: TMW-3

Date Collected: 10/09/25 10:24
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-9

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	7470A			50 mL	50 mL	268450	10/14/25 14:02	PB	EET HOU
Total/NA	Analysis	7470A		1			268571	10/14/25 21:05	SHZ	EET HOU

Client Sample ID: TMW-5

Date Collected: 10/09/25 13:26
Date Received: 10/10/25 09:19

Lab Sample ID: 860-113841-10

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260D		1	5 mL	5 mL	268883	10/16/25 12:42	NA	EET HOU
Total/NA	Prep	TX_1005_W_Prep			31.4 mL	3 mL	268476	10/14/25 15:27	IS	EET HOU
Total/NA	Analysis	TX 1005		1			268299	10/15/25 06:36	IS	EET HOU
Total/NA	Analysis	TX 1005		1			268682	10/15/25 06:36	RJT	EET HOU
Total/NA	Prep	3010A			50 mL	50 mL	268321	10/14/25 09:00	MD	EET HOU
Total/NA	Analysis	6020B		1			268623	10/14/25 21:46	DP	EET HOU
Total/NA	Prep	7470A			50 mL	50 mL	268450	10/14/25 14:02	PB	EET HOU
Total/NA	Analysis	7470A		1			268571	10/14/25 21:09	SHZ	EET HOU

Laboratory References:

EET HOU = Eurofins Houston, 4145 Greenbriar Dr, Stafford, TX 77477, TEL (281)240-4200

Accreditation/Certification Summary

Client: Phase Engineering Inc.
Job ID: 860-113841-1
Project/Site: PE # 202510014, Abilene, TX

Laboratory: Eurofins Houston

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
Texas	NELAP	T104704215	06-30-26

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
8260D		Water	Cyclohexane
8260D	5035	Solid	Cyclohexane
9045D		Solid	Temperature
Moisture		Solid	Percent Solids

Method Summary

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Method	Method Description	Protocol	Laboratory
8260D	Volatile Organic Compounds by GC/MS	SW846	EET HOU
TX 1005	Texas - Total Petroleum Hydrocarbon (GC)	TCEQ	EET HOU
6020B	Metals (ICP/MS)	SW846	EET HOU
7470A	Mercury (CVAA)	SW846	EET HOU
7471A	Mercury (CVAA)	SW846	EET HOU
9045D	pH	SW846	EET HOU
Moisture	Percent Moisture	EPA	EET HOU
3010A	Preparation, Total Metals	SW846	EET HOU
3051A	Preparation, Metals, Microwave Assisted	SW846	EET HOU
5030C	Purge and Trap	SW846	EET HOU
5035	Closed System Purge and Trap	SW846	EET HOU
7470A	Preparation, Mercury	SW846	EET HOU
7471A	Preparation, Mercury	SW846	EET HOU
DI Leach	Deionized Water Leaching Procedure	ASTM	EET HOU
TX_1005_S_Prep	Extraction - Texas Total petroleum Hyrdocarbons	TCEQ	EET HOU
TX_1005_W_Prep	Extraction - Texas Total petroleum Hyrdocarbons	TCEQ	EET HOU

Protocol References:

ASTM = ASTM International
EPA = US Environmental Protection Agency
SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.
TCEQ = Texas Commission of Environmental Quality

Laboratory References:

EET HOU = Eurofins Houston, 4145 Greenbriar Dr, Stafford, TX 77477, TEL (281)240-4200

Sample Summary

Client: Phase Engineering Inc.
Project/Site: PE # 202510014, Abilene, TX

Job ID: 860-113841-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Sample Origin
860-113841-1	SB-1 5-8'	Solid	10/09/25 08:00	10/10/25 09:19	Texas
860-113841-2	SB-2 1-5'	Solid	10/09/25 09:16	10/10/25 09:19	Texas
860-113841-3	SB-2 13-15'	Solid	10/09/25 09:28	10/10/25 09:19	Texas
860-113841-4	SB-3 5-8'	Solid	10/09/25 10:00	10/10/25 09:19	Texas
860-113841-5	SB-4 3-5'	Solid	10/09/25 12:02	10/10/25 09:19	Texas
860-113841-6	SB-4 10-12'	Solid	10/09/25 12:16	10/10/25 09:19	Texas
860-113841-7	SB-5 1-5'	Solid	10/09/25 12:55	10/10/25 09:19	Texas
860-113841-8	TMW-1	Water	10/09/25 08:41	10/10/25 09:19	Texas
860-113841-9	TMW-3	Water	10/09/25 10:24	10/10/25 09:19	Texas
860-113841-10	TMW-5	Water	10/09/25 13:26	10/10/25 09:19	Texas

Eurofins Houston
4145 Greenbriar Dr
Stafford TX 77477
Phone (281) 240-4200

Chain of Custody Record

eurofins
Environment Testing

Client Information	Sampler: Jaymi Reser	Lab PM: Garza, Sylvia	Carrier Tracking No(s):	COC No: 860-44130-14262.1
Client Contact: Jaymi Reser	Phone: 832-485-2252	E-Mail: Sylvia.Garza@et.eurofinsus.com	State of Origin:	Page: Page 1 of 1
Company: Phase Engineering Inc.	PWSID:			Job #: 202510014
Address: 300 East Sonterra Boulevard, Suite 1140	Due Date Requested:			
City: San Antonio	TAT Requested (days): 5-day			
State, Zip: TX, 78258	Compliance Project: Δ Yes ☒ No			
Phone:	PO #: PE # 202510014			
Email: Jaymi@phaseengineering.com	WO #:			
Project Name: PE # 202510014	Project #: 86009355			
Site: 301 Cypress Street, Abilene, TX 79601	SSOW#:			

Analysis Requested

Preservation Codes:
N None
D HNO3
A HCL

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water S=solid, O=waste/oil BT=Tissue, A=Air DW=Drinking Water)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	VOA 8260D Full List	TX_1005 Standard List	RCRA 8 6020B, 7471A, PAH 8270, pH 9046D	Moisture Percent Moisture	Polycyclic Aromatic Hydrocarbons (PAHs) 8270	RCRA 8 6020B, 7470A	VOA 8260D, TPH TX_1005	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	N	N	N	N	D	A		
SB-1 5-8'	10/9/25	800	G	S			X	X	X	X				8	hold PAHs
SB-2 1-5'	10/9/25	916	G	S			X	X	X	X				8	hold PAHs
SB-2 13-15'	10/9/25	928	G	S			X	X	X	X				8	hold PAHs
SB-3 5-8'	10/9/25	1000	G	S			X	X	X	X				8	hold PAHs
SB-4 3-5'	10/9/25	1202	G	S			X	X	X	X				8	hold PAHs
SB-4 10-12'	10/9/25	1216	G	S			X	X	X	X				8	hold PAHs
SB-5 1-5'	10/9/25	1255	G	S			X	X	X	X				10	hold PAHs
TMW-1	10/9/25	841	G	W							X	X	X	10	hold PAHs
TMW-3	10/9/25	1024	G	W							X	X	X	10	hold PAHs
TMW-5	10/9/25	1320	G	W							X	X	X	10	hold PAHs

860-113841 Chain of Custody

Other:

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, (II), III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment: FedEx	
Relinquished by: Jaymi Reser Jaymi Reser	Date/Time: 10/9/25 1500	Company: Phase	Received by:	Date/Time: / Company:
Relinquished by:	Date/Time:	Company:	Received by: Nuecmor	Date/Time: 10 10 25 919 Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time: / Company:

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.	Cooler Temperature(s) °C and Other Remarks: 3 3/3	HOU 368

Ver 05/06/2024

Login Sample Receipt Checklist

Client: Phase Engineering Inc.

Job Number: 860-113841-1

Login Number: 113841
List Number: 1
Creator: Jimenez, Nicanor

List Source: Eurofins Houston

Question	Answer	Comment
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	

APPENDIX V

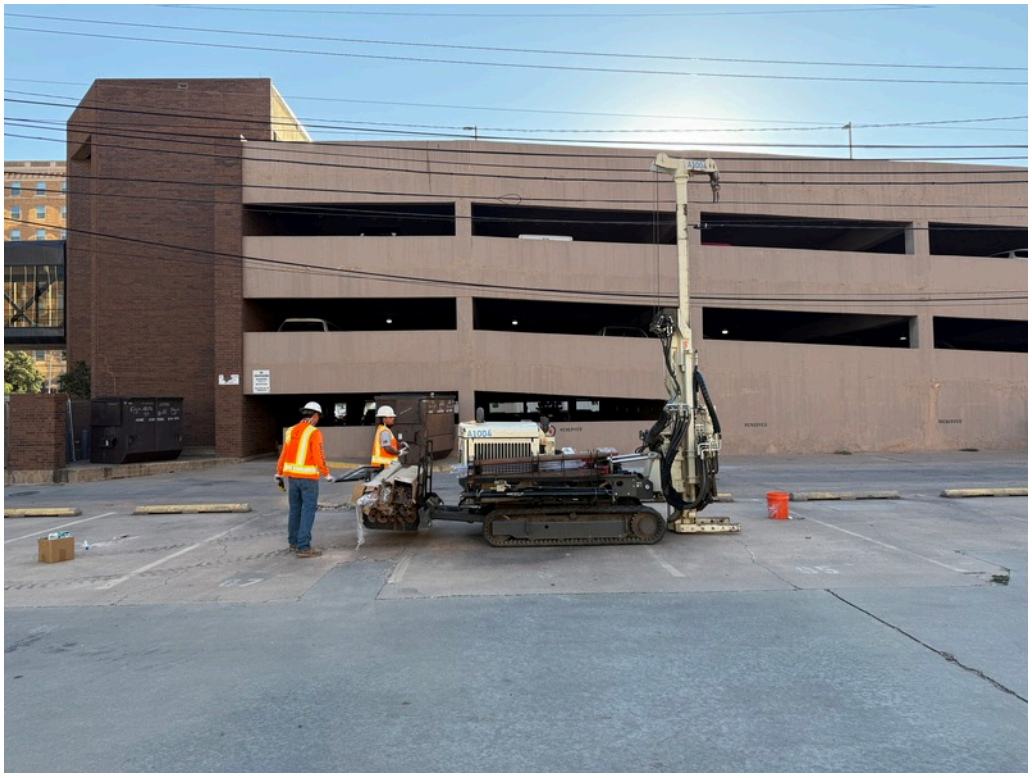
PHOTO GALLERY



1. (1) View east of SB-1 drilling activities



2. (2) View east of TMW-1



3. (10) View east of SB-2 drilling activities



4. (11) View east of SB-3 drilling activities



5. (13) View north of TMW-3 and SV-2 soil vapor port



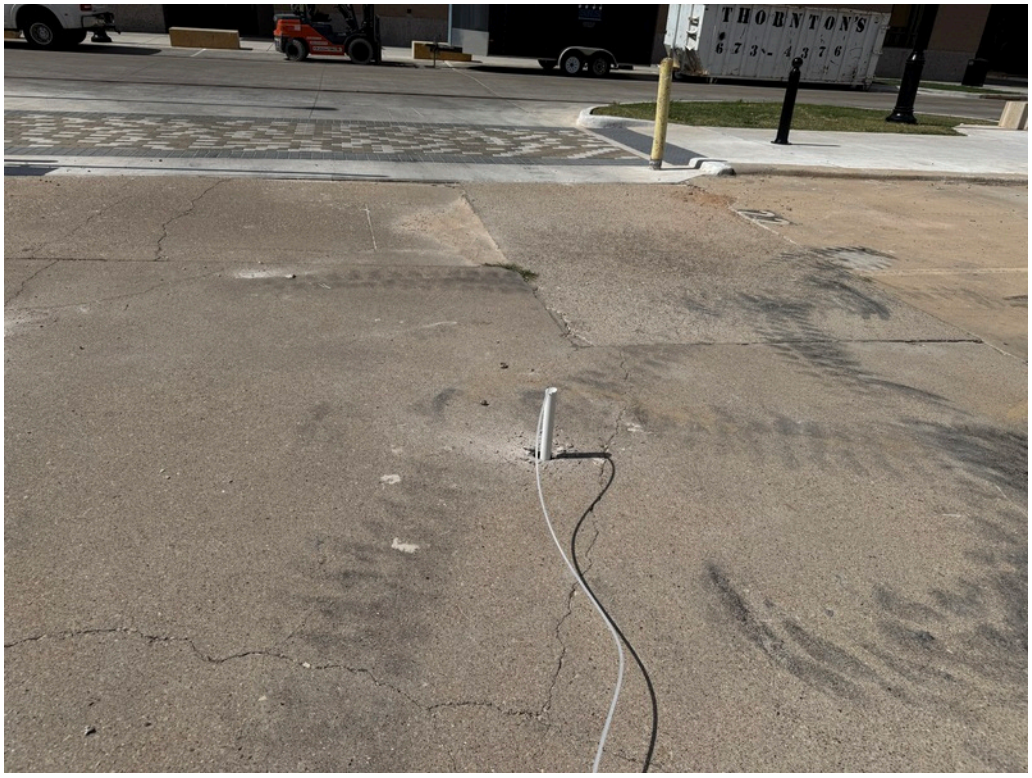
6. (31) View northwest of SB-4 drilling activities



7. (32) View west of first two SB-5 attempts



8. (37) Brick material in SB-5 soil cores



9. (39) View west of TMW-5



10. (44) View east of TMW-5 groundwater purging activities

APPENDIX VI

AGREEMENT FOR SERVICES

AGREEMENT FOR PROFESSIONAL ENVIRONMENTAL CONSULTING SERVICES

Section 1 – General Terms and Conditions

1.1 Definitions

"Agreement" means this Agreement for Professional Environmental Consulting Services.
"Party" (or collectively, "Parties") means Phase and Client, unless expressly stated otherwise in this Agreement.
"Phase" means Phase Engineering, LLC
"Engagement Letter" the instrument delivered by Phase to the Parties
"Services" has the meaning set forth in Section 1.2 below.
Any capitalized terms not otherwise defined in this Agreement have the meanings given to them under the Engagement Letter.

1.2 Services

The professional environmental consulting services to be provided by Phase for the Client are set forth in the Engagement Letter, and such services, including subsequent services, changed, altered or additional services are hereinafter called the "Services".

1.3 Standard of Care

Phase shall perform the services under this agreement with that degree of care, skill and diligence generally accepted as typical of the industry in the performance of such services as contemplated by the Agreement at the time and location such services are rendered. Phase shall employ only competent staff and sub-contractors who will be under the supervision of a senior member of Phase's staff.

1.4 Rights of Entry, Site Information and Utilities

The Client shall provide right of entry for Phase and its subcontractors to carry out the Services, unless specified otherwise in the Engagement Letter. The Client warrants that it has furnished to Phase all information known to, or in possession or control of, the Client relating to the past and existing conditions of the site, including but not limited to soil and geologic data, contaminants, wastes, petroleum products, controlled substances, hazardous materials, and subsurface utilities. The Client shall extend use and reliance of this information to Phase, unless stated otherwise and to the extent permitted by law. Such information shall be and remain confidential as between the Client and Phase and Phase shall not disclose same to any third party unless required by law.

1.5 Safety

1.5.1 Phase maintains a General Health and Safety Plan, a copy of which will be provided to the Client on written request and will fall under Section 1.8 Subsequent Changes of this Agreement unless this service is included in the Engagement Letter.

1.5.2 Phase shall take every precaution reasonable in the circumstances for the protection of the workers providing any of the Services. When required and prior to any field work being carried out, Phase shall provide the Client with a comprehensive site-specific safety plan for providing the Services. Such request must be made in writing by the Client prior to commencement of the Services by Phase and will fall under Section 1.9 Subsequent Changes of this Agreement unless included in the Engagement Letter.

1.6 Investigations and Reports

1.6.1 Findings: The findings of any investigation undertaken as part of the Services will be based upon information generated as a result of the specific scope of the Services as described in the Engagement Letter.

1.6.2 Restoration: The Client accepts that in the normal course of the Services some damage to existing ground or other surface finishes may occur, the restoration of which shall be the responsibility of the client or as specified in the Engagement Letter.

1.6.3 Investigations: The parties acknowledge and accept that unique risks exist whenever engineering or related disciplines are applied to identify environmental conditions and even a comprehensive sampling and testing program may fail to detect certain conditions. Because of the inherent uncertainties in environmental evaluations, changed or unanticipated conditions may occur or become known subsequent to Phase's investigation that could affect conclusions, recommendations, total Project cost and/or execution. Changes in conditions are subject to amendments to the Scope of Services.

1.6.4 Confidentiality and Reliance: Any Final Report or draft reports and the information contained therein shall be treated as confidential and, unless otherwise agreed to by Phase and the Client, the information, sampling data, analysis, findings, conclusions and recommendations (if any), may be used and relied upon only by the Client, its officers, directors and employees and professional advisors in the performance of their obligations for or on behalf of the Client. Any such use and reliance shall be subject to the limitations set forth in this agreement. In addition, the Client may submit any report to a regulatory authority or lender for the purpose of obtaining financing on a property.

1.6.5 Third Party Reliance: This Agreement and the Services provided are for Consultant and Client's sole benefit and exclusive use with no third party beneficiaries intended. Reliance upon the Services and any work product is limited to Client, and is not intended for third parties. In the event Phase agrees, in its sole and absolute discretion, to make the Report available to a third party not mentioned in Paragraph 1.6.4, the Third Party shall be required to obtain the original Clients release, sign Phase's standard Authorized User Agreement (AUA) and pay Phase a fee of not less than $350.00. Any such use shall be subject to the terms, conditions and limitations set forth in this Agreement, the Report and the AUA.

1.7 Ownership of Records/Reports:

All documents or records created or prepared by Phase in the performance of the Services are considered Phase's professional work product and shall remain the copyright property of Phase, subject to any reasonable disclosure request from the Client as may be necessary and for which reasonable reimbursement for copies is provided.

1.8 Disposal and Samples

1.8.1 Disposal of all wastes generated from the subject property shall be the responsibility of the Client.

1.8.2 Phase shall be responsible for appropriate disposal of sample material and sample residuals after 30 days following submission of the FinalReport unless the Client specifically requests otherwise.

1.9 Subsequent Changes
With the consent of Phase, the Client may in writing at any time after the execution of this Agreement or the commencement of the Services delete, extend, increase, vary or otherwise alter the Services. The Parties further agree that such changes shall alter the Services, schedule and/or the costs. Any such changes shall be made in writing with reference to this Agreement, and accepted in writing by both Parties.

1.10 Delays
Neither Party shall be liable or penalized for delays or failure to perform its Services if the same is caused directly or indirectly by circumstances beyond a Party's reasonable control. The Client shall not hold Phase responsible for damages or delays in performance caused by the Client, acts of God, acts and/or omissions of governmental authorities and regulatory agencies or other events which are beyond the reasonable control of the Parties.

1.11 Payment
1.11.1 Phase shall invoice the Client in accordance with the provisions set forth in the Engagement Letter. Except as stated in the Engagement Letter, the Client shall pay to Phase at its corporate office each invoice within 30 days of the date of the invoice without holdback. Interest at a rate of 10% per year or the maximum rate allowed by law, whichever is lower, may be charged on all overdue amounts.
1.11.2 In the event of a disputed billing, only the disputed portion will be withheld from payment, and the undisputed portion will be paid. The Client shall exercise reasonableness in disputing any bill or portion thereof. No interest will accrue on any disputed portion of the billing until mutually resolved.
1.11.3 If the Client fails to make payment of any sum due hereunder within a reasonable time period, Client acknowledges and agrees that the subject Invoice will be referred to legal collections, and any amount in aggregate less than Ten Thousand Dollars U.S. ($10,000) will be referred to small claims court in Harris County, Texas.

1.12 Suspension or Termination
The Client may at any time by notice in writing to Phase, suspend or terminate the Services or any portion thereof at any stage of the Project. Upon receipt of such written notice by the Client, Phase shall perform no further Services other than those reasonably necessary to close out its Services. In such an event, Phase shall invoice the Client for the portion of the Services completed and shall be entitled to payment in accordance with Section 1.9. Once the Services are completed the Client assumes the risk of Frustration of Purpose.

1.13 Insurance
1.13.1 Phase agrees to carry and maintain the following **minimum** insurance coverages for the term of this Agreement:
Worker's Compensation Insurance: Statutory requirement amounts
Commercial General Liability: $1,000,000 per occurrence
Automobile Liability Insurance: $1,000,000 per occurrence for both owned and non-owned vehicles
Umbrella Liability (including Professional Liability and Contractors Professional Insurance): $10,000,000 aggregate

1.13.2 Phase's current Certificate of Insurance is provided with the Engagement Letter. If the Client requests to be a named as a certificate holder,
this request must be made in writing to Phase prior to commencement of the Services.
1.13.3 Phase will renew the Professional Liability Insurance at or above the minimum coverage for period of two (2) years after completion of the Services.
1.13.4 If the Client requests that Phase increase the amount of insurance coverage or obtain other special insurance for the Project, Phase shall endeavor forthwith to obtain such increased or special insurance at the Client's expense.
1.13.5 Each of Phase and Client waive all claims, losses, damages and rights of recovery against the other to extent of the limits of coverage under any commercial general liability or property insurance policy actually obtained by a Party to this Agreement (or, in the case of Phase, to the extent obtained or required to be obtained by Phase under this Agreement). In addition, each Party shall exercise commercially reasonable efforts to cause to waive subrogation under its commercial general liability and property insurance policies and provide any necessary endorsements thereto.

1.14 Indemnity/Statute of Limitations.
EACH OF Phase AND CLIENT SHALL INDEMNIFY AND HOLD HARMLESS THE OTHER AND THEIR RESPECTIVE AGENTS, EMPLOYEES, SUCCESSORS AND ASSIGNS FROM AND AGAINST LEGAL LIABILITY FOR CLAIMS, LOSSES, DAMAGES, AND EXPENSES TO THE EXTENT SUCH CLAIMS, LOSSES, DAMAGES, OR EXPENSES ARE LEGALLY DETERMINED TO BE CAUSED BY THEIR NEGLIGENT ACTS, ERRORS, OR OMISSIONS. IN THE EVENT SUCH CLAIMS, LOSSES, DAMAGES, OR EXPENSES ARE LEGALLY DETERMINED TO BE CAUSED BY THE JOINT OR CONCURRENT NEGLIGENCE OF Phase AND CLIENT, THE PARTIES SHALL BEAR LIABILITY IN PROPORTION TO ITS OWN NEGLIGENCE UNDER COMPARATIVE FAULT PRINCIPLES. NEITHER PARTY SHALL HAVE A DUTY TO DEFEND THE OTHER PARTY, AND NO DUTY TO DEFEND IS HEREBY CREATED BY THIS INDEMNITY PROVISION AND SUCH DUTY IS EXPLICITLY WAIVED UNDER THIS AGREEMENT. CAUSES OF ACTION ARISING OUT OF Phase's SERVICES OR THIS AGREEMENT, REGARDLESS OF CAUSE OR THE THEORY OF LIABILITY, INCLUDING NEGLIGENCE, INDEMNITY OR OTHER RECOVERY, SHALL BE DEEMED TO HAVE ACCRUED AND THE APPLICABLE STATUTE OF LIMITATIONS SHALL COMMENCE TO RUN NO LATER THAN THE DATE OF Phase's SUBSTANTIAL COMPLETION OF SERVICES ON THE PROJECT.

1.15 Limitation of Liability.
1.15.1 Notwithstanding any other provisions contained herein, it is understood and agreed that Phase's liability to the Client for all claims arising out of this Agreement, or in any way relating to the Services, will be limited to direct damages and/or to the specific performance of any Services not meeting the Standard of Care set forth herein and such liability will, in the aggregate, not exceed the sum of the coverages shown on Phase's Certificate of Insurance in effect at the time of the claim.
1.15.2 No claim may be brought against Phase more than Two (2) years after the Services were completed under this Agreement, or as negotiated between Phase and the Client.

1.15.3. **TO THE FULLEST EXTENT PERMITTED BY LAW, THE TOTAL AGGREGATE LIABILITY OF Phase (AND ITS DIRECTORS, EMPLOYEES, AGENTS AND AFFILIATES) TO CLIENT AND THIRD PARTIES GRANTED RELIANCE IS LIMITED TO THE GREATER OF $50,000 OR Phase's FEE FOR ANY AND ALL INJURIES, DAMAGES, CLAIMS, LOSSES, OR EXPENSES (INCLUDING ATTORNEYAND EXPERT FEES) ARISING OUT OF Phase's SERVICES OR THIS AGREEMENT. THIS LIMITATION SHALL APPLY REGARDLESS OF AVAILABLE PROFESSIONAL LIABILITY INSURANCE COVERAGE, CAUSE OR THE THEORY OF LIABILITY, INCLUDING NEGLIGENCE, INDEMNITY, OR OTHER RECOVERY; PROVIDED, HOWEVER, THAT THIS LIMITATION SHALL NOT APPLY TO THE EXTENT OF ANY AVAILABLE COVERAGE UNDER Phase's COMMERCIAL GENERAL LIABILITY POLICY.**

1.16 Consequential Damages.
EXCEPT AS EXPRESSLY PROVIDED IN THIS AGREEMENT, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR LOSS OF PROFITS OR REVENUE, LOSS OF USE OR OPPORTUNITY, LOSS OF GOOD WILL, COST OF SUBSTITUTE FACILITIES, GOODS, OR SERVICES, COST OF CAPITAL, OR FOR ANY SPECIAL, CONSEQUENTIAL, INDIRECT, PUNITIVE, OR EXEMPLARY DAMAGES.

1.17 Regulatory Reporting Requirements
Client recognizes that hazardous substances or contaminates may be discovered at the subject property in the course of provision of the Services by Phase under conditions that may be reportable to Federal or State environmental regulatory agencies. The "duty to report" is ultimately the responsibility of the landowner unless the condition represents an acute threat to human health or the environment. Phase will notify the Client of any such reportable condition. The Client will notify the Landowner, or under mutual agreement, authorize Phase to perform such notification to the landowner.

Section 2 – MISCELLANEOUS PROVISIONS

2.1 Notices:
All notices under this Agreement shall be in writing. It shall be sufficient in all respects if the Notice is delivered by hand, sent by any electronic means, including email or facsimile transmission, with confirmation ("Transmission") during normal business hours, or sent by registered mail, postage prepaid, addressed to the Parties shown on the Engagement Letter or to such other address as either Party shall designate by written notice to the other Party. Any notice so given shall be deemed to have been given and to have been received on the day of delivery, if so delivered, on the third Business Day (excluding each day during which there exists any interruption of postal services due to strike, lockout or other cause) following the mailing thereof, if so mailed, and on the day that notice was sent by Transmission, provided such day is a Business Day (a Business Day being any day of the week save and except for Saturday and Sunday) and if not, on the first Business Day thereafter.

2.2 Entire Agreement, Modifications, Headings, Severability:
The Parties acknowledge that this Agreement and the Engagement Letter constitutes the entire agreement between them and supersedes all prior representations, warranties, agreements, and understandings, oral or written, between the Parties with respect to its subject matter. Unless stated otherwise in this Agreement, this Agreement may not be modified except in writing signed by both Parties. The headings to this Agreement are for convenience and reference purposes only and shall not constitute a part of the Agreement. If any element of this Agreement is later held to violate the law or a regulation, it shall be deemed void, and all remaining provisions shall continue in force.

2.3 Effect:
This Agreement shall be binding upon and inure to the benefit of the Parties hereto and their respective successors and assigns provided that it may not be assigned by either Party without the consent of the other, which consent shall not be unreasonably withheld.

2.4 Survival:
All representations and obligations (including without limitation the mutual obligations of indemnification) shall survive the termination of this Agreement and expire five (5) years from the date of completion of Services.

2.5 Waiver of Rights:
Any waiver of, or consent to depart from, the requirements of any provision of this Agreement shall be effective only if made in writing and signed by the Party granting such waiver or consent, and is valid only in the specific instance and for the specific purpose for which it has been granted. No failure on the part of any Party to exercise, and no delay in exercising, any right under this Agreement shall operate as a waiver of such right. No single or partial exercise of any such right shall preclude any other or further exercise of such right or the exercise of any other right.

2.6 Applicable Law:
This Agreement shall be governed by, and interpreted and enforced in accordance with, the laws in the State of Texas and the laws of The United States of America, as applicable.

2.7 Dispute Resolution:
Excepting Section 1.11 for the purpose of this Agreement, any disagreement arising between the Parties to this Agreement with reference to the interpretation of this Agreement or any matter arising hereunder and upon which the Parties cannot agree shall be referred to mediation. Reference to mediation shall be to a single mediator and in accordance with the laws of mediation in the State of Texas. The costs of the mediator shall be shared equally by the Parties on an interim basis as may be necessary provided however that the mediator shall have the discretion to award costs of the proceeding, including costs of the mediator. The venue for such mediation is agreed to be Harris County, Texas

2.8 Contract Documents:
The Contract Documents consist of the documents listed. If there is a conflict with the Contract Documents, the conflicting terms will be governed in the order of priority set forth as follows: 1. Agreement 2. Engagement Letter

SECTION 01010

GENERAL WORK REQUIREMENTS

1. GENERAL
Should conflict occur between these General Work Requirements and the General Conditions, the requirements of this Section take precedence.

2. INTENT OF DOCUMENTS
The Contract Drawings are complementary and what is called for by anyone shall be as binding as if called by all. The intention of the documents is to include all labor and materials, equipment and transportation necessary for the proper execution of the work.

3. MANUFACTURERS' DIRECTIONS
All manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturers, unless herein specified to the contrary.

4. COOPERATION - CONTRACTOR WITH OWNER
It shall be clearly understood that the Owner reserves the right to install various equipment in the building prior to completion and acceptance, and it shall be the duty of the Contractor to cooperate with the Owner's employees rendering such assistance and so arranging their work that the entire project will be delivered complete in the best possible condition when required.

5. BUILDING PERMIT
As stated in Subparagraph 4.7.1, AIA DOCUMENT A201, General Conditions, the General Contractor shall secure and pay for the building permit.

6. CONSTRUCTION COORDINATION
Before starting construction, a meeting shall be held with Contractor(s), Architect, and Consulting Engineers in attendance to plan and coordinate the schedule of construction and to review intent of Contract Documents. Contractor(s) shall follow instructions received at meeting in prosecuting the Work.

7. MATERIALS - EQUIPMENT - SUBSTITUTION
   a. In general, these Specifications identify the required materials and equipment by naming one or more manufacturers, brand, model, catalog number, and/or other identification; the first-named manufacturer's product used as a basis for design; the other named brands considered equivalent. Equivalent brand manufacturers named must furnish products consistent with the Specifications for the first-named product, as determined by the Architect. Base Bid shall include only those brands named and must be used on the project, except as hereinafter provided.
   b. Materials or equipment specified exclusively, Base Bid shall be based on same and used on project, except as hereinafter provided.
   c. Prior to receipt of bids, should Contractor wish to incorporate in Base Bid, brands or products other than those named in the Specifications, they shall submit written request for substitution to Architect not later than seven (7) days prior to date bids are due. Architect will consider request and items approved will be listed in an addendum issued to all bidders.
   d. After execution of Contract, substitution of product brands for those named in the Specifications will be considered, only if request is received within thirty (30) days after Contract Date and request includes showing credit due Owner.
   e. Materials specified equivalent and those proposed for substitution must be equal or better than first-named material in construction, efficiency, utility, aesthetic design, physical size shall not be larger than space provided for it. Request for substitution by full description and technical data in two (2) copies, including manufacturer's name, model, catalog number, photographs or cuts, physical dimensions, operating characteristics, and any other information for comparison.
   f. Owner reserves the right:
      1) To require any or all bidders, before execution of Contract, to state what materials they will use.
      2) To require "if bound with the Bid Form," the Contractor to fill out a BID SUPPLEMENT listing the BASE BID and "ADD" or "DEDUCT" for other materials he proposes to use.

8. APPROVAL OF SUBCONTRACTORS - MATERIALS
   a. The Contractor, if requested, must submit for approval before signing Agreement, list of Subcontractors and material suppliers enumerating items of work to be performed, name of materials, equipment, etc., to be furnished and/or installed. Refer to Paragraph - MATERIALS - EQUIPMENT - SUBSTITUTION.
   b. If the list is not requested prior to signing of Agreement, list, as described in previous paragraph, shall be furnished within ten (10) days of signing Agreement.

9. PROTECTION - Supplement, ARTICLE 10, AIA GENERAL CONDITIONS
   a. Refer to Paragraph - WEATHER CONDITIONS.
   b. Each Contractor shall assume responsibility for their materials stored on the premises.
   c. General Contractor shall take charge and assume general responsibility for proper protection of project during construction.
   d. The General Contractor shall protect trees, shrubs, lawns and all landscape from damage, providing guards and covering. Damaged work shall be repaired or replaced at his expense. Protect streets and sidewalks and make repairs at his expense.
      1) Water Protection. The General Contractor shall, at all times, protect the excavation, trenches, and/or the building from damage by rain water, spring water, ground water, backing up of drains or sewers and all other water. He shall provide all pumps and equipment and enclosures to provide this protection.
      2) Temporary Drainage. The General Contractor shall construct and maintain all necessary temporary drainage and do all pumping necessary to keep the excavation free of water.
      3) Snow and Ice. The General Contractor shall remove all snow and ice from public sidewalks and from the building, as may be required for the proper protection and/or prosecution of the Work.
      4) Bracing, Shoring, and Sheeting. The General Contractor shall provide all shoring, bracing and sheeting as required for safety and for the proper execution of the work and have same removed when the work is completed.
      5) Guard Lights. The General Contractor shall provide and maintain guard lights at all barricades, railings, obstructions in the streets, roads or sidewalks and at all trenches or pits adjacent to public walks or roads.
      6) Weather Conditions. The General Contractor shall, at all times, provide protection against weather; rain, winds, storms, frost, or heat, so as to maintain all work, materials, apparatus, and fixtures, free from injury or damage. At the end of the day's work, all new work likely to be damaged shall be covered.

10. WEATHER CONDITIONS
The Contractor shall protect all portions of his work and all materials, at all times from damage by water, freezing, frost and is to repair, replace and make good to the satisfaction of the Architect, any portion of same which may in the Architect's opinion, have been damaged by the elements.

11. GRADES, LINES, LEVELS, AND SURVEYS
The Owner will establish the lot lines, restrictions and a bench mark. All other grades, lines, levels, and bench marks shall be established and maintained by the General Contractor, who shall be responsible for same. The General Contractor shall verify all grades, lines, levels, and dimensions as shown on the Drawings and he shall report all errors or inconsistencies in the above to the Architect before commencing work.
   a. The General Contractor shall provide and maintain well-built batter boards at all corners. He shall establish bench marks in not less than two (2) widely separated places. As the work progresses, he shall establish bench marks at each floor, giving exact levels of the various floors.
   b. As the work progresses, the General Contractor shall lay out in the forms and the rough flooring the exact location of all partitions as a guide to all trades.
   c. The General Contractor shall verify all grades, lines, levels, and dimensions as shown on the Drawings and he shall report any errors or inconsistencies in the above to the Architect before commencing work.

12. USE OF COMPLETED PORTIONS

The Owner reserves the right to take possession of and use any completed or partially completed portions of the building, and further reserves the right to install equipment and facilities which are not a part of the Contract, notwithstanding the fact that the time of completion of entire work or portions thereof may not have expired; but such taking possession or installation of facilities shall not be deemed an acceptance of any work not completed in accordance with the Contract Documents. The Owner, in taking possession of completed portions or installing such equipment, and facilities, shall do so at his own expense any damage which may occur either directly or indirectly by reason of such action.

a. Building Completion-Occupancy. Owner reserves the right to occupy building when the time for completion of work as stipulated in Contract has been reached, even though all parts of the work have not been completed and accepted by Owner. All work, including heating, electrical, and water service, will be discontinued only to Owner schedule.

b. Limit of Contract is not confined to any particular area of the site, but includes any area required to perform work shown on the Drawings and/or specified in these Specifications.

13. REQUIREMENTS IMMEDIATELY AFTER EXECUTION OF CONTRACT

Immediately after execution of the Contract, the Contractor shall deliver to the Architect the following items which are described more fully in following Articles:

Schedule of Values
Schedule of Operations
Progress Charts
Samples
Superintendent's name and resume of experience
List of Subcontractors and Material Suppliers

a. Schedule of Values on AIA Form G702, or other form approved by the Architect, a detailed breakdown of the Contract Sum indicating the amounts allotted to the various divisions of the work for labor and material. The schedule will serve as a guide to the Architect in determining the amounts due each month as the work progresses. The schedule shall be broken down as directed by the Architect.

b. Schedule of Operations based on the above Schedule of Values and indicating the progress of the work up to the first day of each month shall be prepared by the Contractor in a form approved by the Architect and shall be delivered to the Architect in duplicate with each application for payment.

c. Progress Charts based on the above specified schedule of operations and indicating the progress of the work up to the first day of each month shall be prepared by the Contractor in a form approved by the Architect and shall be delivered to the Architect in duplicate with each application for payment. Progress charts shall be in the form of a bar graph. Along with progress charts the Contractor shall provide an estimated monthly cash flow chart.

14. CONSTRUCTION PROCEDURE

a. Each Contractor shall schedule his work so as to cause a minimum of interference with business operations during all of the construction work.

b. In-Use Areas. Construction work within areas immediately adjacent to existing in-use areas shall be coordinated with the Owner, so that work is accomplished during periods of light occupancy of the areas and cause the least disturbance. Work shall be executed by methods that will create the last amount of noise. Work shall be prefabricated when practical to do so. New facilities shall be ready for use prior to disturbing existing areas.

c. Precautions and Cooperation

1) Notify the Owner 7 days in advance before any utility (natural gas, water, electricity, or sewer) is to be interrupted.

2) With proper notification, interruption in utilities up to 4 hours will be permitted without special provisions by the Contractor. *If any interruption of a utility exceeds 4 hours the Contractor must make arrangements for temporary alternate utility service.

3) Interruption of utilities must be coordinated with the Owner with changeovers and out of service at night. Weekend and evening changeovers of utilities shall occur with no additional cost to the Owner.

15. TIME EXTENSIONS ADVERSE WEATHER

a. The Contractor shall comply with all provisions of the General Conditions in submitting any request for extension of Contract Time due to unusually severe weather.

b. Definitions:

1. Adverse Weather - Atmospheric conditions at a definite time and place which are unfavorable to construction activities.
2. Unusually Severe Weather - Weather which is more severe than the adverse weather anticipated for the season, location, or activity involved.

c. In order for any request of time extension due to unusually severe weather to be valid, the Contractor must document both of the following conditions.

1. The weather experienced at the project site during the Contract period is more severe that the adverse weather anticipated for the project location during any given month.
2. The unusually severe weather actually caused a delay to the completion of the project. The delay must be beyond the control and without fault or negligence by the Contractor.

d. The following schedule of monthly anticipated adverse weather delays will constitute the baseline for monthly weather time evaluations. The Contractor's Progress Schedule must reflect these anticipated adverse weather delays in all weather affected activities:
MONTHLY ANTICIPATED ADVERSE WEATHER DELAY WORK DAYS BASED ON FIVE (5) DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10	8	7	6	7	7	5	5	5	4	5	9

END OF SECTION 01010

SECTION 01019

SPECIAL PROVISIONS

1. GENERAL

Should conflict occur between these Special Provisions and the General Conditions, the requirements of the Special Provisions shall take precedence.

2. TIME OF CONSTRUCTION - LIQUIDATED DAMAGES

a. Time of Construction - The Contractor will commence the work within ten (10) days after the Architect shall have given the Contractor written notice to commence construction to the satisfaction of the Owner within the calendar days as Contractor so stated in his Bid Form. The time for completion herein set forth shall be extended for the period of any reasonable delay which is due exclusively to causes beyond the control and without the fault of the Contractor, including acts of God, fires, floods, and direction by the Architect. It is impractical to perform any operation of construction and acts of omissions of the Owner with respect to matters for which Owner is solely responsible; provided, however, that no such extension of time for completion shall be granted the Contractor, unless within ten (10) days after the happening of any event relied upon by the Contractor for such extension of time, the Contractor shall have made a request, therefore, in writing to the Architect. Extended time will be submitted with pay request for Owner's approval.

b. Liquidated Damages - The time of completion of the construction of the project is of the essence of this Contract. Should the Contractor neglect, refuse, or fail to complete the project within the time herein agreed upon, after giving effect to extensions of time, if any, herein provided; then in that event and in view of the difficulty of estimating with exactness damages caused by such delay, the Owner shall have the right to deduct from and retain out of such money, which may then be due or which may become due and payable to the Contractor, the sum of THREE HUNDRED DOLLARS ($300.00) per day for each and every day that such construction is delayed in its completion beyond the specified time, as liquidated damages and not as a penalty. If the amount due and to become due from the Contractor to the Owner is insufficient to pay in full any such liquidated damages, the Contractor shall pay to the Owner the amount necessary to effect such payment in full; provided, however, that the Owner shall promptly notify the Contractor in writing of the manner in which the amount retained, deducted or claimed as liquidated damages was computed.

c. Joint Responsibility - The General Contractor and/or Subcontractors causing the delay in completion of the project shall be responsible for payment of liquidated damages. In no case shall the total liquidated damages for all contracts exceed the sum of daily liquidated damages multiplied by the number of days of delay in completion.

3. ALTERNATES - Refer to Alternate Schedule, Section 01030

a. Alternates specified are not a part of Base Bid, but are Alternates to same, their acceptance being at option of Owner.

4. CASH ALLOWANCES

a. Costs included in Allowances: Cost of Product to Contractor or Subcontractor, less applicable trade discounts, delivery to site, except those taxes saved by use of Owner's tax exemption.

b. Costs Not Included in the Allowance: Fees for overhead and profit, product handling at the site, including unloading, uncrating, and storage; protection of Products from elements and from damage and labor for installation and finishing.

c. Architect Responsibilities:
   1. Consult with Contractor in consideration and selection of Products, suppliers and installers.
   2. Select Products in consultation with Owner and transmit decision to Contractor.
   3. Prepare Proposal Requests and Change Orders.

d. Contractor Responsibilities:
   1. Assist Architect/Engineer in selection of Products, suppliers and installers.
   2. Obtain proposals from suppliers and installers and offer recommendations.
   3. On notification of selection by Architect, execute purchase agreement with designated supplier and installer.
   4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
   5. Promptly inspect Products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.
   6. Product handling at the site, including unloading, uncrating and storage, protection of Products from elements and from damage and labor for installation and finishing.

7. The Contractor shall include in his Bid all fees for all cash allowances.

e. Funds will be drawn from Cash Allowances only by written authorization from Owner.

f. Cash Allowances:

1. Contractor to provide a cash allowance in the amount of $15,000 for the fabrication and installation of one new "fin-style" building mounted sign, including design coordination, shop drawings, mounting hardware, electrical connections, and all associated work necessary for a complete and operational installation. The Contractor shall coordinate with the Architect and Owner to finalize design, materials, dimensions, and placement.

5. ENUMERATION OF DRAWINGS AND SPECIFICATIONS

a. Correlation. Accompanying these Specifications are the Drawings, which jointly with these Specifications, are intended to explain each other and describe and coordinate the work to be performed under the Contract.

b. Verification of Documents. Before submitting his bid, each Bidder shall check his set(s) of Drawings and Specifications and advise the Architect if any sheets are missing.

c. Specifications Explanations. For convenience of reference, the Specifications are separated into Titled Divisions and Sections. Such separation shall not, however, operate to make the Architect an arbiter to establish limits between the Contractor and Subcontractor or Sub-Subcontractor.

d. Drawings. Refer to LIST OF DRAWINGS.

e. Specifications. Refer to TABLE OF CONTENTS.

6. WARRANTIES

Before being eligible for final payment, Contractor shall deliver to Owner, through Architect, all special warranties specified for materials, equipment and installation.

7. OPERATING INSTRUCTIONS

Before being eligible for final payment, Contractor shall deliver to Owner, through Architect, three (3) copies of manufacturer's operating instructions, one (1) complete set of shop drawings on each piece of equipment, and such framed instructions as instructed.

8. AS-BUILT DRAWINGS

Before being eligible for final payment, the Electrical and Mechanical Contractors shall prepare and deliver to Owner, through Architect, one (1) set of AS-BUILT DRAWINGS. These drawings may consist of marked-up prints, if the Contractor so chooses, but shall show the correct location of every item of equipment, piping, conduit, panel boards, ductwork, switches, valves, etc. If marked-up prints are used, they shall be new white prints.

9. CERTIFICATE OF COMPLIANCE

Upon completion of project, Contractor is to furnish written Certification to the Architect that he has complied with every paragraph of the Specifications and Drawings.

10. CONTRACTOR'S MONTHLY APPLICATION FOR PAYMENT FORM

Contractor's monthly Application for Payment shall be submitted as per General Conditions. AIA Document G702, Application and Certificate for Payment is approved and acceptable.

11. FILING AND RECORDING OF BONDS

In addition to furnishing the number of combination Performance Bond and Labor and Materials Payment Bond, and Statutory Bond, if required, the Contractor shall file copies of such bonds with Clerk of the District Court and furnish Architect with receipt furnished by Clerk of the District Court, covering charges for filing and recording of said bonds.

12. STATUTORY BONDS

In addition to furnishing the combination Performance and Labor and Materials Payment Bond specified in General Conditions, the Contractor shall furnish Statutory Bond in an amount not less than 100% of the Agreement in such numbers and form stated in Sample Copy bound in the Specifications. Statutory Bond shall be filed and recorded with Clerk of the District Court, as specified in Paragraph - FILING AND RECORDING OF BONDS.

13. DOCUMENTS FURNISHED CONTRACTORS

The General Contractor will be furnished, free of charge, the following working drawings and specifications, including modifications for construction of the project - 20 sets. The General Contractor will be responsible for distribution of these sets to the Subcontractors and suppliers. The Contractor shall pay the actual cost of reproduction and postage for all additional sets requested by him.

14. SALES TAX EXEMPTIONS

a. Materials, labor and equipment incorporated into this project are not exempt from the payment of sales tax under the laws of the **State of Texas** and such sales tax **shall be included in the Bid of the Bidder.**

END OF SECTION 01019

SECTION 01030

ALTERNATES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

1.3 GENERAL

1. The General Contractor shall state in his Bid Form the amount of dollars to be ADDED or DEDUCTED from his Base Bid for the following Alternates.
2. Alternates are not in order of acceptance.
3. It shall be the responsibility of the General Contractor to advise all necessary personnel and suppliers as to the nature and extent of all alternates selected by the owner.
4. Circle Add or Deduct to indicate that the alternate price is to be added or subtracted from the base bid.

1.4 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.5 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

1. ALTERNATE NO. 1
   Contractor shall state amount of dollars to be deducted from the Base Bid for all work, labor and materials associated with installing LVT flooring at the apartment (unit) bathrooms in lieu of Ceramic/Porcelain Tile.

   Deduct $ _____

2. ALTERNATE NO. 2
   As specified by Addendum.

   Add/Deduct $ _____

END OF SECTION 01030

SECTION 01220

UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related requirements:

1. Section 012100 “Allowances” for procedures for using unit prices to adjust quantity allowances.

1.2 DEFINITIONS

1. Unit price is an amount incorporated into the Agreement, applicable during the duration of the work as a price per unit of measurement for materials, equipment, or services, or a portion of the work, added to or deducted from the contract sum by appropriate modification, if the scope of work or estimated quantities of work required by the Contract Document are increased or decreased.

1.3 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor’s measurement of work-in-place that involves use of established unit prices and to have this work measured, at the Owner’s expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections references in the schedule contain requirements for materials described under each unit price.

PART 2 – PRODUCTS (not used)

PART 3 – EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1: included in the **BASE BID:** Brick Masonry Repair and Replacement Brick

1. Description: Repairing brick masonry and replacing units at both the interior and exterior of the building. Reference Section 040120 – Brick Masonry Repair.
2. Unit of Measurement: **Contractor to provide a price per 100 Bricks.**

B. Unit Price No. 2: included in the **BASE BID:** Brick & Masonry Repointing

1. Description: Repointing existing brick and stone masonry at both the exterior and interior of the building. Reference Section 040120 – Brick & Masonry Repointing
2. Unit of Measurement: **Contractor to provide a price per 100 s.f.**

END OF SECTION 01220

SECTION 01500

TEMPORARY FACILITIES

1. GENERAL

Should conflict occur between the Temporary Facilities and the General Conditions, the requirements of this Section take precedence.

2. TEMPORARY HEAT

a. The General Contractor shall provide heat, fuel and services as necessary to protect all work and materials against injury from dampness and cold until final acceptance of all work and material in the Contract, unless the building or buildings are fully occupied by the Owner prior to such acceptance, in which case, the Owner shall assume all expenses of heating from date of occupancy. The General Contractor shall provide heat as follows:
   1. At all times during the placing, setting and curing of concrete, provide sufficient heat to insure the heating of the spaces involved to not less than 50° F.
   2. From the beginning of the application of gypsum board taping and during the setting and curing period, provide sufficient heat to produce a temperature in the spaces involved of not less than 50° F.
   3. For a period of ten (10) days previous to the placing of interior wood finish and throughout the placing of this and other interior finishing, varnishing, painting, etc., and until final acceptance of the work or until full occupancy by the Owner, provide sufficient heat to produce a temperature of not less than 70° F. Heating Subcontractor shall set such necessary temporary radiation as may be required.
   4. Mechanical Subcontractor shall, as soon as possible, provide temporary heating facilities through the installed heating equipment.

3. SIGN AND ADVERTISING

a. The General Contractor shall furnish and erect one (1) painted sign, 4'-0" x 8'-0" in size, as shown on the last page of this Section and placed where directed. Sign shall have the following:
   1. Name of Project
   2. Name and Address of Architect
   3. Name and Address of General Contractor
   4. Name of Mechanical Subcontractor
   5. Name of Electrical Subcontractor
   6. Picture of Project (coordinate with Architect)

b. Post entire construction with DANGER and NO TRESPASSING signs to comply with safety and insurance regulations.

c. Keep premises clear and free from other signs or posters.

4. TEMPORARY FIELD OFFICES

a. General Contractor shall provide and maintain in good condition, a painted weatherproof field office (adequate size trailer acceptable) for use of General Contractor and Architect's representative. Provide such building with heat, electric lights, telephone, locked doors, windows, table, and rack for Drawings. Building to remain property of General Contractor.

b. Electrical and Mechanical Subcontractors shall maintain similar field office, meeting requirements of previous paragraph, except provisions for Architect's representative not needed.

5. TEMPORARY ENCLOSURES

General Contractor to provide:

a. Temporary weathertight enclosures for all exterior openings as soon as possible as walls and roofs are built to protect work from weather. Temporary exterior doors equipped with padlocks.

b. In cold weather, provide additional precautions necessary, including heat at such openings to protect building and contents.

6. TEMPORARY SHEDS

The Contractor shall provide and maintain on the premises watertight storage sheds for storage of all materials which may be damaged by weather. These sheds shall have wood floors raised above the ground.

7. TEMPORARY CONSTRUCTION ITEMS

General Contractor shall furnish necessary temporary stairs, chutes, runways, scaffolds, ladders, and hoist.

8. TEMPORARY TOILET ACCOMMODATIONS
   a. The General Contractor shall provide for the use of all workmen, in accordance with local ordinances, ample temporary sanitary toilet accommodations and keep such clean and free from flies. Prior to completion of the Contract, all connections and appliances connected with same will be removed and the premises left perfectly clean.
   b. The Mechanical Subcontractor shall, as soon as conditions of the work will allow, install inside building a temporary toilet with connections to the sewer.

9. TEMPORARY TELEPHONE
   The General Contractor shall install at his own expense, a job telephone, and shall pay for all local calls. All long distance calls shall be paid by party making the call.

10. TEMPORARY LIGHT AND POWER
   a. For new construction, the General Contractor shall arrange for temporary service, pay for all expenses therewith and bring services to building and run extensions to locations necessary for operations.
   b. Permit other Subcontractors to use same. Other Subcontractors requiring additional extensions, make and remove same at their expense. General Contractor shall pay for all electricity consumed.

11. WATER FOR CONSTRUCTION
   The Owner will furnish all water for construction. The General Contractor will be responsible for necessary water connections to existing source.

END OF SECTION 01500

SECTION 02225

TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Excavating trenches for utilities from 5 feet outside building to municipal utilities.
- B. Compacted fill from top of utility bedding to subgrade elevations.
- C. Backfilling and compaction.

1.03 REFERENCES
- A. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

1.04 FIELD MEASUREMENTS
- A. Verify that survey bench mark and intended elevations for the Work are as shown on drawings.

1.05 COORDINATION
- A. Coordinate all work as required.
- B. Verify work associated with lower elevation utilities are complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.01 FILL MATERIALS
- A. Fill: As specified in Section 02205.

PART 3 EXECUTION

3.01 PREPARATION
- A. Identify required lines, levels, contours, and datum.
- B. Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.
- C. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.
- D. Maintain and protect above and below grade utilities which are to remain.
- E. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with fill and compact to density equal to or greater than requirements for subsequent backfill material.

3.02 EXCAVATION
- A. Excavate subsoil required for utilities to municipal utilities.
- B. Cut trenches sufficiently wide to enable installation and allow inspection.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Hand trim excavation. Remove loose matter.
- E. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume.
- F. Correct areas over excavated in accordance with Section 02222.
- G. Stockpile excavated material in area designated on site and remove excess material not being used, from site.

3.03 BACKFILLING
- A. Backfill trenches to contours and elevations with unfrozen materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Granular Fill: Place and compact materials in continuous layers not exceeding 8 inches compacted depth.
- D. Soil Fill: Place and compact material in continuous layers not exceeding 8 inches compacted depth.
- E. Employ a placement method that does not disturb or damage foundation perimeter drainage, conduit or pipes in trench.

F. Maintain optimum moisture content of fill materials to attain required compaction density.
G. Remove surplus fill materials from site.
H. Leave fill material stockpile areas completely free of excess fill materials.

3.04 TOLERANCES
A. Top Surface of Backfilling: Plus or minus 1 inch from required elevations.

3.05 FIELD QUALITY CONTROL
A. Field inspection and testing will be performed under provisions of the General Requirements.
B. Compaction testing will be performed in accordance with ANSI/ASTM D698.
C. If tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest at no additional cost to the owner.

3.06 PROTECTION OF FINISHED WORK
A. Protect or reshape and recompact fills subjected to vehicular traffic during construction.

END OF SECTION 02225

SECTION 02281

TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Soil treatment for termite control below grade, to interior and exterior foundation perimeter.

1.02 QUALIFICATIONS
A. Applicator: Company specializing in performing the work of this Section with minimum 5 years documented experience approved by manufacturer, licensed and approved regulations.

1.03 REGULATORY REQUIREMENTS
A. Conform to requirements for application, application licensing, and authority to use toxicant chemicals and in accordance with EPA.
B. Provide certificate of compliance from authority having jurisdiction indicating approval of toxicants.

1.04 SEQUENCING
A. Apply toxicant 12 hours prior to installation of vapor barrier under slabs-on-grade and finish grading work outside foundations.
B. Notify Architect 24 hours prior to application.

1.05 WARRANTY
A. Provide five year warranty under provisions of the General Requirements.
B. Warranty: Include coverage for damage and repairs to building and building contents caused by termites. Repair damage. Re-treat where required.
C. Inspect and report annually to Owner in writing. Owner reserves the right to renew warranty for an additional five years.

PART 2 PRODUCTS

2.01 MATERIALS
A. Toxicant Chemical: EPA and Local authority approved; (DRAGNET, DURSBAN TC, or as approved equal) synthetically color dyed to permit visual identification of treated soil.
B. Diluent: Recommended by toxicant manufacturer.
C. Mix toxicant to manufacturer’s instructions.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify all the site conditions and become familiar with project scope.
B. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
C. Verify final grading is complete.

3.02 APPLICATION
A. Spray apply or Inject toxicant in accordance with manufacturer’s instructions.
B. Apply toxicant at locations indicated in Schedule at end of Section.
C. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
D. Re-treat disturbed treated soil with same toxicant as original treatment. Retreat around building perimeter after top soil has been placed, directly adjacent to foundation wall.
E. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION OF FINISHED WORK
A. Protect finished Work, post signage to warn workers that soil poisoning has been applied.
B. Do not permit soil grading over treated work.

3.04 SCHEDULES

A. Locations: Both Sides of Foundation Surfaces and soil within 10’ of building perimeter

END OF SECTION 02281

SECTION 02520

PORTLAND CEMENT CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Concrete sidewalks and stair steps, integral curbs, gutters, driveways, and parking areas.
- B. Additional information included on Civil Drawings. Civil notes and drawings will take precedence over these specifications if any discrepancies occur.

1.02 PERFORMANCE REQUIREMENTS
- A. Paving: Designed for parking and light duty commercial vehicles.

1.03 QUALITY ASSURANCE
- A. Perform work in accordance with ACI 301, requirements of Sections 03100, 03200 and 03300.
- B. Obtain cementitious materials from same source throughout.

1.04 ENVIRONMENTAL REQUIREMENTS
- A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.01 FORM MATERIALS
- A. Wood or Steel form material, profiled to suit conditions.
- B. Joint Filler: ANSI/ASTM D1751 type; 3/4 inch thick.

2.02 REINFORCEMENT
- A. Welded Steel Wire Fabric: Plain type, ANSI/ASTM A185; 6x6 - 6x6 in flat sheets or coiled rolls.
- B. Reinforcing Steel: ASTM A615; 40 ksi yield grade; deformed billet steel bars; unfinished.

2.03 CONCRETE MATERIALS
- A. Cement: ASTM C150 Air Entraining - Type IA Portland type, natural color.
- B. Fine and Coarse Mix Aggregates: ASTM C33.
- C. Water: Potable, not detrimental to concrete.
- D. Air Entrainment: ASTM C260.
- E. Chemical Admixture: ASTM C494, as approved by Architect.

2.04 CONCRETE MIX - BY PERFORMANCE CRITERIA
- A. Mix concrete in accordance with, ACI 304. Deliver concrete in accordance with ASTM C94.
- B. Provide concrete to the following criteria:
  1. Compressive Strength: Reference schedule below.
  2. Slump: 1 to 2 inches.
  3. Minimum Water/Cement Ratio: 6.5 gallon/5.5 sack.
  4. Air Entrained: 5 percent.
- C. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.
- D. Use calcium chloride only when approved by Architect/Engineer.
- E. Use set retarding admixtures during hot weather only when approved by Architect/Engineer.

2.05 SOURCE QUALITY CONTROL
- A. Submit proposed mix design of each class of concrete to the architect and appointed testing laboratory firm for review prior to commencement of work.
- B. Tests on cement and aggregates shall be performed to ensure conformance with specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify compacted subgrade, granular base and stabilized soil is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.
B. Coat surfaces of manholes, catch basins and frames with oil to prevent bond with concrete pavement.
C. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.03 FORMING

A. Place and secure forms to correct location, dimension, and profile.
B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.04 REINFORCEMENT

A. Place reinforcement at mid-height of slabs-on-grade.
B. Interrupt reinforcement at expansion joints.
C. Place dowels and reinforcement to achieve pavement and curb alignment as detailed.
D. Provide doweled joints 12 inch o.c. at interruptions of concrete.

3.05 PLACING CONCRETE

A. Place concrete in accordance with ACI 301.
B. Ensure reinforcement, inserts, embedded parts, are not disturbed during concrete placement.
C. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
D. Place concrete to indicated pattern.

3.06 JOINTS

A. Place 1/2 inch expansion joints at 60 foot intervals. Align curb, gutter, and sidewalk joints.
B. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/4 inch for sealant placement by Section 07900.
C. Provide scored or sawn joints at 4 feet intervals U.N.O. at sidewalks and curbs and 15 feet at pavement.
D. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

3.07 FINISHING

A. Parking: Light broom.
B. Sidewalk Paving: Light broom, radius to 1/4 inch and trowel joint edges.
C. Handicapped Ramps: Reference ADA.
D. Curbs and Gutters: Trowel finish.
E. Inclined Vehicular Ramps: Broom perpendicular to slope.
F. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.08 FIELD QUALITY CONTROL

A. Three concrete test cylinders shall be taken for every 100 or less cu yds of each class of concrete placed each day.
B. One additional test cylinder shall be taken during cold weather and cured on site under same conditions as concrete it represents.
C. One slump test shall be taken for each set of test cylinders taken.

3.09 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

3.10 SCHEDULES

A. Concrete Sidewalks, Ramps, Stairs and Retaining Walls: 3,000 psi 28 day concrete, 4 inches thick, 6x6 - 10x10 inch mesh reinforcement, natural color Portland cement, broom finish, detectable warnings per ADA at ramps and curb cuts.
B. Concrete Aprons and Driveways: 4,000 psi 28 day concrete, 6 inches thick, 6x6 - 6x6 W.W.F. reinforced, natural color Portland cement, broom finish.

END OF SECTION 02520

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

1.02 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect and handle products to site per the suppliers and/or manufacturer's recommendations.
- B. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.03 COORDINATION
- A. Coordinate this Section with other Sections of work which require attachment of components to formwork.
- B. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

PART 2 PRODUCTS

2.01 WOOD FORM MATERIALS
- A. Form Materials: At the discretion of the Contractor.

2.02 PREFABRICATED FORMS
- A. Preformed Steel Forms: Minimum gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

2.03 FORMWORK ACCESSORIES
- A. Form Ties: Removable or Snap-off type, metal, size and shape to minimize filling, waterproofing and refinishing concrete surfaces.
- B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
- C. Corners: Chamfer, exposed edges 1/2 inch unless otherwise noted or detailed on the drawings.
- D. Dovetail Anchor Slot: Galvanized steel, 22 gage thick, release tape sealed slots, anchors for securing to concrete formwork.
- E. Flashing Reglets: Galvanized steel 22 gage thick, longest possible lengths, with alignment splines for joints, release tape sealed slots, anchors for securing to concrete formwork.
- F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- G. Waterstops: Rubber Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS
- A. Earth forms if permitted, hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.03 ERECTION – FORMWORK
- A. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to over stressing by construction loads.
C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
D. Align joints and make watertight. Keep form joints to a minimum.
E. Obtain approval before framing openings in structural members which are not indicated on Drawings.
F. Provide chamfer strips on external corners of beams joists columns and exposed decorative concrete edges.
G. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

3.04 APPLICATION - FORM RELEASE AGENT
A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are effected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS
A. Provide formed openings where required for items to be embedded in passing through concrete work.
B. Locate and set in place items which will be cast directly into concrete.
C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
D. Position recessed reglets for brick veneer masonry anchors to spacing and intervals specified in Section 04300.
E. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
F. Install waterstops continuous without displacing reinforcement. Heat seal joints watertight.
G. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
H. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING
A. Clean forms as erection proceeds, to remove foreign matter within forms.
B. Clean formed cavities of debris prior to placing concrete.
C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.07 FORMWORK TOLERANCES
A. Construct formwork to maintain tolerances required by ACI 301. Construct and align formwork for elevator hoistway in accordance with ANSI/ASME A17.1.

3.08 FIELD QUALITY CONTROL
A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.
B. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.09 FORM REMOVAL
A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and
B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION 03100

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

1.02 SUBMITTALS
A. Submit under provisions of the General Requirements.
B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.

1.03 QUALITY ASSURANCE
A. Perform Work in accordance with CRSI - Manual of Standard Practice and ACI 301.

1.04 QUALIFICATIONS
A. Design reinforcement under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Kansas.

1.05 COORDINATION
A. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.01 REINFORCEMENT
A. Reinforcing Steel: ASTM A615, 40, 60, or 75 ksi yield grade as indicated on the drawings; deformed billet steel bars, unfinished.
B. Reinforcing Steel Plain Bar and Rod Mats: ASTM A704, ASTM A615, Grade 40 or 60 as indicated on the drawings; steel bars or rods, unfinished.
C. Stirrup Steel: ANSI/ASTM A82, unfinished.
D. Welded Steel Wire Fabric: ASTM A815; in flat sheets or coiled rolls; unfinished.

2.02 ACCESSORY MATERIALS
A. Tie Wire: Minimum 16 gage annealed type.
B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.
C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required.

2.03 FABRICATION
A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice.
B. Weld reinforcement in accordance with ANSI/AWS D1.4.
C. Locate reinforcing splices not indicated on drawings, at point of minimum stress.

PART 3 EXECUTION

3.01 PLACEMENT
A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
B. Do not displace or damage vapor barrier.
C. Accommodate placement of formed openings.

D. Maintain concrete cover around reinforcing as indicated on the drawings or if not indicated as follows:

Item	Coverage
Beams	1 1/2 inch
Column Ties	1 1/2 inch
Walls (exposed to weather or backfill)	2 inch
Footings and Concrete Formed Against Earth	3 inch
Slabs on Fill	3/4 inch

END OF SECTION 03200

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Cast-in-place concrete floors, footings, foundation walls, retaining walls, steps and ramps.
- B. Concrete fill over Metal Deck
- C. Floors and slabs on grade.
- D. Control, expansion and contraction joint devices associated with concrete work, including joint sealants.
- E. Equipment pads, light pole base and flagpole base.

1.02 SUBMITTALS
- A. Submit under provisions of the General Requirements.
- B. Product Data: Provide data on joint devices, attachment accessories.
- C. Samples: Submit 2-inch long samples of expansion/contraction joint.
- D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent Work.

1.03 PROJECT RECORD DOCUMENTS
- A. Accurately record actual locations of embedded utilities and components which are concealed from view.

1.04 QUALITY ASSURANCE
- A. Perform Work in accordance with ACI 301.
- B. Acquire cement and aggregate from same source for all work.
- C. Conform to ACI 305R when concreting during hot weather.
- D. Conform to ACI 306R when concreting during cold weather.

1.05 COORDINATION
- A. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS
- A. Cement: ASTM C150, Type I - Normal or Type III - High Early Strength Type V - Sulfate Resistant as required Portland type.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.

2.02 ADMIXTURES
- A. Air Entrainment: ASTM C260.
- B. Chemical: ASTM C494 Type A - Water Reducing, Type B - Retarding, Type C - Accelerating, Type D - Water Reducing and Retarding, Type E - Water Reducing and Accelerating.

2.03 ACCESSORIES
- A. Bonding Agent: Polymer resin emulsion, polyvinyl acetate, Latex emulsion, two component modified epoxy resin, non-solvent two component polysulfide epoxy, mineral filled polysulfide polymer epoxy, mineral filled polysulfide polymer epoxy resin, or Polyamid cured epoxy as approved.
- B. Vapor Barrier: 6 mil thick clear polyethylene film, type recommended for below grade application.
- C. Non-Shrink Grout: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.04 JOINT DEVICES AND FILLER MATERIALS
- A. Joint Filler:
  1. Joint Filler Type A: ASTM D1751; Asphalt impregnated fiberboard or felt, 1/4 inch thick.
  2. Joint Filler Type B: ASTM D1752; Closed cell polyvinyl chloride foam, resiliency recovery of 95 percent if not compressed more than 50 percent of original thickness.

B. Expansion and Contraction Joint Devices: ASTM B221 alloy, extruded aluminum; resilient elastomeric, vinyl, or neoprene, filler strip with a Shore A hardness of 35 to permit plus or minus 25 percent joint movement with full recovery; extruded aluminum or vinyl cover plate, of longest manufactured length at each location, recess mounted; color as selected.
C. Sealant: Rubber or synthetic rubber compound.

2.05 CONCRETE MIX
A. Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94.
B. Select proportions for normal weight concrete in accordance with ACI 301.
C. Provide concrete as noted on structural drawings (minimum compressive strength of 3,500 psi at 28 days).
D. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.
E. Use calcium chloride only when approved by Architect/Engineer.
F. Use set retarding admixtures during hot weather only when approved by Architect/Engineer.
G. Add air entraining agent to normal weight concrete mix for work exposed to exterior.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify requirements for concrete cover over reinforcement.
B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.02 PREPARATION
A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
B. In locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.03 PLACING CONCRETE
A. Place concrete in accordance with ACI 301.
B. Notify Architect/Engineer minimum 24 hours prior to commencement of operations.
C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.
D. Install vapor barrier under interior slabs on grade. Lap joints minimum 6 inches and seal watertight by sealant applied between overlapping edges and ends or taping edges and ends.
E. Repair vapor barrier damaged during placement of concrete reinforcing. Repair with vapor barrier material; lap over damaged areas minimum 6 inches and seal watertight.
F. Separate slabs on grade from vertical surfaces with 1/2 inch thick joint filler.
G. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
H. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface. Conform to Section 07900 for finish joint sealer requirements.
I. Install joint devices in accordance with manufacturer's instructions.
J. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
K. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.
L. Install joint covers in longest practical length, when adjacent construction activity is complete.
M. Apply sealants in joint devices in accordance with Section 07900.
N. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
O. Place concrete continuously between predetermined expansion, control, and construction joints.
P. Do not interrupt successive placement; do not permit cold joints to occur where possible.
Q. Place floor slabs in checkerboard or saw cut pattern indicated.
R. Saw cut joints within 24 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.
S. Screed floors and slabs on grade level, maintaining surface flatness of maximum 1/4 inch in 10 ft.

3.04 CONCRETE FINISHING

A. Provide formed concrete surfaces to be left exposed concrete walls columns beams joists with smooth rubbed finish.
B. Finish concrete floor surfaces in accordance with ACI 301.
C. Wood float surfaces which will receive quarry tile, ceramic tile, or terrazzo with full bed setting system.
D. Steel trowel surfaces which will receive carpeting, resilient flooring, seamless flooring, thin set quarry tile, or thin set ceramic tile. NO AIR ENTRAINMENT IN SLABS TO RECEIVE TROWEL FINISH.
E. Steel trowel surfaces which are scheduled to be exposed. NO AIR ENTRAINMENT IN SLABS TO RECEIVE TROWEL FINISH.
F. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/4 inch per foot or as indicated on drawings.

3.05 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
C. Cure floor surfaces in accordance with ACI 308.
D. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 4 days.
E. Spraying: Spray water over floor slab areas and maintain wet for 7 days.

3.06 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed in accordance with ACI 301 and under provisions of the General Requirements.
B. Provide free access to Work and cooperate with appointed firm.
C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
D. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.
E. Three concrete test cylinders will be taken for every 75 or less cu yds of each class of concrete placed.
F. One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.
G. One slump test will be taken for each set of test cylinders taken.

3.07 PATCHING

A. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.
B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.
C. Patch imperfections as directed or in accordance with ACI 301.

3.08 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
B. Repair or replacement of defective concrete will be determined by the Architect/Engineer.
C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

END OF SECTION 03300

PRESERVATION BRIEF 1

Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings

- Preparing for a Cleaning Project
- Understanding the Building Materials
- Cleaning Methods and Materials
- Planning a Cleaning Project
- Water-Repellent Coatings and Waterproof Coatings

Inappropriate cleaning and coating treatments are a major cause of damage to historic masonry buildings. While either or both treatments may be appropriate in some cases, they can be very destructive to historic masonry if they are not selected carefully. Historic masonry, as considered here, includes stone, brick, architectural terra cotta, cast stone, concrete and concrete block. It is frequently cleaned because cleaning is equated with improvement. Cleaning may sometimes be followed by the application of a water-repellent coating. However, unless these procedures are carried out under the guidance and supervision of an architectural conservator, they may result in irrevocable damage to the historic resource.

The purpose of this Brief is to provide information on the variety of cleaning methods and materials that are available for use on the exterior of historic masonry buildings, and to provide guidance in selecting the most appropriate method or combination of methods. The difference between water-repellent coatings and waterproof coatings is explained, and the purpose of each, the suitability of their application to historic masonry buildings, and the possible consequences of their inappropriate use are discussed.

The Brief is intended to help develop sensitivity to the qualities of historic masonry that makes it so special, and to assist historic building owners and property managers in working cooperatively with architects, architectural conservators, and contractors. Although specifically intended for historic buildings, the information is applicable to all masonry buildings. The Brief is not meant to be a cleaning manual or a guide for preparing specifications. Rather, it provides general information to raise awareness of the many factors involved in selecting cleaning and water-repellent treatments for historic masonry buildings.

Preparing for a Cleaning Project, Reasons for Cleaning

First, it is important to determine whether it is appropriate to clean the masonry. The objective of cleaning a historic masonry building must be considered carefully before arriving at a decision to clean. There are several major reasons for cleaning a historic masonry building: improve the appearance of the building by removing unattractive dirt or soiling materials, or non-historic paint from the masonry; retard deterioration by removing soiling materials that may be damaging the masonry; or provide a clean surface to accurately match repointing mortars or patching compounds, or to conduct a condition survey of the masonry.

Identify What is to be Removed

The general nature and source of dirt or soiling material on a building must be identified to remove it in the gentlest means possible--that is, in the most effective, yet least harmful, manner. Soot and smoke, for example, require a different cleaning agent to remove than oil stains or metallic stains. Other common cleaning problems include biological growth such as mold or mildew, and organic matter such as the tendrils left on masonry after removal of ivy.

Consider the Historic Appearance of the Building

If the proposed cleaning is to remove paint, it is important in each case to learn whether or not unpainted masonry is historically appropriate. And, it is necessary to consider why the building was painted. Was it to cover bad repointing or unmatched repairs? Was the building painted to protect soft brick or to conceal deteriorating stone? Or, was painted masonry simply a fashionable treatment in a particular historic period? Many buildings were painted at the time of construction or shortly thereafter; retention of the paint, therefore, may be more appropriate historically than removing it. And, if the

building appears to have been painted for a long time, it is also important to think about whether the paint is part of the character of the historic building and if it has acquired significance over time.

Consider the Practicalities of Cleaning or Paint Removal

Some gypsum or sulfate crusts may have become integral with the stone and, if cleaning could result in removing some of the stone surface, it may be preferable not to clean. Even where unpainted masonry is appropriate, the retention of the paint may be more practical than removal in terms of long range preservation of the masonry. In some cases, however, removal of the paint may be desirable. For example, the old paint layers may have built up to such an extent that removal is necessary to ensure a sound surface to which the new paint will adhere.

Study the Masonry

Although not always necessary, in some instances it can be beneficial to have the coating or paint type, color, and layering on the masonry researched before attempting its removal. Analysis of the nature of the soiling or of the paint to be removed from the masonry, as well as guidance on the appropriate cleaning method, may be provided by professional consultants, including architectural conservators, conservation scientists, and preservation architects. The State Historic Preservation Office (SHPO), local historic district commissions, architectural review boards, and preservation-oriented websites may also be able to supply useful information on masonry cleaning techniques.

Understanding the Building Materials

The construction of the building must be considered when developing a cleaning program because inappropriate cleaning can have a deleterious effect on the masonry as well as on other building materials. The masonry material or materials must be correctly identified. It is sometimes difficult to distinguish one type of stone from another; for example, certain sandstones can be easily confused with limestones. Or, what appears to be natural stone may not be stone at all, but cast stone or concrete. Historically, cast stone and architectural terra cotta were frequently used in combination with natural stone, especially for trim elements or on upper stories of a building where, from a distance, these substitute materials looked like real stone. Other features on historic buildings that appear to be stone, such as decorative cornices, entablatures and window hoods, may not even be masonry, but metal.

Identify Prior Treatments

Previous treatments of the building and its surroundings should be researched and building maintenance records should be obtained, if available. Sometimes if streaked or spotty areas do not seem to get cleaner following an initial cleaning, closer inspection and analysis may be warranted. The discoloration may turn out not to be dirt but the remnant of a water-repellent coating applied long ago which has darkened the surface of the masonry over time. Successful removal may require testing several cleaning agents to find something that will dissolve and remove the coating. Complete removal may not always be possible. Repairs may have been stained to match a dirty building, and cleaning may make these differences apparent. De-icing salts used near the building that have dissolved can migrate into the masonry. Cleaning may draw the salts to the surface, where they will appear as efflorescence (a powdery, white substance), which may require a second treatment to be removed. Allowances for dealing with such unknown factors, any of which can be a potential problem, should be included when investigating cleaning methods and materials. Just as more than one kind of masonry on a historic building may necessitate multiple cleaning approaches, unknown conditions that are encountered may also require additional cleaning treatments.

Choose the Appropriate Cleaner

The importance of testing cleaning methods and materials cannot be over emphasized. Applying the wrong cleaning agents to historic masonry can have disastrous results. Acidic cleaners can be extremely damaging to acid-sensitive stones, such as marble and limestone, resulting in etching and dissolution of these stones. Other kinds of masonry can also be damaged by incompatible cleaning agents, or even by cleaning agents that are usually compatible. There are also numerous kinds of sandstone, each with a considerably different geological composition. While an acid-based cleaner may be safely used on some sandstones, others are acid-sensitive and can be severely etched or dissolved by an acid cleaner. Some sandstones contain water-soluble minerals and can be eroded by water cleaning. And, even if the stone type is correctly identified, stones, as well as some bricks, may contain unexpected impurities, such as iron particles, that may react negatively with a particular cleaning agent and result in staining. Thorough

understanding of the physical and chemical properties of the masonry will help avoid the inadvertent selection of damaging cleaning agents.
Other building materials also may be affected by the cleaning process. Some chemicals, for example, may have a corrosive effect on paint or glass. The portions of building elements most vulnerable to deterioration may not be visible, such as embedded ends of iron window bars. Other totally unseen items, such as iron cramps or ties which hold the masonry to the structural frame, also may be subject to corrosion from the use of chemicals or even from plain water. The only way to prevent problems in these cases is to study the building construction in detail and evaluate proposed cleaning methods with this information in mind. However, due to the very likely possibility of encountering unknown factors, any cleaning project involving historic masonry should be viewed as unique to that particular building.

Cleaning Methods and Materials

Masonry cleaning methods generally are divided into three major groups: water, chemical, and abrasive. Water methods soften the dirt or soiling material and rinse the deposits from the masonry surface. Chemical cleaners react with dirt, soiling material or paint to effect their removal, after which the cleaning effluent is rinsed off the masonry surface with water. Abrasive methods include blasting with grit, and the use of grinders and sanding discs, all of which mechanically remove the dirt, soiling material or paint (and, usually, some of the masonry surface). Abrasive cleaning is also often followed with a water rinse. Laser cleaning, although not discussed here in detail, is another technique that is used sometimes by conservators to clean small areas of historic masonry. It can be quite effective for cleaning limited areas, but it is expensive and generally not practical for most historic masonry cleaning projects.
Although it may seem contrary to common sense, masonry cleaning projects should be carried out starting at the bottom and proceeding to the top of the building always keeping all surfaces wet below the area being cleaned. The rationale for this approach is based on the principle that dirty water or cleaning effluent dripping from cleaning in progress above will leave streaks on a dirty surface but will not streak a clean surface as long as it is kept wet and rinsed frequently.
Water Cleaning
Water cleaning methods are generally the gentlest means possible, and they can be used safely to remove dirt from all types of historic masonry. There are essentially four kinds of water-based methods: soaking; pressure water washing; water washing supplemented with non-ionic detergent; and steam, or hot-pressurized water cleaning. Once water cleaning has been completed, it is often necessary to follow up with a water rinse to wash off the loosened soiling material from the masonry.
Water cleaning methods may not be appropriate to use on some badly deteriorated masonry because water may exacerbate the deterioration, or on gypsum or alabaster, which are very soluble in water.

Soaking

Prolonged spraying or misting with water is particularly effective for cleaning limestone and marble. It is also a good method for removing heavy accumulations of soot, sulfate crusts or gypsum crusts that tend to form in protected areas of a building not regularly washed by rain. Water is distributed to lengths of punctured hose or pipe with non-ferrous fittings hung from moveable scaffolding or a swing stage that continuously mists the surface of the masonry with a very fine spray. A timed on-off spray is another approach to using this cleaning technique. After one area has been cleaned, the apparatus is moved on to another. Soaking is often used in combination with water washing and is also followed by a final water rinse. Soaking is a very slow method—it may take several days or a week—but it is a very gentle method to use on historic masonry.

Water Washing

Washing with low-pressure or medium-pressure water is probably one of the most commonly used methods for removing dirt or other pollutant soiling from historic masonry buildings. Starting with a very low pressure (100 psi or below), even using a garden hose, and progressing as needed to slightly higher pressure—generally no higher than 300-400 psi—is always the recommended way to begin. Scrubbing with natural bristle or synthetic bristle brushes—never metal which can abrade the surface and leave metal particles that can stain the masonry—can help in cleaning areas of the masonry that are especially dirty.

Water Washing with Detergents

Non-ionic detergents—which are not the same as soaps—are synthetic organic compounds that are especially effective in removing oily soil. (Examples of some of the numerous proprietary non-ionic detergents include Igepal by GAF, Tergitol by Union Carbide and Triton by Rohm & Haas.) Thus, the addition of a non-ionic detergent, or surfactant, to a low- or medium-pressure water wash can be a useful aid in the cleaning process. (A non-ionic detergent, unlike most household detergents, does not leave a solid, visible residue on the masonry.) Adding a non-ionic detergent and scrubbing with a natural bristle or synthetic bristle brush can facilitate cleaning textured or intricately carved masonry. This should be followed with a final water rinse.

Steam/Hot-Pressurized Water Cleaning

Steam cleaning is actually low-pressure hot water washing because the steam condenses almost immediately upon leaving the hose. This is a gentle and effective method for cleaning stone and particularly for acid-sensitive stones. Steam can be especially useful in removing built-up soiling deposits and dried-up plant materials, such as ivy disks and tendrils. It can also be an efficient means of cleaning carved stone details and, because it does not generate a lot of liquid water, it can sometimes be appropriate to use for cleaning interior masonry.

Potential Hazards of Water Cleaning

Despite the fact that water-based methods are generally the most gentle, even they can be damaging to historic masonry. Before beginning a water cleaning project, it is important to make sure that all mortar joints are sound and that the building is watertight. Otherwise water can seep through the walls to the interior, resulting in rusting metal anchors and stained and ruined plaster.

Some water supplies may contain traces of iron and copper which may cause masonry to discolor. Adding a chelating or complexing agent to the water, such as EDTA (ethylene diamine tetra-acetic acid), which inactivates other metallic ions, as well as softens minerals and water hardness, will help prevent staining on light-colored masonry.

Any cleaning method involving water should never be done in cold weather or if there is any likelihood of frost or freezing because water within the masonry can freeze, causing spalling and cracking. Since a masonry wall may take over a week to dry after cleaning, no water cleaning should be permitted for several days prior to the first average frost date, or even earlier if local forecasts predict cold weather.

Most important of all, it is imperative to be aware that using water at too high a pressure, a practice common to "power washing" and "water blasting", is very abrasive and can easily etch marble and other soft stones, as well as some types of brick. In addition, the distance of the nozzle from the masonry surface and the type of nozzle, as well as gallons per minute (gpm), are also important variables in a water cleaning process that can have a significant impact on the outcome of the project. This is why it is imperative that the cleaning be closely monitored to ensure that the cleaning operators do not raise the pressure or bring the nozzle too close to the masonry in an effort to "speed up" the process. The appearance of grains of stone or sand in the cleaning effluent on the ground is an indication that the water pressure may be too high.

Chemical Cleaning

Chemical cleaners, generally in the form of proprietary products, are another material frequently used to clean historic masonry. They can remove dirt, as well as paint and other coatings, metallic and plant stains, and graffiti. Chemical cleaners used to remove dirt and soiling include acids, alkalies and organic compounds. Acidic cleaners, of course, should not be used on masonry that is acid sensitive. Paint removers are alkaline, based on organic solvents or other chemicals.

Chemical Cleaners to Remove Dirt

Both alkaline and acidic cleaning treatments include the use of water. Both cleaners are also likely to contain surfactants (wetting agents), that facilitate the chemical reaction that removes the dirt. Generally, the masonry is wet first for both types of cleaners, then the chemical cleaner is sprayed on at very low pressure or brushed onto the surface. The cleaner is left to dwell on the masonry for an amount of time recommended by the product manufacturer or, preferably, determined by testing, and rinsed off with a low- or moderate-pressure cold, or sometimes hot, water wash.

More than one application of the cleaner may be necessary, and it is always a good practice to test the product manufacturers recommendations concerning dilution rates and dwell times. Because each cleaning situation is unique, dilution rates and dwell times can vary considerably. The masonry surface

may be scrubbed lightly with natural or synthetic bristle brushes prior to rinsing. After rinsing, pH strips should be applied to the surface to ensure that the masonry has been neutralized completely.

Acidic Cleaners

Acid-based cleaning products may be used on non-acid sensitive masonry, which generally includes: granite, most sandstones, slate, unglazed brick and unglazed architectural terra cotta, cast stone and concrete. Most commercial acidic cleaners are composed primarily of hydrofluoric acid, and often include some phosphoric acid to prevent rust-like stains from developing on the masonry after the cleaning. Acid cleaners are applied to the pre-wet masonry which should be kept wet while the acid is allowed to "work", and then removed with a water wash.

Alkaline Cleaners

Alkaline cleaners should be used on acid-sensitive masonry, including: limestone, polished and unpolished marble, calcareous sandstone, glazed brick and glazed architectural terra cotta, and polished granite. (Alkaline cleaners may also be used sometimes on masonry materials that are not acid sensitive--after testing, of course--but they may not be as effective as they are on acid-sensitive masonry.) Alkaline cleaning products consist primarily of two ingredients: a non-ionic detergent or surfactant; and an alkali, such as potassium hydroxide or ammonium hydroxide. Like acidic cleaners, alkaline products are usually applied to pre-wet masonry, allowed to dwell, and then rinsed off with water. (Longer dwell times may be necessary with alkaline cleaners than with acidic cleaners.) Two additional steps are required to remove alkaline cleaners after the initial rinse. First the masonry is given a slightly acidic wash--often with acetic acid--to neutralize it, and then it is rinsed again with water.

Chemical Cleaners to Remove Paint and Other Coatings, Stains and Graffiti

Removing paint and some other coatings, stains and graffiti can best be accomplished with alkaline paint removers, organic solvent paint removers, or other cleaning compounds. The removal of layers of paint from a masonry surface usually involves applying the remover either by brush, roller or spraying, followed by a thorough water wash. As with any chemical cleaning, the manufacturer's recommendations regarding application procedures should always be tested before beginning work.

Alkaline Paint Removers

These are usually of much the same composition as other alkaline cleaners, containing potassium or ammonium hydroxide, or trisodium phosphate. They are used to remove oil, latex and acrylic paints, and are effective for removing multiple layers of paint. Alkaline cleaners may also remove some acrylic water-repellent coatings. As with other alkaline cleaners, both an acidic neutralizing wash and a final water rinse are generally required following the use of alkaline paint removers.

Organic Solvent Paint Removers

The formulation of organic solvent paint removers varies and may include a combination of solvents, including methylene chloride, methanol, acetone, xylene and toluene.

Other Paint Removers and Cleaners

Other cleaning compounds that can be used to remove paint and some painted graffiti from historic masonry include paint removers based on N-methyl-2-pyrrolidone (NMP), or on petroleum-based compounds. Removing stains, whether they are industrial (smoke, soot, grease or tar), metallic (iron or copper), or biological (plant and fungal) in origin, depends on carefully matching the type of remover to the type of stain. Successful removal of stains from historic masonry often requires the application of a number of different removers before the right one is found. The removal of layers of paint from a masonry surface is usually accomplished by applying the remover either by brush, roller or spraying, followed by a thorough water wash.

Potential Hazards of Chemical Cleaning

Since most chemical cleaning methods involve water, they have many of the potential problems of plain water cleaning. Like water methods, they should not be used in cold weather because of the possibility of freezing. Chemical cleaning should never be undertaken in temperatures below 40 degrees F (4 degrees C), and generally not below 50 degrees F. In addition, many chemical cleaners simply do not work in cold temperatures. Both acidic and alkaline cleaners can be dangerous to cleaning operators, and clearly, there are environmental concerns associated with the use of chemical cleaners.

If not carefully chosen, chemical cleaners can react adversely with many types of masonry. Obviously, acidic cleaners should not be used on acid-sensitive materials; however, it is not always clear exactly what the composition is of any stone or other masonry material. For, this reason, testing the cleaner on an inconspicuous spot on the building is always necessary. While certain acid-based cleaners may be appropriate if used as directed on a particular type of masonry, if left too long or if not adequately rinsed from the masonry they can have a negative effect. For example, hydrofluoric acid can etch masonry leaving a hazy residue (whitish deposits of silica or calcium fluoride salts) on the surface. While this efflorescence may usually be removed by a second cleaning—although it is likely to be expensive and time-consuming—hydrofluoric acid can also leave calcium fluoride salts or a colloidal silica deposit on masonry which may be impossible to remove. Other acids, particularly hydrochloric (muriatic) acid, which is very powerful, should not be used on historic masonry, because it can dissolve lime-based mortar, damage brick and some stones, and leave chloride deposits on the masonry.
Alkaline cleaners can stain sandstones that contain a ferrous compound. Before using an alkaline cleaner on sandstone it is always important to test it, since it may be difficult to know whether a particular sandstone may contain a ferrous compound. Some alkaline cleaners, such as sodium hydroxide (caustic soda or lye) and ammonium bifluoride, can also damage or leave disfiguring brownish-yellow stains and, in most cases, should not be used on historic masonry. Although alkaline cleaners will not etch a masonry surface as acids can, they are caustic and can burn the surface. In addition, alkaline cleaners can deposit potentially damaging salts in the masonry which can be difficult to rinse thoroughly.

Poulticing to Remove Stains and Graffiti

Graffiti and stains, which have penetrated into the masonry, often are best removed by using a poultice. A poultice consists of an absorbent material or clay powder (such as kaolin or fullerís earth, or even shredded paper or paper towels), mixed with a liquid (a solvent or other remover) to form a paste which is applied to the stain. The poultice is kept moist and left on the stain as long as necessary for it to draw the stain out of the masonry. As it dries, the paste absorbs the staining material so that it is not redeposited on the masonry surface.

Some commercial cleaning products and paint removers are specially formulated as a paste or gel that will cling to a vertical surface and remain moist for a longer period of time in order to prolong the action of the chemical on the stain. Pre-mixed poultices are also available as a paste or in powder form needing only the addition of the appropriate liquid. The masonry must be pre-wet before applying an alkaline cleaning agent, but not when using a solvent. Once the stain has been removed, the masonry must be rinsed thoroughly.

Abrasive and Mechanical Cleaning

Generally, abrasive cleaning methods are not appropriate for use on historic masonry buildings. Abrasive cleaning methods are just that—abrasive. Grit blasters, grinders, and sanding discs all operate by abrading the dirt or paint off the surface of the masonry, rather than reacting with the dirt and the masonry which is how water and chemical methods work. Since the abrasives do not differentiate between the dirt and the masonry, they can also remove the outer surface of the masonry at the same time, and result in permanently damaging the masonry. Brick, architectural terra cotta, soft stone, detailed carvings, and polished surfaces, are especially susceptible to physical and aesthetic damage by abrasive methods. Brick and architectural terra cotta are fired products which have a smooth, glazed surface which can be removed by abrasive blasting or grinding. Abrasively-cleaned masonry is damaged aesthetically as well as physically, and it has a rough surface which tends to hold dirt and the roughness will make future cleaning more difficult. Abrasive cleaning processes can also increase the likelihood of subsurface cracking of the masonry. Abrasion of carved details causes a rounding of sharp corners and other loss of delicate features, while abrasion of polished surfaces removes the polished finish of stone. Mortar joints, especially those with lime mortar, also can be eroded by abrasive or mechanical cleaning. In some cases, the damage may be visual, such as loss of joint detail or increased joint shadows. As mortar joints constitute a significant portion of the masonry surface (up to 20 per cent in a brick wall), this can result in the loss of a considerable amount of the historic fabric. Erosion of the mortar joints may also permit increased water penetration, which will likely necessitate repointing.

Abrasive Blasting

Blasting with abrasive grit or another abrasive material is the most frequently used abrasive method. Sandblasting is most commonly associated with abrasive cleaning. Finely ground silica or glass powder, glass beads, ground garnet, powdered walnut and other ground nut shells, grain hulls, aluminum oxide, plastic particles and even tiny pieces of sponge, are just a few of the other materials that have also been

used for abrasive cleaning. Although abrasive blasting is not an appropriate method of cleaning historic masonry, it can be safely used to clean some materials. Finely-powdered walnut shells are commonly used for cleaning monumental bronze sculpture, and skilled conservators clean delicate museum objects and finely detailed, carved stone features with very small, micro-abrasive units using aluminum oxide.
A number of current approaches to abrasive blasting rely on materials that are not usually thought of as abrasive, and not as commonly associated with traditional abrasive grit cleaning. Some patented abrasive cleaning processes—one dry, one wet—use finely-ground glass powder intended to "erase" or remove dirt and surface soiling only, but not paint or stains. Cleaning with baking soda (sodium bicarbonate) is another patented process. Baking soda blasting is being used in some communities as a means of quick graffiti removal. However, it should not be used on historic masonry which it can easily abrade and can permanently "etch" the graffiti into the stone; it can also leave potentially damaging salts in the stone which cannot be removed. Most of these abrasive grits may be used either dry or wet, although dry grit tends to be used more frequently.
Ice particles, or pelletized dry ice (carbon dioxide or CO2), are another medium used as an abrasive cleaner. This is also too abrasive to be used on most historic masonry, but it may have practical application for removing mastics or asphaltic coatings from some substrates.
Some of these processes are promoted as being more environmentally safe and not damaging to historic masonry buildings. However, it must be remembered that they are abrasive and that they "clean" by removing a small portion of the masonry surface, even though it may be only a minuscule portion. The fact that they are essentially abrasive treatments must always be taken into consideration when planning a masonry cleaning project. In general, abrasive methods should not be used to clean historic masonry buildings. In some, very limited instances, highly-controlled, gentle abrasive cleaning may be appropriate on selected, hard-to-clean areas of a historic masonry building if carried out under the watchful supervision of a professional conservator. But, abrasive cleaning should never be used on an entire building.

Grinders and Sanding Disks

Grinding the masonry surface with mechanical grinders and sanding disks is another means of abrasive cleaning that should not be used on historic masonry. Like abrasive blasting, grinders and disks do not really clean masonry but instead grind away and abrasively remove and, thus, damage the masonry surface itself rather than remove just the soiling material.

Planning a Cleaning Project

Once the masonry and soiling material or paint have been identified, and the condition of the masonry has been evaluated, planning for the cleaning project can begin.

Testing Cleaning Methods

In order to determine the gentlest means possible, several cleaning methods or materials may have to be tested prior to selecting the best one to use on the building. Testing should always begin with the gentlest and least invasive method proceeding gradually, if necessary, to more complicated methods, or a combination of methods. All too often simple methods, such as a low-pressure water wash, are not even considered, yet they frequently are effective, safe, and not expensive. Water of slightly higher pressure or with a non-ionic detergent additive also may be effective. It is worth repeating that these methods should always be tested prior to considering harsher methods; they are safer for the building and the environment, often safer for the applicator, and relatively inexpensive.
The level of cleanliness desired also should be determined prior to selection of a cleaning method. Obviously, the intent of cleaning is to remove most of the dirt, soiling material, stains, paint or other coating. A "brand new" appearance, however, may be inappropriate for an older building, and may require an overly harsh cleaning method to be achieved. When undertaking a cleaning project, it is important to be aware that some stains simply may not be removable. It may be wise, therefore, to agree upon a slightly lower level of cleanliness that will serve as the standard for the cleaning project. The precise amount of residual dirt considered acceptable may depend on the type of masonry, the type of soiling and difficulty of total removal, and local environmental conditions.
Cleaning tests should be carried out in an area of sufficient size to give a true indication of their effectiveness. It is preferable to conduct the test in an inconspicuous location on the building so that it will not be obvious if the test is not successful. A test area may be quite small to begin, sometimes as small as six square inches, and gradually may be increased in size as the most appropriate methods and cleaning agents are determined. Eventually the test area may be expanded to a square yard or more, and it should include several masonry units and mortar joints. It should be remembered that a single

building may have several types of masonry and that even similar materials may have different surface finishes. Each material and different finish should be tested separately. Cleaning tests should be evaluated only after the masonry has dried completely. The results of the tests may indicate that several methods of cleaning should be used on a single building.
When feasible, test areas should be allowed to weather for an extended period of time prior to final evaluation. A waiting period of a full year would be ideal in order to expose the test patch to a full range of seasons. If this is not possible, the test patch should weather for at least a month or two. For any building which is considered historically important, the delay is insignificant compared to the potential damage and disfigurement which may result from using an incompletely tested method. The successfully cleaned test patch should be protected as it will serve as a standard against which the entire cleaning project will be measured.

Environmental Considerations

The potential effect of any method proposed for cleaning historic masonry should be evaluated carefully. Chemical cleaners and paint removers may damage trees, shrubs, grass, and plants. A plan must be provided for environmentally safe removal and disposal of the cleaning materials and the rinsing effluent before beginning the cleaning project. Authorities from the local regulatory agency--usually under the jurisdiction of the federal or state Environmental Protection Agency (EPA)--should be consulted prior to beginning a cleaning project, especially if it involves anything more than plain water washing. This advance planning will ensure that the cleaning effluent or run-off, which is the combination of the cleaning agent and the substance removed from the masonry, is handled and disposed of in an environmentally sound and legal manner. Some alkaline and acidic cleaners can be neutralized so that they can be safely discharged into storm sewers. However, most solvent-based cleaners cannot be neutralized and are categorized as pollutants, and must be disposed of by a licensed transport, storage and disposal facility. Thus, it is always advisable to consult with the appropriate agencies before starting to clean to ensure that the project progresses smoothly and is not interrupted by a stop-work order because a required permit was not obtained in advance.
Vinyl guttering or polyethylene-lined troughs placed around the perimeter of the base of the building can serve to catch chemical cleaning waste as it is rinsed off the building. This will reduce the amount of chemicals entering and polluting the soil, and also will keep the cleaning waste contained until it can be removed safely. Some patented cleaning systems have developed special equipment to facilitate the containment and later disposal of cleaning waste.
Concern over the release of volatile organic compounds (VOCs) into the air has resulted in the manufacture of new, more environmentally responsible cleaners and paint removers, while some materials traditionally used in cleaning may no longer be available for these same reasons. Other health and safety concerns have created additional cleaning challenges, such as lead paint removal, which is likely to require special removal and disposal techniques.

Cleaning can also cause damage to non-masonry materials on a building, including glass, metal and wood. Thus, it is usually necessary to cover windows and doors, and other features that may be vulnerable to chemical cleaners. They should be covered with plastic or polyethylene, or a masking agent that is applied as a liquid which dries to form a thin protective film on glass, and is easily peeled off after the cleaning is finished. Wind drift, for example, can also damage other property by carrying cleaning chemicals onto nearby automobiles, resulting in etching of the glass or spotting of the paint finish. Similarly, airborne dust can enter surrounding buildings, and excess water can collect in nearby yards and basements.

Safety Considerations

Possible health dangers of each method selected for the cleaning project must be considered before selecting a cleaning method to avoid harm to the cleaning applicators, and the necessary precautions must be taken. The precautions listed in Material Safety Data Sheets (MSDS) that are provided with chemical products should always be followed. Protective clothing, respirators, hearing and face shields, and gloves must be provided to workers to be worn at all times. Acidic and alkaline chemical cleaners in both liquid and vapor forms can also cause serious injury to passers-by. It may be necessary to schedule cleaning at night or weekends if the building is located in a busy urban area to reduce the potential danger of chemical overspray to pedestrians. Cleaning during non-business hours will allow HVAC systems to be turned off and vents to be covered to prevent dangerous chemical fumes from entering the building which will also ensure the safety of the buildingís occupants. Abrasive and mechanical methods produce dust which can pose a serious health hazard, particularly if the abrasive or the masonry contains silica.

Water-Repellent Coatings and Waterproof Coatings

To begin with, it is important to understand that waterproof coatings and water-repellent coatings are not the same. Although these terms are frequently interchanged and commonly confused with one another, they are completely different materials. Water-repellent coatings—often referred to incorrectly as "sealers", but which do not or should not "seal"—are intended to keep liquid water from penetrating the surface but to allow water vapor to enter and leave, or pass through, the surface of the masonry. Water-repellent coatings are generally transparent, or clear, although once applied some may darken or discolor certain types of masonry while others may give it a glossy or shiny appearance. Waterproof coatings seal the surface from liquid water and from water vapor. They are usually opaque, or pigmented, and include bituminous coatings and some elastomeric paints and coatings.

Water-Repellent Coatings

Water-repellent coatings are formulated to be vapor permeable, or "breathable". They do not seal the surface completely to water vapor so it can enter the masonry wall as well as leave the wall. While the first water-repellent coatings to be developed were primarily acrylic or silicone resins in organic solvents, now most water-repellent coatings are water-based and formulated from modified siloxanes, silanes and other alkoxysilanes, or metallic stearates. While some of these products are shipped from the factory ready to use, other water-borne water repellents must be diluted at the job site. Unlike earlier water-repellent coatings which tended to form a "film" on the masonry surface, modern water-repellent coatings actually penetrate into the masonry substrate slightly and, generally, are almost invisible if properly applied to the masonry. They are also more vapor permeable than the old coatings, yet they still reduce the vapor permeability of the masonry. Once inside the wall, water vapor can condense at cold spots producing liquid water which, unlike water vapor, cannot escape through a water-repellent coating. The liquid water within the wall, whether from condensation, leaking gutters, or other sources, can cause considerable damage.

Water-repellent coatings are not consolidants. Although modern water-repellents may penetrate slightly beneath the masonry surface, instead of just "sitting" on top of it, they do not perform the same function as a consolidant which is to "consolidate" and replace lost binder to strengthen deteriorating masonry. Even after many years of laboratory study and testing, few consolidants have proven very effective. The composition of fired products such as brick and architectural terra cotta, as well as many types of building stone, does not lend itself to consolidation.

Some modern water-repellent coatings which contain a binder intended to replace the natural binders in stone that have been lost through weathering and natural erosion are described in product literature as both a water repellent and a consolidant The fact that the newer water-repellent coatings penetrate beneath the masonry surface instead of just forming a layer on top of the surface may indeed convey at least some consolidating properties to certain stones. However, a water-repellent coating cannot be considered a consolidant. In some instances, a water-repellent or "preservative" coating, if applied to already damaged or spalling stone, may form a surface crust which, if it fails, may exacerbate the deterioration by pulling off even more of the stone.

Is a Water-Repellent Treatment Necessary?

Water-repellent coatings are frequently applied to historic masonry buildings for the wrong reason. They also are often applied without an understanding of what they are and what they are intended to do. And these coatings can be very difficult, if not impossible, to remove from the masonry if they fail or become discolored. Most importantly, the application of water-repellent coatings to historic masonry is usually unnecessary.

Most historic masonry buildings, unless they are painted, have survived for decades without a water-repellent coating and, thus, probably do not need one now. Water penetration to the interior of a masonry building is seldom due to porous masonry, but results from poor or deferred maintenance. Leaking roofs, clogged or deteriorated gutters and downspouts, missing mortar, or cracks and open joints around door and window openings are almost always the cause of moisture-related problems in a historic masonry building. If historic masonry buildings are kept watertight and in good repair, water-repellent coatings should not be necessary.

Rising damp (capillary moisture pulled up from the ground), or condensation can also be a source of excess moisture in masonry buildings. A water-repellent coating will not solve this problem either and, in fact, may be likely to exacerbate it. Furthermore, a water-repellent coating should never be applied to a damp wall. Moisture in the wall would reduce the ability of a coating to adhere to the masonry and to penetrate below the surface. But, if it did adhere, it would hold the moisture inside the masonry

because, although a water-repellent coating is permeable to water vapor, liquid water cannot pass through it. In the case of rising damp, a coating may force the moisture to go even higher in the wall because it can slow down evaporation, and thereby retain the moisture in the wall.
Excessive moisture in masonry walls may carry waterborne soluble salts from the masonry units themselves or from the mortar through the walls. If the water is permitted to come to the surface, the salts may appear on the masonry surface as efflorescence (a whitish powder) upon evaporation. However, the salts can be potentially dangerous if they remain in the masonry and crystallize beneath the surface as subflorescence. Subflorescence eventually may cause the surface of the masonry to spall, particularly if a water-repellent coating has been applied which tends to reduce the flow of moisture out from the subsurface of the masonry. Although many of the newer water-repellent products are more breathable than their predecessors, they can be especially damaging if applied to masonry that contains salts, because they limit the flow of moisture through masonry.

When a Water-Repellent Coating May be Appropriate

There are some instances when a water-repellent coating may be considered appropriate to use on a historic masonry building. Soft, incompletely fired brick from the 18th-and early-19th centuries may have become so porous that paint or some type of coating is needed to protect it from further deterioration or dissolution. When a masonry building has been neglected for a long period of time, necessary repairs may be required in order to make it watertight. If, following a reasonable period of time after the building has been made watertight and has dried out completely, moisture appears actually to be penetrating through the repointed and repaired masonry walls, then the application of a water-repellent coating may be considered in selected areas only. This decision should be made in consultation with an architectural conservator. And, if such a treatment is undertaken, it should not be applied to the entire exterior of the building.
Anti-graffiti or barrier coatings are another type of clear coating—although barrier coatings can also be pigmented—that may be applied to exterior masonry, but they are not formulated primarily as water repellents. The purpose of these coatings is to make it harder for graffiti to stick to a masonry surface and, thus, easier to clean. But, like water-repellent coatings, in most cases the application of anti-graffiti coatings is generally not recommended for historic masonry buildings. These coatings are often quite shiny which can greatly alter the appearance of a historic masonry surface, and they are not always effective. Generally, other ways of discouraging graffiti, such as improved lighting, can be more effective than a coating. However, the application of anti-graffiti coatings may be appropriate in some instances on vulnerable areas of historic masonry buildings which are frequent targets of graffiti that are located in out-of-the-way places where constant surveillance is not possible.
Some water-repellent coatings are recommended by product manufacturers as a means of keeping dirt and pollutants or biological growth from collecting on the surface of masonry buildings and, thus, reducing the need for frequent cleaning. While this at times may be true, in some cases a coating may actually retain dirt more than uncoated masonry. Generally, the application of a water-repellent coating is not recommended on a historic masonry building as a means of preventing biological growth. Some water-repellent coatings may actually encourage biological growth on a masonry wall. Biological growth on masonry buildings has traditionally been kept at bay through regularly-scheduled cleaning as part of a maintenance plan. Simple cleaning of the masonry with low-pressure water using a natural- or synthetic-bristled scrub brush can be very effective if done on a regular basis. Commercial products are also available which can be sprayed on masonry to remove biological growth.
In most instances, a water-repellent coating is not necessary if a building is watertight. The application of a water-repellent coating is not a recommended treatment for historic masonry buildings unless there is a specific problem which it may help solve. If the problem occurs on only part of the building, it is best to treat only that area rather than an entire building. Extreme exposures such as parapets, for example, or portions of the building subject to driving rain can be treated more effectively and less expensively than the entire building. Water-repellent coatings are not permanent and must be reapplied periodically although, if they are truly invisible, it can be difficult to know when they are no longer providing the intended protection.
Testing a water-repellent coating by applying it in one small area may not be helpful in determining its suitability for the building because a limited test area does not allow an adequate evaluation of a treatment. Since water may enter and leave through the surrounding untreated areas, there is no way to tell if the coated test area is "breathable." But trying a coating in a small area may help to determine whether the coating is visible on the surface or if it will otherwise change the appearance of the masonry.

Waterproof Coatings

In theory, waterproof coatings usually do not cause problems as long as they exclude all water from the masonry. If water does enter the wall from the ground or from the inside of a building, the coating can intensify the damage because the water will not be able to escape. During cold weather this water in the wall can freeze causing serious mechanical disruption, such as spalling.

In addition, the water eventually will get out by the path of least resistance. If this path is toward the interior, damage to interior finishes can result; if it is toward the exterior, it can lead to damage to the masonry caused by built-up water pressure.

In most instances, waterproof coatings should not be applied to historic masonry. The possible exception to this might be the application of a waterproof coating to below-grade exterior foundation walls as a last resort to stop water infiltration on interior basement walls. Generally, however, waterproof coatings, which include elastomeric paints, should almost never be applied above grade to historic masonry buildings.

Summary

A well-planned cleaning project is an essential step in preserving, rehabilitating or restoring a historic masonry building. Proper cleaning methods and coating treatments, when determined necessary for the preservation of the masonry, can enhance the aesthetic character as well as the structural stability of a historic building. Removing years of accumulated dirt, pollutant crusts, stains, graffiti or paint, if done with appropriate caution, can extend the life and longevity of the historic resource. Cleaning that is carelessly or insensitively prescribed or carried out by inexperienced workers can have the opposite of the intended effect. It may scar the masonry permanently, and may actually result in hastening deterioration by introducing harmful residual chemicals and salts into the masonry or causing surface loss. Using the wrong cleaning method or using the right method incorrectly, applying the wrong kind of coating or applying a coating that is not needed can result in serious damage, both physically and aesthetically, to a historic masonry building. Cleaning a historic masonry building should always be done using the gentlest means possible that will clean, but not damage the building. It should always be taken into consideration before applying a water-repellent coating or a waterproof coating to a historic masonry building whether it is really necessary and whether it is in the best interest of preserving the building.

PRESERVATION BRIEFS 2

Repointing Mortar Joints in Historic Masonry Buildings

- Historical Background
- Identifying the Problem Before Repointing
- Finding an Appropriate Mortar Match
- Properties of Mortar
- Mortar Analysis
- Components of Mortar
- Mortar Type and Mix
- Execution of the Work
- Visually Examining the Mortar and the Masonry Units
- Summary

Masonry—brick, stone, terra-cotta, and concrete block—is found on nearly every historic building. Structures with all-masonry exteriors come to mind immediately, but most other buildings at least have masonry foundations or chimneys. Although generally considered "permanent," masonry is subject to deterioration, especially at the mortar joints. Repointing, also known simply as "pointing"or—somewhat inaccurately—"tuck pointing"*, is the process of removing deteriorated mortar from the joints of a masonry wall and replacing it with new mortar. Properly done, repointing restores the visual and physical integrity of the masonry. Improperly done, repointing not only detracts from the appearance of the building, but may also cause physical damage to the masonry units themselves.

The purpose of this Brief is to provide general guidance on appropriate materials and methods for repointing historic masonry buildings and it is intended to benefit building owners, architects, and contractors. The Brief should serve as a guide to prepare specifications for repointing historic masonry buildings. It should also help develop sensitivity to the particular needs of historic masonry, and to assist historic building owners in working cooperatively with architects, architectural conservators and historic preservation consultants, and contractors. Although specifically intended for historic buildings, the guidance is appropriate for other masonry buildings as well. This publication updates *Preservation Briefs 2: Repointing Mortar Joints in Historic Brick Buildings* to include all types of historic unit masonry. The scope of the earlier Brief has also been expanded to acknowledge that the many buildings constructed in the first half of the 20th century are now historic and eligible for listing in the National Register of Historic Places, and that they may have been originally constructed with portland cement mortar.

Historical Background

Mortar consisting primarily of lime and sand has been used as an integral part of masonry structures for thousands of years. Up until about the mid-19th century, lime or quicklime (sometimes called lump lime) was delivered to construction sites, where it had to be slaked, or combined with water. Mixing with water caused it to boil and resulted in a wet lime putty that was left to mature in a pit or wooden box for several weeks, up to a year. Traditional mortar was made from lime putty, or slaked lime, combined with local sand, generally in a ratio of 1 part lime putty to 3 parts sand by volume. Often other ingredients, such as crushed marine shells (another source of lime), brick dust, clay, natural cements, pigments, and even animal hair were also added to mortar, but the basic formulation for lime putty and sand mortar remained unchanged for centuries until the advent of portland cement or its forerunner, Roman cement, a natural, hydraulic cement.

Portland cement was patented in Great Britain in 1824. It was named after the stone from Portland in Dorset which it resembled when hard. This is a fast-curing, hydraulic cement which hardens under water. Portland cement was first manufactured in the United States in 1872, although it was imported before this date. But it was not in common use throughout the country until the early 20th century. Up until the turn of the century portland cement was considered primarily an additive, or "minor ingredient" to help accelerate mortar set time. By the 1930s, however, most masons used a mix of equal parts portland cement and lime putty. Thus, the mortar found in masonry structures built between 1873 and 1930 can range from pure lime and sand mixes to a wide variety of lime, portland cement, and sand combinations.

In the 1930s more new mortar products intended to hasten and simplify masons' work were introduced in the U.S. These included **masonry cement**, a premixed, bagged mortar which is a combination of portland cement and ground limestone, and **hydrated lime**, machine-slaked lime that eliminated the necessity of slaking quicklime into putty at the site.

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The decision to repoint is most often related to some obvious sign of deterioration, such as disintegrating mortar, cracks in mortar joints, loose bricks or stones, damp walls, or damaged plasterwork. It is, however, erroneous to assume that repointing alone will solve deficiencies that result from other problems. The root cause of the deterioration—leaking roofs or gutters, differential settlement of the building, capillary action causing rising damp, or extreme weather exposure—should always be dealt with prior to beginning work.

Without appropriate repairs to eliminate the source of the problem, mortar deterioration will continue and any repointing will have been a waste of time and money.

Use of Consultants

Because there are so many possible causes for deterioration in historic buildings, it may be desirable to retain a consultant, such as a historic architect or architectural conservator, to analyze the building. In addition to determining the most appropriate solutions to the problems, a consultant can prepare specifications which reflect the particular requirements of each job and can provide oversight of the work in progress. Referrals to preservation consultants frequently can be obtained from State Historic Preservation Offices, the American Institute for Conservation of Historic and Artistic Works (AIC), the Association for Preservation Technology (APT), and local chapters of the American Institute of Architects (AIA).

Finding an Appropriate Mortar Match

Preliminary research is necessary to ensure that the proposed repointing work is both physically and visually appropriate to the building. Analysis of unweathered portions of the historic mortar to which the new mortar will be matched can suggest appropriate mixes for the repointing mortar so that it will not damage the building because it is excessively strong or vapor impermeable.

Examination and analysis of the masonry units—brick, stone or terra cotta—and the techniques used in the original construction will assist in maintaining the building's historic appearance. A simple, non-technical, evaluation of the masonry units and mortar can provide information concerning the relative strength and permeability of each—critical factors in selecting the repointing mortar—while a visual analysis of the historic mortar can provide the information necessary for developing the new mortar mix and application techniques.

Although not crucial to a successful repointing project, for projects involving properties of special historic significance, a mortar analysis by a qualified laboratory can be useful by providing information on the original ingredients. However, there are limitations with such an analysis, and replacement mortar specifications should not be based solely on laboratory analysis. Analysis requires interpretation, and there are important factors which affect the condition and performance of the mortar that cannot be established through laboratory analysis. These may include: the original water content, rate of curing, weather conditions during original construction, the method of mixing and placing the mortar, and the cleanliness and condition of the sand. *The most useful information that can come out of laboratory analysis is the identification of sand by gradation and color.* This allows the color and the texture of the mortar to be matched with some accuracy because sand is the largest ingredient by volume.

In creating a repointing mortar that is compatible with the masonry units, the objective is to achieve one that matches the historic mortar as closely as possible, so that the new material can coexist with the old in a sympathetic, supportive and, if necessary, sacrificial capacity. The exact physical and chemical properties of the historic mortar are not of major significance as long as the new mortar conforms to the following criteria:

- The new mortar must match the historic mortar in **color, texture and tooling.** (If a laboratory analysis is undertaken, it may be possible to match the binder components and their proportions with the historic mortar, if those materials are available.)
- The **sand must match the sand** in the historic mortar. (The color and texture of the new mortar will usually fall into place if the sand is matched successfully.)
- The new mortar must have **greater vapor permeability** and be **softer** (measured in compressive strength) than the masonry units.
- The new mortar must be **as vapor permeable** and **as soft or softer** (measured in compressive strength) than the historic mortar. (Softness or hardness is not necessarily an indication of permeability; old, hard lime mortars can still retain high permeability.)

Mortar Analysis

Methods for analyzing mortars can be divided into two broad categories: **wet chemical** and **instrumental**. Many laboratories that analyze historic mortars use a simple **wet-chemical** method called acid digestion, whereby a sample of the mortar is crushed and then mixed with a dilute acid. The acid dissolves all the carbonate-containing minerals not only in the binder, but also in the aggregate (such as oyster shells, coral sands, or other carbonate-based materials), as well as any other acid-soluble materials. The sand and fine-grained acid-insoluble material is left behind. There are several variations on the simple acid digestion test. One involves collecting the carbon dioxide gas given off as the carbonate is digested by the acid; based on the gas volume the carbnate content of the mortar can be accurately determined (Jedrzejewska, 1960). Simple acid digestion methods are rapid, inexpensive, and easy to perform, but the information they provide about the original composition of a mortar is limited to the color and texture of the sand. The gas collection method provides more information about the binder than a simple acid digestion test.

Instrumental analysis methods that have been used to evaluate mortars include polarized light or thin-section microscopy, scanning electron microscopy, atomic absorption spectroscopy, X-ray diffraction, and differential thermal analysis. All instrumental methods require not only expensive, specialized equipment, but also highly-trained experienced analysts. However, instrumental methods can provide much more information about a mortar. Thin-section microscopy is probably the most commonly used instrumental method. Examination of thin slices of a mortar in transmitted light is often used to supplement acid digestion methods, particularly to look for carbonate-based aggregate. For example, the new ASTM test method, ASTM C 1324-96 "Test Method for Examination and Analysis of Hardened Mortars" which was designed specifically for the analysis of modern lime-cement and masonry cement mortars, combines a complex series of wet chemical analyses with thin-section microscopy.

The drawback of most mortar analysis methods is that mortar samples of known composition have not been analyzed in order to evaluate the method. Historic mortars were not prepared to narrowly defined specifications from materials of uniform quality; they contain a wide array of locally derived materials combined at the discretion of the mason. While a particular method might be able to accurately determine the original proportions of a lime-cement-sand mortar prepared from modern materials, the usefulness of that method for evaluating historic mortars is questionable unless it has been tested against mortars prepared from materials more commonly used in the past.

Properties of Mortar

Mortars for repointing should be softer or more permeable than the masonry units and no harder or more impermeable than the historic mortar to prevent damage to the masonry units. It is a common error to assume that hardness or high strength is a measure of appropriateness, particularly for lime-based historic mortars. Stresses within a wall caused by expansion, contraction, moisture migration, or settlement must be accommodated in some manner; in a masonry wall, these stresses should be relieved by the mortar rather than by the masonry units. A mortar that is stronger in compressive strength than the masonry units will not "give," thus causing stresses to be relieved through the masonry units—resulting in permanent damage to the masonry, such as cracking and spalling, that cannot be repaired easily.

While stresses can also break the bond between the mortar and the masonry units, permitting water to penetrate the resulting hairline cracks, this is easier to correct in the joint through repointing than if the break occurs in the masonry units.

Permeability, or rate of vapor transmission, is also critical. High lime mortars are more permeable than denser cement mortars. Historically, mortar acted as a bedding material—not unlike an expansion joint—rather than a "glue" for the masonry units, and moisture was able to migrate through the mortar joints rather than the masonry units. When moisture evaporates from the masonry it deposits any soluble salts either on the surface as *efflorescence* or below the surface as *subflorescence.* While salts deposited on the surface of masonry units are usually relatively harmless, salt crystallization within a masonry unit creates pressure that can cause parts ofthe outer surface to spall off or delaminate. If the mortar does not permitmoisture or moisture vapor to migrate out of the wall and evaporate, theresult will be damage to the masonry units.

Components of Mortar

Sand

Sand is the largest component of mortar and the material that gives mortar its distinctive color, texture and cohesiveness. Sand must be free of impurities, such as salts or clay. The three key characteristics of sand are: particle shape, gradation and void ratios.

When viewed under a magnifying glass or low-power microscope, particles of sand generally have either rounded edges, such as found in beach and river sand, or sharp, angular edges, found in crushed or manufactured sand. For repointing mortar, rounded or natural sand is preferred for two reasons. It is usually similar to the sand in the historic mortar and provides a better visual match. It also has better working qualities or plasticity and can thus be forced into the joint more easily, forming a good contact with the remaining historic mortar and the surface of the adjacent masonry units. Although manufactured sand is frequently more readily available, it is usually possible to locate a supply of rounded sand.

The gradation of the sand (particle size distribution) plays a very important role in the durability and cohesive properties of a mortar. Mortar must have a certain percentage of large to small particle sizes in order to deliver the optimum performance. Acceptable guidelines on particle size distribution may be found in ASTM C 144 (American Society for Testing and Materials). However, in actuality, since neither historic nor modern sands are always in compliance with ASTM C 144, matching the same particle appearance and gradation usually requires sieving the sand.

A scoop of sand contains many small voids between the individual grains. A mortar that performs well fills all these small voids with binder (cement/lime combination or mix) in a balanced manner. Well-graded sand generally has a 30 per cent void ratio by volume. Thus, 30 per cent binder by volume generally should be used, unless the historic mortar had a different binder: aggregate ratio. This represents the 1:3 binder to sand ratios often seen in mortar specifications.

For repointing, sand generally should conform to ASTM C 144 to assure proper gradation and freedom from impurities; some variation may be necessary to match the original size and gradation. Sand color and texture also should match the original as closely as possible to provide the proper color match without other additives.

Lime

Mortar formulations prior to the late-19th century used lime as the primary binding material. Lime is derived from heating limestone at high temperatures which burns off the carbon dioxide, and turns the limestone into quicklime. There are three types of limestone—calcium, magnesium, and dolomitic—differentiated by the different levels of magnesium carbonate they contain which impart specific qualities to mortar. Historically, calcium lime was used for mortar rather than the dolomitic lime (calcium magnesium carbonate) most often used today. But it is also important to keep in mind the fact that the historic limes, and other components of mortar, varied a great deal because they were natural, as opposed to modern lime which is manufactured and, therefore, standardized. Because some of the kinds of lime, as well as other components of mortar, that were used historically are no longer readily available, even when a conscious effort is made to replicate a "historic" mix, this may not be achievable due to the differences between modern and historic materials.

Lime, itself, when mixed with water into a paste is very plastic and creamy. It will remain workable and soft indefinitely, if stored in a sealed container. Lime (calcium hydroxide) hardens by carbonation absorbing carbon dioxide primarily from the air, converting itself to calcium carbonate. Once a lime and sand mortar is mixed and placed in a wall, it begins the process of carbonation. If lime mortar is left to dry too rapidly, carbonation of the mortar will be reduced, resulting in poor adhesion and poor durability. In addition, lime mortar is slightly water soluble and thus is able to re-seal any hairline cracks that may develop during the life of the mortar. Lime mortar is soft, porous, and changes little in volume during temperature fluctuations thus making it a good choice for historic buildings. *Because of these qualities, high calcium lime mortar may be considered for many repointing projects, not just those involving historic buildings.*

For repointing, lime should conform to ASTM C 207, Type S, or Type SA, Hydrated Lime for Masonry Purposes. This machine-slaked lime is designed to assure high plasticity and water retention. The use of quicklime which must be slaked and soaked by hand may have advantages over hydrated lime in some restoration projects if time and money allow.

Lime Putty

Lime putty is slaked lime that has a putty or paste-like consistency. It should conform to ASTM C 5. Mortar can be mixed using lime putty according to ASTM C 270 property or proportion specification.

Portland Cement

More recent, 20th-century mortar has used portland cement as a primary binding material. A straight portland cement and sand mortar is extremely hard, resists the movement of water, shrinks upon setting, and undergoes relatively large thermal movements. When mixed with water, portland cement forms a harsh, stiff paste that is quite unworkable, becoming hard very quickly. (Unlike lime, portland

cement will harden regardless of weather conditions and does not require wetting and drying cycles.) Some portland cement assists the workability and plasticity of the mortar without adversely affecting the finished project; it also provides early strength to the mortar and speeds setting. Thus, it may be appropriate to add some portland cement to an essentially lime-based mortar even when repointing relatively soft 18th or 19th century brick under some circumstances when a slightly harder mortar is required. The more portland cement that is added to a mortar formulation the harder it becomes—and the faster the initial set.

For repointing, portland cement should conform to ASTM C 150. White, non- staining portland cement may provide a better color match for some historic mortars than the more commonly available grey portland cement. But, it should not be assumed, however, that white portland cement is always appropriate for all historic buildings, since the original mortar may have been mixed with grey cement. The cement should not have more than 0.60 per cent alkali to help avoid efflorescence.

Masonry Cement

Masonry cement is a preblended mortar mix commonly found at hardware and home repair stores. It is designed to produce mortars with a compressive strength of 750 psi or higher when mixed with sand and water at the job site. It may contain hydrated lime, but it always contains a large amount of portland cement, as well as ground limestone and other workability agents, including air-entraining agents. Because masonry cements are not required to contain hydrated lime, and generally do not contain lime, they produce high strength mortars that can damage historic masonry. *For this reason, they generally are not recommended for use on historic masonry buildings.*

Lime Mortar (pre-blended)

Hydrated lime mortars, and pre-blended lime putty mortars with or without a matched sand are commercially available. Custom mortars are also available with color. In most instances, pre-blended lime mortars containing sand may not provide an exact match; however, if the project calls for total repointing, a pre-blended lime mortar may be worth considering as long as the mortar is compatible in strength with the masonry. If the project involves only selected, "spot" repointing, then it may be better to carry out a mortar analysis which can provide a custom pre-blended lime mortar with a matching sand. In either case, if a preblended lime mortar is to be used, it should contain Type S or SA hydrated lime conforming to ASTM C 207.

Water

Water should be potable—clean and free from acids, alkalis, or other dissolved organic materials.

Other Components

Historic components

In addition to the color of the sand, the texture of the mortar is of critical importance in duplicating historic mortar. Most mortars dating from the mid-19th century on—with some exceptions—have a fairly homogeneous texture and color. Some earlier mortars are not as uniformly textured and may contain lumps of partially burned lime or "dirty lime", shell (which often provided a source of lime, particularly in coastal areas), natural cements, pieces of clay, lampblack or other pigments, or even animal hair. The visual characteristics of these mortars can be duplicated through the use of similar materials in the repointing mortar.

Replicating such unique or individual mortars will require writing new specifications for each project. If possible, suggested sources for special materials should be included. For example, crushed oyster shells can be obtained in a variety of sizes from poultry supply dealers.

Pigments

Some historic mortars, particularly in the late 19th century, were tinted to match or contrast with the brick or stone. Red pigments, sometimes in the form of brick dust, as well as brown, and black pigments were commonly used. Modern pigments are available which can be added to the mortar at the job site, but they should not exceed 10 per cent by weight of the portland cement in the mix, and carbon black should be limited to 2 per cent. Only synthetic mineral oxides, which are alkali-proof and sun-fast, should be used to prevent bleaching and fading.

Modern Components

Admixtures are used to create specific characteristics in mortar, and whether they should be used will depend upon the individual project. *Air entraining agents*, for example, help the mortar to resist freeze-

thaw damage in northern climates. *Accelerators* are used to reduce mortar freezing prior to setting while *retarders* help to extend the mortar life in hot climates. Selection of admixtures should be made by the architect or architectural conservator as part of the specifications, not something routinely added by the masons.
Generally, modern chemical additives are unnecessary and may, in fact, have detrimental effects in historic masonry projects. The use of antifreeze compounds is not recommended. They are not very effective with high lime mortars and may introduce salts, which may cause efflorescence later. A better practice is to warm the sand and water, and to protect the completed work from freezing. No definitive study has determined whether air-entraining additives should be used to resist frost action and enhance plasticity, but in areas of extreme exposure requiring high-strength mortars with lower permeability, air-entrainment of 10-16 percent may be desirable (see formula for "severe weather exposure" in Mortar Type and Mix). Bonding agents are not a substitute for proper joint preparation, and they should generally be avoided. If the joint is properly prepared, there will be a good bond between the new mortar and the adjacent surfaces. In addition, a bonding agent is difficult to remove if smeared on a masonry surface.

Mortar Type and Mix

Mortars for repointing projects, especially those involving historic buildings, typically are custom mixed in order to ensure the proper physical and visual qualities. These materials can be combined in varying proportions to create a mortar with the desired performance and durability. The actual specification of a particular mortar type should take into consideration all of the factors affecting the life of the building including: current site conditions, present condition of the masonry, function of the new mortar, degree of weather exposure, and skill of the mason.
Thus, no two repointing projects are exactly the same. Modern materials specified for use in repointing mortar should conform to specifications of the American Society for Testing and Materials (ASTM) or comparable federal specifications, and the resulting mortar should conform to ASTM C 270, Mortar for Unit Masonry.
Specifying the proportions for the repointing mortar for a specific job is not as difficult as it might seem. Five mortar types, each with a corresponding recommended mix, have been established by ASTM to distinguish high strength mortar from soft flexible mortars. The ASTM designated them in decreasing order of approximate general strength as Type M (2,500 psi), Type S (1,800 psi), Type N (750 psi), Type O (350 psi) and Type K (75 psi). (The letters identifying the types are from the words MASON WORK using every other letter.) Type K has the highest lime content of the mixes that contain portland cement, although it is seldom used today, except for some historic preservation projects. The designation "L" in the accompanying chart identifies a straight lime and sand mix. Specifying the appropriate ASTM mortar by proportion of ingredients, will ensure the desired physical properties. Unless specified otherwise, measurements or proportions for mortar mixes are always given in the following order: cement-lime-sand. Thus, a Type K mix, for example, would be referred to as 1-3-10, or 1 part cement to 3 parts lime to 10 parts sand. Other requirements to create the desired visual qualities should be included in the specifications.
The strength of a mortar can vary. If mixed with higher amounts of portland cement, a harder mortar is obtained. The more lime that is added, the softer and more plastic the mortar becomes, increasing its workability. A mortar strong in compressive strength might be desirable for a hard stone (such as granite) pier holding up a bridge deck, whereas a softer, more permeable lime mortar would be preferable for a historic wall of soft brick. Masonry deterioration caused by salt deposition results when the mortar is less permeable than the masonry unit. A strong mortar is still more permeable than hard, dense stone. However, in a wall constructed of soft bricks where the masonry unit itself has a relatively high permeability or vapor transmission rate, a soft, high lime mortar is necessary to retain sufficient permeability.

Execution of the Work

Test Panels

These panels are prepared by the contractor using the same techniques that will be used on the remainder of the project. Several panel locations—preferably not on the front or other highly visible location of the building—may be necessary to include all types of masonry, joint styles, mortar colors, and other problems likely to be encountered on the job.
If cleaning tests, for example, are also to be undertaken, they should be carried out in the same location. Usually a 3 foot by 3 foot area is sufficient for brickwork, while a somewhat larger area may be

required for stonework. These panels establish an acceptable standard of work and serve as a benchmark for evaluating and accepting subsequent work on the building.

Joint Preparation

Old mortar should be removed to a minimum depth of 2 to 2-1/2 times the width of the joint to ensure an adequate bond and to prevent mortar "popouts." For most brick joints, this will require removal of the mortar to a depth of approximately Ω to 1 inch; for stone masonry with wide joints, mortar may need to be removed to a depth of several inches. Any loose or disintegrated mortar beyond this minimum depth also should be removed.

Although some damage may be inevitable, careful joint preparation can help limit damage to masonry units. The traditional manner of removing old mortar is through the use of hand chisels and mash hammers. Though labor-intensive, in most instances this method poses the least threat for damage to historic masonry units and produces the best final product.

The most common method of removing mortar, however, is through the use of power saws or grinders. The use of power tools by unskilled masons can be disastrous for historic masonry, particularly soft brick. Using power saws on walls with thin joints, such as most brick walls, almost always will result in damage to the masonry units by breaking the edges and by overcutting on the head, or vertical joints. However, small pneumatically-powered chisels generally can be used safely and effectively to remove mortar on historic buildings as long as the masons maintain appropriate control over the equipment. Under certain circumstances, thin diamond-bladed grinders may be used to cut out *horizontal* joints only on hard portland cement mortar common to most early-20th century masonry buildings. Usually, automatic tools most successfully remove old mortar without damaging the masonry units when they are used in combination with hand tools in preparation for repointing. Where horizontal joints are uniform and fairly wide, it may be possible to use a power masonry saw to assist the removal of mortar, such as by cutting along the middle of the joint; final mortar removal from the sides of the joints still should be done with a hand chisel and hammer. Caulking cutters with diamond blades can sometimes be used successfully to cut out joints without damaging the masonry. Caulking cutters are slow; they do not rotate, but vibrate at very high speeds, thus minimizing the possibility of damage to masonry units. Although mechanical tools may be safely used in limited circumstances to cut out horizontal joints in preparation for repointing, they should never be used on vertical joints because of the danger of slipping and cutting into the brick above or below the vertical joint. Using power tools to remove mortar without damaging the surrounding masonry units also necessitates highly skilled masons experienced in working on historic masonry buildings. Contractors should demonstrate proficiency with power tools before their use is approved.

Using any of these power tools may also be more acceptable on hard stone, such as quartzite or granite, than on terra cotta with its glass-like glaze, or on soft brick or stone. The test panel should determine the acceptability of power tools. If power tools are to be permitted, the contractor should establish a quality control program to account for worker fatigue and similar variables.

Mortar should be removed cleanly from the masonry units, leaving square corners at the back of the cut. Before filling, the joints should be rinsed with a jet of water to remove all loose particles and dust. At the time of filling, the joints should be damp, but with no standing water present. For masonry walls—limestone, sandstone and common brick—that are extremely absorbent, it is recommended that a continual mist of water be applied for a few hours before repointing begins.

Mortar Preparation

Mortar components should be measured and mixed carefully to assure the uniformity of visual and physical characteristics. Dry ingredients are measured by volume and thoroughly mixed before the addition of any water. Sand must be added in a damp, loose condition to avoid over sanding. Repointing mortar is typically pre-hydrated by adding water so it will just hold together, thus allowing it to stand for a period of time before the final water is added. Half the water should be added, followed by mixing for approximately 5 minutes. The remaining water should then be added in small portions until a mortar of the desired consistency is reached. The total volume of water necessary may vary from batch to batch, depending on weather conditions. It is important to keep the water to a minimum for two reasons: first, a drier mortar is cleaner to work with, and it can be compacted tightly into the joints; second, with no excess water to evaporate, the mortar cures without shrinkage cracks. Mortar should be used within approximately 30 minutes of final mixing, and "retempering," or adding more water, should not be permitted.

Using Lime Putty to Make Mortar

Mortar made with lime putty and sand, sometimes referred to as roughage or course stuff, should be measured by volume, and may require slightly different proportions from those used with hydrated lime. No additional water is usually needed to achieve a workable consistency because enough water is already contained in the putty. Sand is proportioned first, followed by the lime putty, then mixed for five minutes or until all the sand is thoroughly coated with the lime putty. But mixing, in the familiar sense of turning over with a hoe, sometimes may not be sufficient if the best possible performance is to be obtained from a lime putty mortar. Although the old practice of chopping, beating and ramming the mortar has largely been forgotten, recent field work has confirmed that lime putty and sand rammed and beaten with a wooden mallet or ax handle, interspersed by chopping with a hoe, can significantly improve workability and performance. The intensity of this action increases the overall lime/sand contact and removes any surplus water by compacting the other ingredients. It may also be advantageous for larger projects to use a mortar pan mill for mixing. Mortar pan mills which have a long tradition in Europe produce a superior lime putty mortar not attainable with today's modern paddle and drum type mixers.

For larger repointing projects the lime putty and sand can be mixed together ahead of time and stored indefinitely, on or off site, which eliminates the need for piles of sand on the job site. This mixture, which resembles damp brown sugar, must be protected from the air in sealed containers with a wet piece of burlap over the top or sealed in a large plastic bag to prevent evaporation and premature carbonation. The lime putty and sand mixture can be recombined into a workable plastic state months later with no additional water.

If portland cement is specified in a lime putty and sand mortar—Type O (1:2:9) or Type K (1:3:11)—the portland cement should first be mixed into a slurry paste before adding it to the lime putty and sand. Not only will this ensure that the portland cement is evenly distributed throughout the mixture, but if dry portland cement is added to wet ingredients it tends to "ball up," jeopardizing dispersion. (Usually water must be added to the lime putty and sand anyway once the portland cement is introduced.) Any color pigments should be added at this stage and mixed for a full five minutes. The mortar should be used within 30 minutes to 1Ω hours and it should not be retempered. Once portland cement has been added the mortar can no longer be stored.

Filling the Joint

Where existing mortar has been removed to a depth of greater than 1 inch, these deeper areas should be filled first, compacting the new mortar in several layers. The back of the entire joint should be filled successively by applying approximately 1/4 inch of mortar, packing it well into the back corners. This application may extend along the wall for several feet. As soon as the mortar has reached thumb-print hardness, another 1/4 inch layer of mortar—approximately the same thickness—may be applied. Several layers will be needed to fill the joint flush with the outer surface of the masonry. It is important to allow each layer time to harden before the next layer is applied; most of the mortar shrinkage occurs during the hardening process and layering thus minimizes overall shrinkage.

When the final layer of mortar is thumb-print hard, the joint should be tooled to match the historic joint. Proper timing of the tooling is important for uniform color and appearance. If tooled when too soft, the color will be lighter than expected, and hairline cracks may occur; if tooled when too hard, there may be dark streaks called "tool burning," and good closure of the mortar against the masonry units will not be achieved.

If the old bricks or stones have worn, rounded edges, it is best to recess the final mortar slightly from the face of the masonry. This treatment will help avoid a joint which is visually wider than the actual joint; it also will avoid creation of a large, thin featheredge which is easily damaged, thus admitting water. After tooling, excess mortar can be removed from the edge of the joint by brushing with a natural bristle or nylon brush. Metal bristle brushes should never be used on historic masonry.

Curing Conditions

The preliminary hardening of high-lime content mortars—those mortars that contain more lime by volume than portland cement, i.e., Type O (1:2:9), Type K (1:3:11), and straight lime/sand, Type "L" (0:1:3)—takes place fairly rapidly as water in the mix is lost to the porous surface of the masonry and through evaporation. A high lime mortar (especially Type "L") left to dry out too rapidly can result in chalking, poor adhesion, and poor durability. Periodic wetting of the repointed area after the mortar joints are thumb-print hard and have been finish tooled may significantly accelerate the carbonation process. When feasible, misting using a hand sprayer with a fine nozzle can be simple to do for a day or two after repointing. Local conditions will dictate the frequency of wetting, but initially it may be as often as every hour and gradually reduced to every three or four hours. Walls should be covered with burlap for the first three days after repointing. (Plastic may be used, but it should be tented out and not placed

directly against the wall.) This helps keep the walls damp and protects them from direct sunlight. Once carbonation of the lime has begun, it will continue for many years and the lime will gain strength as it reverts back to calcium carbonate within the wall.

Aging the Mortar

Even with the best efforts at matching the existing mortar color, texture, and materials, there will usually be a visible difference between the old and new work, partly because the new mortar has been matched to the unweathered portions of the historic mortar. Another reason for a slight mismatch may be that the sand is more exposed in old mortar due to the slight erosion of the lime or cement. Although spot repointing is generally preferable and some color difference should be acceptable, if the difference between old and new mortar is too extreme, it may be advisable in some instances to repoint an entire area of a wall, or an entire feature such as a bay, to minimize the difference between the old and the new mortar. If the mortars have been properly matched, usually the best way to deal with surface color differences is to let the mortars age naturally. Other treatments to overcome these differences, including cleaning the non-repointed areas or staining the new mortar, should be carefully tested prior to implementation.

Staining the new mortar to achieve a better color match is generally not recommended, but it may be appropriate in some instances. Although staining may provide an initial match, the old and new mortars may weather at different rates, leading to visual differences after a few seasons. In addition, the mixtures used to stain the mortar may be harmful to the masonry; for example, they may introduce salts into the masonry which can lead to efflorescence.

Cleaning the Repointed Masonry

If repointing work is carefully executed, there will be little need for cleaning other than to remove the small amount of mortar from the edge of the joint following tooling. This can be done with a stiff natural bristle or nylon brush after the mortar has dried, but before it is initially set (1-2 hours). Mortar that has hardened can usually be removed with a wooden paddle or, if necessary, a chisel.

Further cleaning is best accomplished with plain water and natural bristle or nylon brushes. If chemicals must be used, they should be selected with extreme caution. Improper cleaning can lead to deterioration of the masonry units, deterioration of the mortar, mortar smear, and efflorescence. New mortar joints are especially susceptible to damage because they do not become fully cured for several months. Chemical cleaners, particularly acids, should never be used on dry masonry. The masonry should always be completely soaked once with water before chemicals are applied. After cleaning, the walls should be flushed again with plain water to remove all traces of the chemicals.

Several precautions should be taken if a freshly repointed masonry wall is to be cleaned. First, the mortar should be fully hardened before cleaning. Thirty days is usually sufficient, depending on weather and exposure; as mentioned previously, the mortar will continue to cure even after it has hardened. Test panels should be prepared to evaluate the effects of different cleaning methods. Generally, on newly repointed masonry walls, only very low pressure (100 psi) water washing supplemented by stiff natural bristle or nylon brushes should be used, except on glazed or polished surfaces, where only soft cloths should be used.**

New construction "bloom" or efflorescence occasionally appears within the first few months of repointing and usually disappears through the normal process of weathering. If the efflorescence is not removed by natural processes, the safest way to remove it is by dry brushing with stiff natural or nylon bristle brushes followed by wet brushing. Hydrochloric (muriatic) acid, is generally ineffective, and it should not be used to remove efflorescence. It may liberate additional salts, which, in turn, can lead to more efflorescence.

Surface grouting is sometimes suggested as an alternative to repointing brick buildings, in particular. This process involves the application of a thin coat of cement-based grout to the mortar joints and the mortar/brick interface. To be effective, the grout must extend slightly onto the face of the masonry units, thus widening the joint visually. The change in the joint appearance can alter the historic character of the structure to an unacceptable degree. In addition, although masking of the bricks is intended to keep the grout off the remainder of the face of the bricks, some level of residue, called "veiling," will inevitably remain. Surface grouting cannot substitute for the more extensive work of repointing, and it is not a recommended treatment for historic masonry.

Visually Examining the Mortar and the Masonry Units

A simple *in situ* comparison will help determine the hardness and condition of the mortar and the masonry units. Begin by scraping the mortar with a screwdriver, and gradually tapping harder with a

cold chisel and mason's hammer. Masonry units can be tested in the same way beginning, even more gently, by scraping with a fingernail. This relative analysis which is derived from the 10-point hardness scale used to describe minerals, provides a good starting point for selection of an appropriate mortar. It is described more fully in "The Russack System for Brick & Mortar Description" referenced in Reading List at the end of this Brief.

Mortar samples should be chosen carefully, and picked from a variety of locations on the building to find unweathered mortar, if possible. Portions of the building may have been repointed in the past while other areas may be subject to conditions causing unusual deterioration. There may be several colors of mortar dating from different construction periods or sand used from different sources during the initial construction. Any of these situations can give false readings to the visual or physical characteristics required for the new mortar. Variations should be noted which may require developing more than one mix.

1. Remove with a chisel and hammer three or four unweathered samples of the mortar to be matched from several locations on the building. (Set the largest sample aside--this will be used later for comparison with the repointing mortar). Removing a full representation of samples will allow selection of a "mean" or average mortar sample.
2. Mash the remaining samples with a wooden mallet, or hammer if necessary, until they are separated into their constituent parts. There should be a good handful of the material.
3. Examine the powdered portion—the lime and/or cement matrix of the mortar. Most particularly, note the color. There is a tendency to think of historic mortars as having white binders, but grey portland cement was available by the last quarter of the 19th century, and traditional limes were also sometimes grey. Thus, in some instances, the natural color of the historic binder may be grey, rather than white. The mortar may also have been tinted to create a colored mortar, and this color should be identified at this point.
4. Carefully blow away the powdery material (the lime and/or cement matrix which bound the mortar together).
5. With a low power (10 power) magnifying glass, examine the remaining sand and other materials such as lumps of lime or shell.
6. Note and record the wide range of color as well as the varying sizes of the individual grains of sand, impurities, or other materials.

Other Factors to Consider

Color

Regardless of the color of the binder or colored additives, the sand is the primary material that gives mortar its color. A surprising variety of colors of sand may be found in a single sample of historic mortar, and the different sizes of the grains of sand or other materials, such as incompletely ground lime or cement, play an important role in the texture of the repointing mortar. Therefore, when specifying sand for repointing mortar, it may be necessary to obtain sand from several sources and to combine or screen them in order to approximate the range of sand colors and grain sizes in the historic mortar sample.

Pointing Style

Close examination of the historic masonry wall and the techniques used in the original construction will assist in maintaining the visual qualities of the building. Pointing styles and the methods of producing them should be examined. It is important to look at both the horizontal and the vertical joints to determine the order in which they were tooled and whether they were the same style. Some late-19th and early-20th century buildings, for example, have horizontal joints that were raked back while the vertical joints were finished flush and stained to match the bricks, thus creating the illusion of horizontal bands. Pointing styles may also differ from one facade to another; front walls often received greater attention to mortar detailing than side and rear walls. **Tuckpointing** is not true repointing but the application of a raised joint or lime putty joint on top of flush mortar joints. **Penciling** is a purely decorative, painted surface treatment over a mortar joint, often in a contrasting color.

Masonry Units

The masonry units should also be examined so that any replacement units will match the historic masonry. Within a wall there may be a wide range of colors, textures, and sizes, particularly with hand-made brick or rough-cut, locally-quarried stone. Replacement units should blend in with the full range of masonry units rather than a single brick or stone.

Matching Color and Texture of the Repointing Mortar

New mortar should match the unweathered interior portions of the historic mortar. The simplest way to check the match is to make a small sample of the proposed mix and allow it to cure at a temperature of approximately 70 degrees F for about a week, or it can be baked in an oven to speed up the curing; this sample is then broken open and the surface is compared with the surface of the largest "saved" sample of historic mortar.

If a proper color match cannot be achieved through the use of natural sand or colored aggregates like crushed marble or brick dust, it may be necessary to use a modern mortar pigment.

During the early stages of the project, it should be determined how closely the new mortar should match the historic mortar. Will "quite close" be sufficient, or is "exactly" expected? The specifications should state this clearly so that the contractor has a reasonable idea how much time and expense will be required to develop an acceptable match.

The same judgment will be necessary in matching replacement terra cotta, stone or brick. If there is a known source for replacements, this should be included in the specifications. If a source cannot be determined prior to the bidding process, the specifications should include an estimated price for the replacement materials with the final price based on the actual cost to the contractor.

Mortar Types (Measured by volume)

Designation	Cement	Hydrated Lime or Lime Putty	Sand
M	1	1/4	3 - 3 3/4
S	1	1/2	4–4 1/2
N	1	1	5–6
O	1	2	8–9
K	1	3	10–12
"L"	0	1	2 1/4–3

Suggested Mortar Types for Different Exposures

	Exposure		
Masonry Material	Sheltered	Moderate	Severe
Very durable: granite, hard-cored brick, etc.	O	N	S
Moderately durable:limestone, durable stone, molded brick	K	O	N
Minimally durable:soft hand-made brick	"L"	K	O

Summary and References

A good repointing job is meant to last, at least 30 years, and preferably 50- 100 years. Shortcuts and poor craftsmanship result not only in diminishing the historic character of a building, but also in a job that looks bad, and will require future repointing sooner than if the work had been done correctly. The mortar joint in a historic masonry building has often been called a wall's "first line of defense." Good repointing practices guarantee the long life of the mortar joint, the wall, and the historic structure. Although careful maintenance will help preserve the freshly repointed mortar joints, it is important to remember that mortar joints are intended to be sacrificial and will probably require repointing some time in the future. Nevertheless, if the historic mortar joints proved durable for many years, then careful repointing should have an equally long life, ultimately contributing to the preservation of the entire building.

PRESERVATION BRIEF 6

Dangers of Abrasive Cleaning to Historic Buildings

- What is Abrasive Cleaning?
- Why are Abrasive Cleaning Methods Used?
- Problems of Abrasive Cleaning
- How Building Materials React to Abrasive Cleaning
- When is Abrasive Cleaning Permissible?
- Do Not Abrasively Clean these Historic Interiors
- Mitigating the Effects of Abrasive Cleaning
- Summary

Abrasive cleaning methods are responsible for causing a great deal of damage to historic building materials. To prevent indiscriminate use of these potentially harmful techniques, this brief has been prepared to explain abrasive cleaning methods, how they can be physically and aesthetically destructive to historic building materials, and why they generally are not acceptable preservation treatments for historic structures. There are alternative, less harsh means of cleaning and removing paint and stains from historic buildings. However, careful testing should precede general cleaning to assure that the method selected will not have an adverse effect on the building materials. A historic building is irreplaceable, and should be cleaned using only the "gentlest means possible" to best preserve it.

What is Abrasive Cleaning?

Abrasive cleaning methods include all techniques that physically abrade the building surface to remove soils, discolorations or coatings. Such techniques involve the use of certain *materials* which impact or abrade the surface under pressure, or abrasive *tools and equipment*. Sand, because it is readily available, is probably the most commonly used type of grit material. However, any of the following materials may be substituted for sand, and all can be classified as abrasive substances: ground slag or volcanic ash, crushed (pulverized) walnut or almond shells, rice husks, ground corncobs, ground coconut shells, crushed eggshells, silica flour, synthetic particles, glass beads and micro-balloons. Even *water* under pressure can be an abrasive substance. Tools and equipment that are abrasive to historic building materials include wire brushes, rotary wheels, power sanding disks and belt sanders. The use of water in combination with grit may also be classified as an abrasive cleaning method. Depending on the manner in which it is applied, water may soften the impact of the grit, but water that is too highly pressurized can be very abrasive. There are basically two different methods which can be referred to as "wet grit," and it is important to differentiate between the two. One technique involves the addition of a stream of water to a regular sandblasting nozzle. This is done primarily to cut down dust, and has very little, if any, effect on reducing the aggressiveness, or cutting action of the grit particles. With the second technique, a very small amount of grit is added to a pressurized water stream. This method may be controlled by regulating the amount of grit fed into the water stream, as well as the pressure of the water.

Why Are Abrasive Cleaning Methods Used?

Usually, an abrasive cleaning method is selected as an expeditious means of quickly removing years of dirt accumulation, unsightly stains, or deteriorating building fabric or finishes, such as stucco or paint. The fact that sandblasting is one of the best known and most readily available building cleaning treatments is probably the major reason for its frequent use. Many mid-19th century brick buildings were painted immediately or soon after completion to protect poor quality brick or to imitate another material, such as stone. Sometimes brick buildings were painted in an effort to produce what was considered a more harmonious relationship between a building and its natural surroundings. By the 1870s, brick buildings were often left unpainted as mechanization in the brick industry brought a cheaper pressed brick and fashion decreed a sudden preference for dark colors. However, it was still customary to paint brick of poorer quality for the additional protection the paint afforded.

It is a common 20th century misconception that all historic masonry buildings were initially unpainted. If the intent of a modern restoration is to return a building to its original appearance, removal of the paint not only may be historically inaccurate, but also harmful. Many older buildings were painted or stuccoed at some point to correct recurring maintenance problems caused by faulty construction techniques, to

hide alterations, or in an attempt to solve moisture problems. If this is the case, removal of paint or stucco may cause these problems to reoccur. Another reason for paint removal, particularly in rehabilitation projects, is to give the building a "new image" in response to contemporary design trends and to attract investors or tenants. Thus, it is necessary to consider the purpose of the intended cleaning. While it is clearly important to remove unsightly stains, heavy encrustations of dirt, peeling paint or other surface coatings, it may not be equally desirable to remove paint from a building which originally was painted. Many historic buildings which show only a slight amount of soil or discoloration are much better left as they are. A thin layer of soil is more often protective of the building fabric than it is harmful, and seldom detracts from the building's architectural and/or historic character. Too thorough cleaning of a historic building may not only sacrifice some of the building's character, but also, misguided cleaning efforts can cause a great deal of damage to historic building fabric. Unless there are stains, graffiti or dirt and pollution deposits which are destroying the building fabric, it is generally preferable to do as little cleaning as possible, or to repaint where necessary. It is important to remember that a historic building does not have to look as if it were newly constructed to be an attractive or successful restoration or rehabilitation project.

Problems of Abrasive Cleaning

The crux of the problem is that abrasive cleaning is just that--abrasive. An abrasively cleaned historic structure may be physically as well as aesthetically damaged. Abrasive methods "clean" by eroding dirt or paint, but at the same time they also tend to erode the surface of the building material. In this way, abrasive cleaning is destructive and causes irreversible harm to the historic building fabric. If the fabric is brick, abrasive methods remove the hard, outer protective surface, and therefore make the brick more susceptible to rapid weathering and deterioration. Grit blasting may also increase the water permeability of a brick wall. The impact of the grit particles tends to erode the bond between the mortar and the brick, leaving cracks or enlarging existing cracks where water can enter. Some types of stone develop a protective patina or "quarry crust" parallel to the worked surface (created by the movement of moisture towards the outer edge), which also may be damaged by abrasive cleaning. The rate at which the material subsequently weathers depends on the quality of the inner surface that is exposed. Abrasive cleaning can destroy, or substantially diminish, decorative detailing on buildings such as a molded brickwork or architectural terra-cotta, ornamental carving on wood or stone, and evidence of historic craft techniques, such as tool marks and other surface textures. In addition, perfectly sound and/or "tooled" mortar joints can be worn away by abrasive techniques. This not only results in the loss of historic craft detailing but also requires repointing, a step involving considerable time, skill and expense, and which might not have been necessary had a gentler method been chosen. Erosion and pitting of the building material by abrasive cleaning creates a greater surface area on which dirt and pollutants collect. In this sense, the building fabric "attracts" more dirt, and will require more frequent cleaning in the future. In addition to causing physical and aesthetic harm to the historic fabric, there are several adverse environmental effects of dry abrasive cleaning methods. Because of the friction caused by the abrasive medium hitting the building fabric, these techniques usually create a considerable amount of dust, which is unhealthy, particularly to the operators of the abrasive equipment. It further pollutes the environment around the job site, and deposits dust on neighboring buildings, parked vehicles and nearby trees and shrubbery. Some adjacent materials not intended for abrasive treatment such as wood or glass, may also be damaged because the equipment may be difficult to regulate. Wet grit methods, while eliminating dust, deposit a messy slurry on the ground or other objects surrounding the base of the building. In colder climates where there is the threat of frost, any wet cleaning process applied to historic masonry structures must be done in warm weather, allowing ample time for the wall to dry out thoroughly before cold weather sets in. Water which remains and freezes in cracks and openings of the masonry surface eventually may lead to spalling. High-pressure wet cleaning may force an inordinate amount of water into the walls, affecting interior materials such as plaster or joist ends, as well as metal building components within the walls.

Variable Factors

The greatest problem in developing practical guidelines for cleaning any historic building is the large number of variable and unpredictable factors involved. Because these variables make each cleaning project unique, it is difficult to establish specific standards at this time. This is particularly true of abrasive cleaning methods because their inherent potential for causing damage is multiplied by the following factors:

- the type and condition of the material being cleaned
- the size and sharpness of the grit particles or the mechanical equipment

- the pressure with which the abrasive grit or equipment is applied to the building surface
- the skill and care of the operator, and
- the constancy of the pressure on all surfaces during the cleaning process.
-

Pressure: The damaging effects of most of the variable factors involved in abrasive cleaning are self evident. However, the matter of pressure requires further explanation. In cleaning specifications, pressure is generally abbreviated as "psi" (pounds per square inch), which technically refers to the "tip" pressure, or the amount of pressure at the nozzle of the blasting apparatus. Sometimes "psig," or pressure at the gauge (which may be many feet away, at the other end of the hose), is used in place of "psi." These terms are often incorrectly used interchangeably. Despite the apparent care taken by most architects and building cleaning contractors to prepare specifications for pressure cleaning which will not cause harm to the delicate fabric of a historic building, it is very difficult to ensure that the same amount of pressure is applied to all parts of the building. For example, if the operator of the pressure equipment stands on the ground while cleaning a two-story structure, the amount of force reaching the first story will be greater than that hitting the second story, even if the operator stands on scaffolding or in a cherry picker, because of the "line drop" in the distance from the pressure source to the nozzle. Although technically it may be possible to prepare cleaning specifications with tight controls that would eliminate all but a small margin of error, it may not be easy to find professional cleaning firms willing to work under such restrictive conditions. The fact is that many professional building cleaning firms do not really understand the extreme delicacy of historic building fabric, and how it differs from modern construction materials. Consequently, they may accept building cleaning projects for which they have no experience. The amount of pressure used in any kind of cleaning treatment which involves pressure, whether it is dry or wet grit, chemicals or just plain water, is crucial to the outcome of the cleaning project. Unfortunately, no standards have been established for determining the correct pressure for cleaning each of the many historic building materials which would not cause harm. The considerable discrepancy between the way the building cleaning industry and architectural conservators define "high" and "low" pressure cleaning plays a significant role in the difficulty of creating standards.

Non-historic/Industrial: A representative of the building cleaning industry might consider "high" pressure water cleaning to be anything over 5,000 psi, or even as high as 10,000 to 15,000 psi! Water under this much pressure may be necessary to clean industrial structures or machinery, but would destroy most historic building materials. Industrial chemical cleaning commonly utilizes pressures between 1,000 and 2,500 psi.

Historic: By contrast, conscientious dry or wet abrasive cleaning of a historic structure would be conducted within the range of 20 to 100 psi at a range of 3 to 12 inches. Cleaning at this low pressure requires the use of a very fine 00 or 0 mesh grit forced through a nozzle with a 1/4-inch opening. A similar, even more delicate method being adopted by architectural conservators uses a micro-abrasive grit on small, hard-to-clean areas of carved, cut or molded ornament on a building facade. Originally developed by museum conservators for cleaning sculpture, this technique may employ glass beads, micro-balloons, or another type of micro-abrasive gently powered at approximately 40 psi by a very small, almost pencil-like pressure instrument. Although a slightly larger pressure instrument may be used on historic buildings, this technique still has limited practical applicability on a large scale building cleaning project because of the cost and the relatively few technicians competent to handle the task. In general, architectural conservators have determined that only through very controlled conditions can most historic building material be abrasively cleaned of soil or paint without measurable damage to the surface or profile of the substrate. Yet some professional cleaning companies which specialize in cleaning historic masonry buildings use chemicals and water at a pressure of approximately 1,500 psi, while other cleaning firms recommend lower pressures ranging from 200 to 800 psi for a similar project. An architectural conservator might decide, after testing, that some historic structures could be cleaned properly using a moderate pressure (200-600 psi), or even a high pressure (600-1800 psi) water rinse. However, cleaning historic buildings under such high pressure should be considered an exception rather than the rule, and would require *very careful* testing and supervision to assure that the historic surface materials could withstand the pressure without gouging, pitting or loosening. These differences in the amount of pressure used by commercial or industrial building cleaners and architectural conservators point to one of the main problems in using abrasive means to clean historic buildings: misunderstanding of the potentially fragile nature of historic building materials. There is no one cleaning formula or pressure suitable for all situations. Decisions regarding the proper cleaning process for historic structures can be made only after careful analysis of the building fabric, and testing.

How Building Materials React to Abrasive Cleaning

Brick and Architectural Terra-cotta: Abrasive blasting does not affect all building materials to the same degree. Such techniques quite logically cause greater damage to softer and more porous materials, such as brick or architectural terra-cotta. When these materials are cleaned abrasively, the hard, outer layer (closest to the heat of the kiln) is eroded, leaving the soft, inner core exposed and susceptible to accelerated weathering. Glazed architectural terra-cotta and ceramic veneer have a baked on glaze which is also easily damaged by abrasive cleaning. Glazed architectural terra-cotta was designed for easy maintenance, and generally can be cleaned using detergent and water; but chemicals or steam may be needed to remove more persistent stains. Large areas of brick or architectural terra-cotta which have been painted are best left painted, or repainted if necessary.

Plaster and Stucco: Plaster and stucco are types of masonry finish materials that are softer than brick or terra-cotta; if treated abrasively these materials will simply disintegrate. Indeed, when plaster or stucco is treated abrasively it is usually with the intention of removing the plaster or stucco from whatever base material or substrate it is covering. Obviously, such abrasive techniques should not be applied to clean sound plaster or stuccoed walls, or decorative plaster wall surfaces.

Building Stones: Building stones are cut from the three main categories of natural rock: dense, igneous rock such as granite; sandy, sedimentary rock such as limestone or sandstone; and crystalline, metamorphic rock such as marble. As opposed to kiln-dried masonry materials such as brick and architectural terra-cotta, building stones are generally homogeneous in character at the time of a building's construction. However, as the stone is exposed to weathering and environmental pollutants, the surface may become friable, or may develop a protective skin or patina. These outer surfaces are very susceptible to damage by abrasive or improper chemical cleaning. Building stones are frequently cut into ashlar blocks or "dressed" with tool marks that give the building surface a specific texture and contribute to its historic character as much as ornately carved decorative stonework. Such detailing is easily damaged by abrasive cleaning techniques; the pattern of tooling or cutting is erased, and the crisp lines of moldings or carving are worn or pitted. Occasionally, it may be possible to clean small areas of rough-cut granite, limestone or sandstone having a heavy dirt encrustation by using the "wet grit" method, whereby a small amount of abrasive material is injected into a controlled, pressurized water stream. However, this technique requires very careful supervision in order to prevent damage to the stone. Polished or honed marble or granite should never be treated abrasively, as the abrasion would remove the finish in much the way glass would be etched or "frosted" by such a process. It is generally preferable to underclean, as too strong a cleaning procedure will erode the stone, exposing a new and increased surface area to collect atmospheric moisture and dirt. Removing paint, stains or graffiti from most types of stone may be accomplished by a chemical treatment carefully selected to best handle the removal of the particular type of paint or stain without damaging the stone. (See section on the "Gentlest Means Possible.")

Wood: Most types of wood used for buildings are soft, fibrous and porous, and are particularly susceptible to damage by abrasive cleaning. Because the summer wood between the lines of the grain is softer than the grain itself, it will be worn away by abrasive blasting or power tools, leaving an uneven surface with the grain raised and often frayed or "fuzzy." Once this has occurred, it is almost impossible to achieve a smooth surface again except by extensive hand sanding, which is expensive and will quickly negate any costs saved earlier by sandblasting. Such harsh cleaning treatment also obliterates historic tool marks, fine carving and detailing, which precludes its use on any interior or exterior woodwork which has been hand planed, milled or carved.

Metals: Like stone, metals are another group of building materials which vary considerably in hardness and durability. Softer metals which are used architecturally, such as tin, zinc, lead, copper or aluminum, generally should not be cleaned abrasively as the process deforms and destroys the original surface texture and appearance, as well as the acquired patina. Much applied architectural metal work used on historic buildings--tin, zinc, lead and copper--is often quite thin and soft, and therefore susceptible to denting and pitting. Galvanized sheet metal is especially vulnerable, as abrasive treatment would wear away the protective galvanized layer. In the late 19th and early 20th centuries, these metals were often cut, pressed or otherwise shaped from sheets of metal into a wide variety of practical uses such as roofs, gutters and flashing, and facade ornamentation such as cornices, friezes, dormers, panels, cupolas, oriel windows, etc. The architecture of the 1920s and 1930s made use of metals such as chrome, nickel alloys, aluminum and stainless steel in decorative exterior panels, window frames, and

doorways. Harsh abrasive blasting would destroy the original surface finish of most of these metals, and would increase the possibility of corrosion. However, conservation specialists are now employing a sensitive technique of glass bead peening to clean some of the harder metals, in particular large bronze outdoor sculpture. Very fine (75125 micron) glass beads are used at a low pressure of 60 to 80 psi. Because these glass beads are completely spherical, there are no sharp edges to cut the surface of the metal. After cleaning, these statues undergo a lengthy process of polishing. Coatings are applied which protect the surface from corrosion, but they must be renewed every 3 to 5 years. A similarly delicate cleaning technique employing glass beads has been used in Europe to clean historic masonry structures without causing damage. But at this time the process has not been tested sufficiently in the United States to recommend it as a building conservation measure. Sometimes a very fine smooth sand is used at a low pressure to clean or remove paint and corrosion from copper flashing and other metal building components. Restoration architects recently found that a mixture of crushed walnut shells and copper slag at a pressure of approximately 200 psi was the only way to remove corrosion successfully from a mid-19th century terne-coated iron roof. Metal cleaned in this manner must be painted immediately to prevent rapid recurrence of corrosion. It is thought that these methods "work harden" the surface by compressing the outer layer, and actually may be good for the surface of the metal. But the extremely complex nature and the time required by such processes make it very expensive and impractical for large-scale use at this time. Cast and wrought iron architectural elements may be gently sandblasted or abrasively cleaned using a wire brush to remove layers of paint, rust and corrosion. Sandblasting was, in fact, developed originally as an efficient maintenance procedure for engineering and industrial structures and heavy machinery--iron and steel bridges, machine tool frames, engine frames, and railroad rolling stock--in order to clean and prepare them for repainting. Because iron is hard, its surface, which is naturally somewhat uneven, will not be noticeably damaged by controlled abrasion. Such treatment will, however, result in a small amount of pitting. But this slight abrasion creates a good surface for paint, since the iron must he repainted immediately to prevent corrosion. Any abrasive cleaning of metal building components will also remove the caulking from joints and around other openings. Such areas must be recaulked quickly to prevent moisture from entering and rusting the metal, or causing deterioration of other building fabric inside the structure.

When is Abrasive Cleaning Permissible?

For the most part, abrasive cleaning is destructive to historic building materials. A limited number of special cases have been explained when it may be appropriate, if supervised by a skilled conservator, to use a delicate abrasive technique on some historic building materials. The type of "wet grit" cleaning which involves a small amount of grit injected into a stream of low pressure water may be used on small areas of stone masonry (i.e., rough cut limestone, sandstone or unpolished granite), where milder cleaning methods have not been totally successful in removing harmful deposits of dirt and pollutants. Such areas may include stone window sills, the tops of cornices or column capitals, or other detailed areas of the facade. This is still an abrasive technique, and without proper caution in handling, it can be *just as harmful to the building surface as any other abrasive cleaning method*. Thus, the decision to use this type of "wet grit" process should be made only after consultation with an experienced building conservator. *Remember that it is very time consuming and expensive to use any abrasive technique on a historic building in such a manner that it does not cause harm to the often fragile and friable building materials*. At this time, and only under certain circumstances, abrasive cleaning methods may he used in the rehabilitation of interior spaces of warehouse or industrial buildings for contemporary uses. Interior spaces of factories or warehouse structures in which the masonry or plaster surfaces do not have significant design, detailing, tooling or finish, and in which wooden architectural features are not finished, molded, beaded or worked by hand, may be cleaned abrasively in order to remove layers of paint and industrial discolorations such as smoke, soot, etc. It is expected after such treatment that brick surfaces will be rough and pitted, and wood will be somewhat frayed or "fuzzy" with raised wood grain. These nonsignificant surfaces will be damaged and have a roughened texture, but because they are interior elements, they will not be subject to further deterioration caused by weathering.

Historic Interiors That Should Not Be Cleaned Abrasively

Those instances (generally industrial and some commercial properties), when it may be acceptable to use an abrasive treatment on the interior of historic structures have been described. But for the majority of historic buildings, the Secretary of the Interior's *Guidelines for Rehabilitation* do not recommend "changing the texture of exposed wooden architectural features (including structural members) and masonry surfaces through sandblasting or use of other abrasive techniques to remove paint, discolorations and plaster. Thus, it is not acceptable to clean abrasively interiors of historic residential

and commercial properties which have *finished* interior spaces featuring milled woodwork such as doors, window and door moldings, wainscoting, stair balustrades and mantelpieces. Even the most modest historic house interior, although it may not feature elaborate detailing, contains plaster and woodwork that is architecturally significant to the original design and function of the house. Abrasive cleaning of such an interior would be destructive to the historic integrity of the building. Abrasive cleaning is also impractical. Rough surfaces of abrasively cleaned wooden elements are hard to keep clean. It is also difficult to seal, paint or maintain these surfaces which can be splintery and a problem to the building's occupants. The force of abrasive blasting may cause grit particles to lodge in cracks of wooden elements, which will be a nuisance as the grit is loosened by vibrations and gradually sifts out. Removal of plaster will reduce the thermal and insulating value of the walls. Interior brick is usually softer than exterior brick, and generally of a poorer quality. Removing surface plaster from such brick by abrasive means often exposes gaping mortar joints and mismatched or repaired brickwork which was never intended to show. The resulting bare brick wall may require repointing, often difficult to match. It also may be necessary to apply a transparent surface coating (or sealer) in order to prevent the mortar and brick from "dusting." However. a sealer may not only change the color of the brick, but may also compound any existing moisture problems by restricting the normal evaporation of water vapor from the masonry surface.

"Gentlest Means Possible" There are alternative means of removing dirt, stains and paint from historic building surfaces that can be recommended as more efficient and less destructive than abrasive techniques. The "gentlest means possible" of removing dirt from a building surface can be achieved by using a low-pressure water wash, scrubbing areas of more persistent grime with a natural bristle (never metal) brush. Steam cleaning can also be used effectively to clean some historic building fabric. Low-pressure water or steam will soften the dirt and cause the deposits to rise to the surface, where they can be washed away. A third cleaning technique which may be recommended to remove dirt, as well as stains, graffiti or paint, involves the use of commercially available chemical cleaners or paint removers, which, when applied to masonry, loosen or dissolve the dirt or stains. These cleaning agents may be used in combination with water or steam, followed by a clear water wash to remove the residue of dirt and the chemical cleaners from the masonry. A natural bristle brush may also facilitate this type of chemically assisted cleaning, particularly in areas of heavy dirt deposits or stains, and a wooden scraper can be useful in removing thick encrustations of soot. A limewash or absorbent talc, whiting or clay poultice with a solvent can be used effectively to draw out salts or stains from the surface of the selected areas of a building facade. It is almost impossible to remove paint from masonry surfaces without causing some damage to the masonry, and it is best to leave the surfaces as they are or repaint them if necessary. Some physicists are experimenting with the use of pulsed laser beams and xenon flash lamps for cleaning historic masonry surfaces. At this time it is a slow, expensive cleaning method, but its initial success indicates that it may have an increasingly important role in the future. There are many chemical paint removers which, when applied to painted wood, soften and dissolve the paint so that it can be scraped off by hand. Peeling paint can be removed from wood by hand scraping and sanding. Particularly thick layers of paint may be softened with a heat gun or heat plate, providing appropriate precautions are taken, and the paint film scraped off by hand. Too much heat applied to the same spot can burn the wood, and the fumes caused by burning paint are dangerous to inhale, and can he explosive. Furthermore, the hot air from heat guns can start fires in the building cavity. Thus, adequate ventilation is important when using a heat gun or heat plate, as well as when using a chemical stripper. A torch or open flame should never he used.

Preparations for Cleaning: It cannot be overemphasized that all of these cleaning methods must be approached with caution. When using any of these procedures which involve water or other liquid cleaning agents on masonry, it is imperative that all openings be tightly covered, and all cracks or joints be well pointed in order to avoid the danger of water penetrating the building's facade, a circumstance which might result in serious moisture related problems such as efflorescence and/or subflorescence. Any time water is used on masonry as a cleaning agent, either in its pure state or in combination with chemical cleaners, it is very important that the work be done in warm weather when there is no danger of frost for several months. Otherwise water which has penetrated the masonry may freeze, eventually causing the surface of the building to crack and spall, which may create another conservation problem more serious to the health of the building than dirt.
Each kind of masonry has a unique composition and reacts differently with various chemical cleaning substances. Water and/or chemicals may interact with minerals in stone and cause new types of stains to leach out to the surface immediately, or more gradually in a delayed reaction. What may be a safe

and effective cleaner for certain stain on one type of stone, may leave unattractive discolorations on another stone, or totally dissolve a third type.

Testing: Cleaning historic building materials, particularly masonry, is a technically complex subject, and thus, should never be done without expert consultation and testing. No cleaning project should be undertaken without first applying the intended cleaning agent to a representative test patch area in an inconspicuous location on the building surface. The test patch or patches should be allowed to weather for a period of time, preferably through a complete seasonal cycle, in order to determine that the cleaned area will not he adversely affected by wet or freezing weather or any by-products of the cleaning process.

Mitigating the Effects of Abrasive Cleaning

There are certain restoration measures which can be adopted to help preserve a historic building exterior which has been damaged by abrasive methods. Wood that has been sandblasted will exhibit a frayed or "fuzzed" surface, or a harder wood will have an exaggerated raised grain. The only way to remove this rough surface or to smooth the grain is by laborious sanding. Sandblasted wood, unless it has been extensively sanded, serves as a dustcatcher, will weather faster, and will present a continuing and ever worsening maintenance problem. Such wood, after sanding, should be painted or given a clear surface coating to protect the wood, and allow for somewhat easier maintenance.

There are few successful preservative treatments that may be applied to grit-blasted exterior masonry. Harder, denser stone may have suffered only a loss of crisp edges or tool marks, or other indications of craft technique. If the stone has a compact and uniform composition, it should continue to weather with little additional deterioration. But some types of sandstone, marble and limestone will weather at an accelerated rate once their protective "quarry crust" or patina has been removed.

Softer types of masonry, particularly brick and architectural terra-cotta, are the most likely to require some remedial treatment if they have been abrasively cleaned. Old brick, being essentially a soft, baked clay product, is greatly susceptible to increased deterioration when its hard, outer skin is removed through abrasive techniques. This problem can be minimized by painting the brick. An alternative is to treat it with a clear sealer or surface coating but this will give the masonry a glossy, or shiny look. It is usually preferable to paint the brick rather than to apply a transparent sealer since sealers reduce the transpiration of moisture, allowing salts to crystallize as subflorescence that eventually spalls the brick. If a brick surface has been so extensively damaged by abrasive cleaning and weathering that spalling has already begun, it may be necessary to cover the walls with stucco, if it will adhere.

Of course, the application of paint, a clear surface coating (sealer), or stucco to deteriorating masonry means that the historical appearance will be sacrificed in an attempt to conserve the historic building materials. However, the original color and texture will have been changed already by the abrasive treatment. At this point it is more important to try to preserve the brick, and there is little choice but to protect it from "dusting" or spalling too rapidly. As a last resort, in the case of severely spalling brick, there may be no option but to replace the brick--a difficult, expensive (particularly if custom-made reproduction brick is used), and lengthy process. As described earlier, sandblasted interior brick work, while not subject to change of weather, may require the application of a transparent surface coating or painting as a maintenance procedure to contain loose mortar and brick dust. (See Preservation Briefs No. 1 for a more thorough discussion of coatings.) Metals, other than cast or wrought iron, that have been pitted and dented by harsh abrasive blasting usually cannot be smoothed out. Although fillers may be satisfactory for smoothing a painted surface, exposed metal that has been damaged usually will have to be replaced.

Summary

Sandblasting or other abrasive methods of cleaning or paint removal are by their nature destructive to historic building materials and should not be used on historic buildings except in a few well-monitored instances. There are exceptions when certain types of abrasive cleaning may be permissible, but only if conducted by a trained conservator, and if cleaning is necessary for the preservation of the historic structure. There is no one formula that will be suitable for cleaning all historic building surfaces. Although there are many commercial cleaning products and methods available, it is impossible to state definitively which of these will be the most effective without causing harm to the building fabric. It is often difficult to identify ingredients or their proportions contained in cleaning products; consequently it is hard to predict how a product will react to the building materials to be cleaned. Similar uncertainties affect the outcome of other cleaning methods as they are applied to historic building materials. Further advances in understanding the complex nature of the many variables of the cleaning techniques may

someday provide a better and simpler solution to the problems. But until that time, the process of cleaning historic buildings must be approached with caution through trial and error.
It is important to remember that historic building materials are neither indestructible, nor are they renewable. They must be treated in a responsible manner, which may mean little or no cleaning at all if they are to be preserved for future generations to enjoy. If it is in the best interest of the building to clean it, then it should be done "using the gentlest means possible."

38 PRESERVATION BRIEFS

Removing Graffiti from Historic Masonry

Martin E. Weaver



U.S. Department of the Interior
National Park Service
Cultural Resources
Preservation Assistance

In Cooperation with the
New York Landmarks Conservancy



Figure 1. Many stones resemble others, and even concrete can sometimes be mistaken for stone. The stone trim on the Old Merchant's (Seabury Tredwell) House (1832), in Greenwich Village, New York City, is documented as Vermont marble. After establishing the stone type, cleaning methods should be tested in a discrete location in order to determine the most effective means of removing the graffiti without damaging the stone. More than one kind of removal technique may be required when both stone and brick require cleaning. Photo: Mark A. Weber

Removing graffiti as soon as it appears is the key to its elimination—*and* recurrence. Thus, the intent of this Preservation Brief is to help owners and managers of historic masonry structures find the best way to remove exterior, surface-applied graffiti* quickly, effectively, and safely. The Brief will discuss the variety of materials used to apply graffiti, and offer guidance on how to remove graffiti from all types of historic masonry without harming either the surface or the substrate. Suggestions will also be given regarding the use of physical barriers to protect masonry surfaces from graffiti, and the application of barrier coatings to facilitate graffiti removal. Building managers and owners of historic properties will be advised on the importance of being prepared for rapid graffiti removal by testing different cleaning techniques in advance in order to select the most appropriate and sensitive cleaning technique. Health and safety and environmental concerns are addressed, as well as regulatory matters. Removing graffiti without causing damage to historic masonry is a job for trained maintenance crews, and in some cases, professional conservators, and generally should not be attempted by untrained workers, property owners or building managers. Although the focus of this Preservation Brief is on *historic* masonry, the same guidance may be applied equally to removing graffiti from non-historic masonry.

Identifying the Graffiti and the Masonry

Successful graffiti removal from historic masonry depends on achieving a balance between breaking the bond between the graffiti and the masonry surface without damaging the masonry. This generally requires knowledge both of the materials used to make the graffiti and the masonry on which the graffiti has been executed, as well as knowledge of cleaning methods and materials (Fig. 1). Without this, masonry surfaces can be badly disfigured or damaged during graffiti removal.

Graffiti. Most graffiti is made with spray paints. Although a number of solvents and paint strippers are capable of dissolving or breaking down these paints, some may permanently discolor or stain the masonry surface if not used correctly. As a result, the remaining paint may become

more difficult, or even impossible, to remove. Poorly thought-out and generally hasty attempts to remove graffiti using harsh chemicals or abrasives can also cause permanent damage to the masonry that may be worse than the graffiti (Fig. 2).

The ability to identify the graffiti material is an important step in successful removal. Numerous kinds of spray paint (polyurethanes, lacquers, and enamels), and brush-applied paints (oils and synthetic resins such as vinyls, acrylics, acetates, methacrylates, or alkyds), as well as permanent felt markers are the materials most often used to make graffiti. But other materials are also used for graffiti, including water-soluble felt markers, ballpoint pens, chalk, graphite and colored pencils, pastels, wax and oil crayons, liquid shoe polish, and lipstick (Fig. 3). The range of materials adopted by graffitists continues to expand.

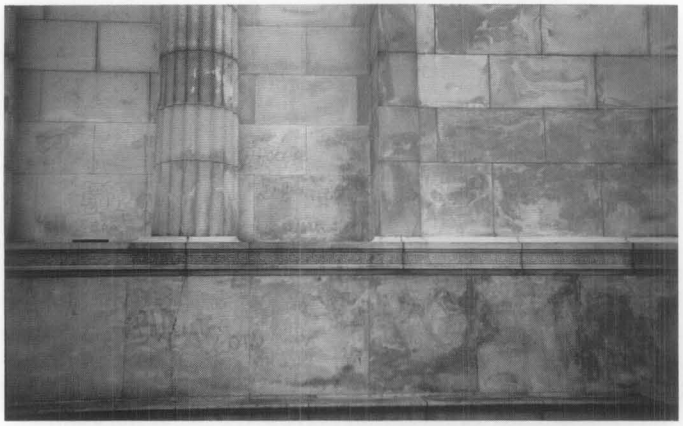
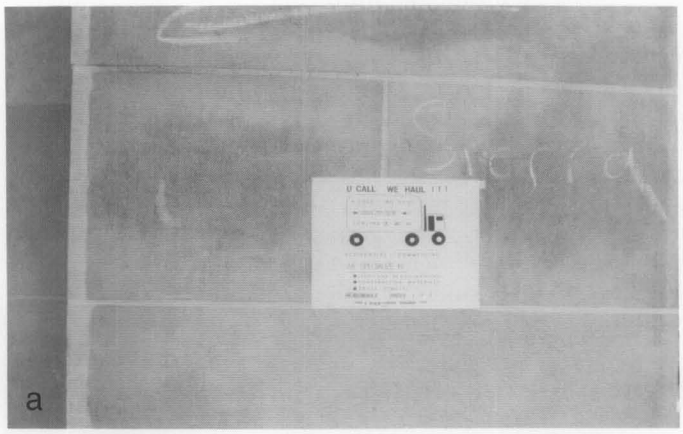
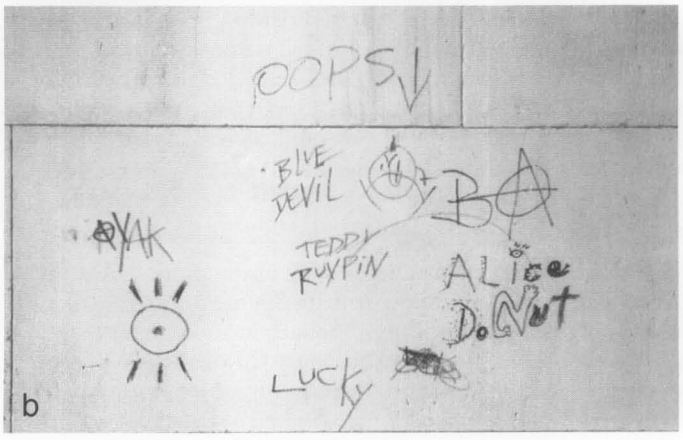


Figure 2. Harsh, but ineffective, graffiti removal methods have resulted in permanent damage to granite walls at the General Grant National Memorial in New York City. Photo: Judith M. Jacob





Paints are composed of pigments that provide color and hiding power; binder that holds the pigments together and to the substrate; and a solvent that allows the pigment/binder mixture to flow. Some spray paints and markers may contain dyes instead of pigments. Paints are applied wet. Generally, as the solvent evaporates, the binder solidifies. The greater the solvent content of the paint, the greater the flow rate, and thus, the greater the ability of the paint to penetrate into masonry pores

The two primary components contained in most graffiti materials—pigment or dye, and binder—may simply remain on the masonry surface, or penetrate into the masonry to varying depths depending on a number of factors, including the surface tension of the substrate and viscosity of the solvent or vehicle. Thus, even the total removal of the pigment or the binder may leave residues of the other component actually in, or below, the surface of the stone. Residual stains, or graffiti "ghosts," such as those from any kind of red paint or the fine black pigments used in spray paints, may be particularly difficult to remove (Fig. 4). With painted graffiti, it is helpful to establish how long it has been on the surface. For most paints that have been on the surface for several weeks or months, hardening processes are likely to be complete or well-advanced; the solubility of the paint is proportionately reduced and it will be more difficult to remove.





Figure 3 (a-d). A wide variety of materials is used to make surface-applied graffiti on masonry, including (a) chalk, (b) felt-tip marker, (c) felt-tip marker combined with crayon, and (d) felt-tip marker and spray paint on concrete. Photos: (a) Anne Grimmer, (b) Frances Gale, (c) Martin Weaver, (d) Anne Grimmer.





Figure 4 (a-b). After cleaning with an alkaline paint remover, remnants or ghosts of black spray-painted graffiti are still visible and may require poulticing, while the blue paint has been almost completely removed. Photos: Mark A. Weber.

Masonry. The historic masonry substrate must also be identified. As used here, the term *masonry* encompasses all types of natural stones; manufactured clay materials, including brick and terra cotta; and cementitious materials, such as cast stone, concrete and mortar. The common factor among masonry materials is that they are porous, to a greater or lesser extent, and sensitive to abrasion. After identifying the masonry, its condition, including fragility, porosity and permeability, must also be assessed prior to beginning graffiti removal. For example, a smooth, newly-polished granite surface is comparatively easy to clean because it is relatively impermeable and paint vehicles tend to stay on the surface rather than penetrate into microscopic pores. A very smooth, polished surface also has no pits or crevices that will retain particles of pigment or binder. In contrast, weathered marble or limestone may be extremely porous and permeable, with a rough surface on which particles of pigment can easily lodge. The fragility of such a surface can make it impossible to clean the surface even with a bristle brush without risking severe surface loss. A difference in surface texture or finish may also be the reason that a particular cleaning agent will work in one situation but not another.

Some types of masonry may react adversely to contact with the various cleaning agents required to break or dissolve the bond between the graffiti and the masonry surface.

Thus, for purposes of cleaning, masonry types are often categorized according to whether they are acid-sensitive, non-acid sensitive, or alkali-sensitive. *Acid-sensitive* stones consisting of carbonate materials may be damaged or even destroyed by contact with acids. Although, in many instances, acidic cleaning compounds are not effective for graffiti removal and generally should not be used for this purpose, it is useful to know that some acid-sensitive materials include: stones such as limestone, marble, travertine, calcareous sandstones and shales; most polished stones; and glazed architectural terra cotta and glazed brick. *Non-acid sensitive* masonry materials include slate, granite, unglazed architectural terra cotta and unglazed brick. *Alkali-sensitive* stones may contain silicates, or ferrous, soluble iron compounds that can react with alkalis or water to form severe staining. *Alkali-sensitive* stones include some granites, Indiana limestone, and many types of sandstone, especially those that are green or grey in color. Glazed and polished surfaces tend to be damaged by both strong acids and strong alkalis.

Graffiti Removal Methods and Materials

A variety of treatments are available from which to choose the most appropriate method of graffiti removal that will not damage the surface of historic masonry. Removal techniques, which are chosen according to the type of graffiti and the masonry, range from simply erasing pencilled graffiti with soft erasers, or removing chalked graffiti with soft brushes, to poulticing with water (with or without detergents), poulticing with organic solvents or alkali-based paint removers, or applying bleach to remove painted graffiti. In very limited situations, it may mean using very delicate and controlled abrasive means. Successful graffiti removal often requires a combination of cleaning materials and methods.

Poulticing

The most effective method of removing graffiti from masonry usually involves the use of a poultice. A poultice consists of an absorbent material or powder—inert clays such as kaolin or sepiolite, diatomaceous earth (fuller's earth); or cellulose products such as fluff pulp cellulose or shredded paper—mixed with a cleaning solution (a liquid reagent such as water, organic solvent, paint stripper or bleach) to form a paste or slurry. The purpose of a poultice is twofold: it enables a cleaning solution to be kept in contact with the stained area as long as possible, while allowing the cleaning solution to pull the staining material out of the substrate via the poultice without redepositing it in, or restaining, the masonry. A poultice is often covered with a plastic sheet to retard evaporation (Fig. 5). With some extremely porous types of stone, such as marble, although a poultice may remove a stain from one side of the stone, stains can pass completely through the stone and be redeposited on the other side of the masonry slab. Thus, caution should always be exercised in stain and graffiti removal.

Water and Detergent. Graffiti removal from historic masonry should always begin with the gentlest means possible. In some instances, this means low-pressure water washing. Fresh graffiti— one or two days old—made with water-soluble markers may sometimes be removed with water, possibly aided by a neutral or non-ionic detergent.

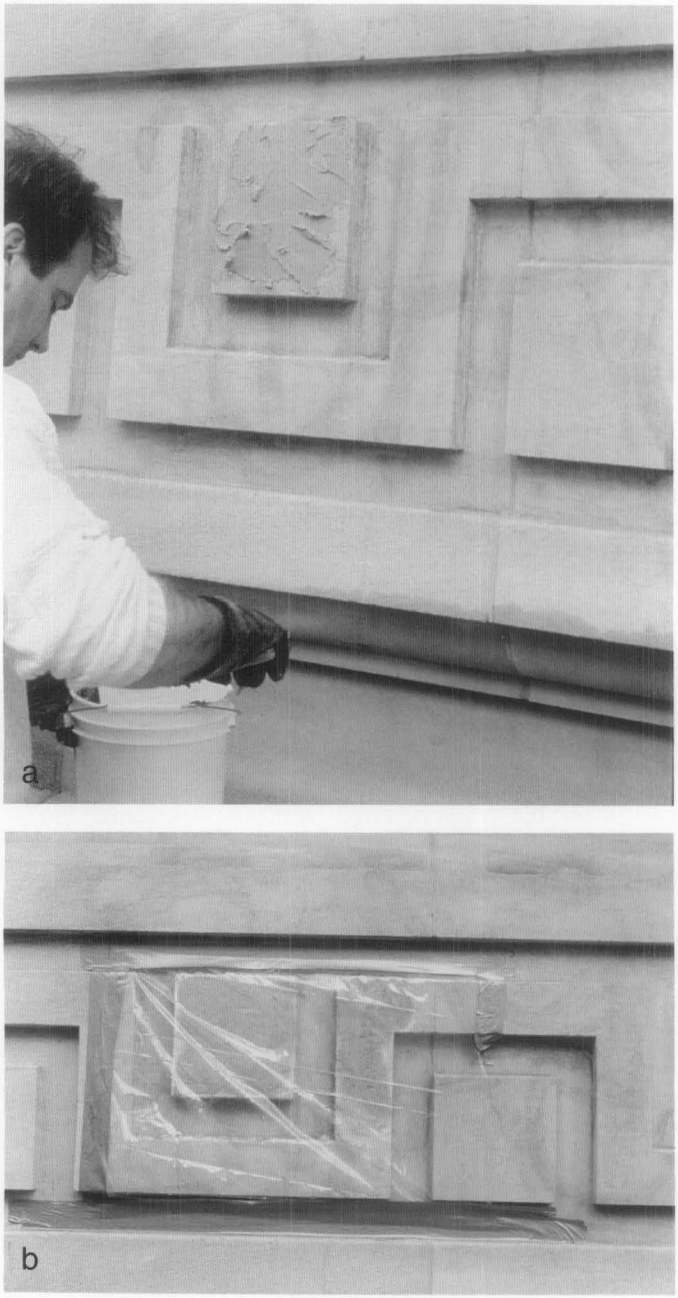


Figure 5. (a) Here, a commercially-manufactured poultice is being applied to the graffiti ghost that remains on this limestone building after an initial treatment with paint remover; (b) a plastic sheet has been taped over the poultice to slow down the rate of evaporation of the solvents contained in the poultice. Photos: Ken Lustbader.

(Non-ionic detergents which do not ionize in solution, do not deposit a solid, visible residue.) Ammonia can also be effective in removing fresh graffiti. Any detergent should be approached with caution and tested before using because most commercial laundry detergents are not neutral and contain substances which may leave undesirable residues on masonry materials. Usually, the water and detergent should be mixed with an absorbent material and applied in the form of a poultice. Although water washing is often likely to be the gentlest cleaning method for historic masonry, it may not be as effective for removing graffiti because many graffiti materials are not soluble in water.

Organic Solvents and Paint Removers. Most graffiti can be removed without damaging the masonry with proprietary graffiti-removal products and commercial paint strippers containing organic solvents. But, these products should always be tested and used in accordance with manufacturer's instructions included in the product literature. Normally, solvents should be used in a poultice form to prevent them from penetrating into the substrate, and permanently discoloring or staining the masonry. A number of paint-removers are manufactured as thick gels or pastes that cling to the surface, and some commercial paint-removal products include a tough fiber-reinforced paper or cloth backing that retards evaporation and also facilitates neat and clean removal of the used stripper. The advantage of using organic solvents is that they evaporate completely, leaving no residual material in the masonry. However, organic solvents may present a severe health hazard, and workers using them must wear adequate protection. "Off-the-shelf" aerosol graffiti removers generally should not be used because the dissolved paint being removed may run down the wall "staining" a previously clean area; or pigments may also be redistributed by the rinsing and scrubbing recommended by the product manufacturer (Fig. 6).

Alkaline Compounds. Alkaline compounds may be used to remove some oils and greases, and waxes from *non-alkali* sensitive masonry. Like organic solvents, alkaline compounds should generally be used in conjunction with a poultice when removing graffiti. The use of alkaline compounds should always be followed by a weak acid



Figure 6. Although an aerosol graffiti remover has taken off much of the graffiti, it has left new stains where it dripped down the masonry surface. Photo: Ken Lustbader.

wash and a water rinse in order to neutralize—or remove—all the alkaline residues from the masonry. Strong alkalies (pH13-14), such as sodium hydroxide-based paint removers (caustic soda or lye), generally should not be used as they can cause efflorescence and staining on masonry surfaces, if not properly neutralized. Potassium and other hydroxide paint removers may react with iron compounds in some masonry, particularly Indiana limestone, to form dark brown (rust-colored), or black ferric hydroxide stains, which are very difficult to remove.

Bleaches. Alkali-based bleaches such as calcium hypochlorite can sometimes be used very successfully in a poultice to bleach or decolorize certain dyes contained in some paints and inks that cannot readily be removed by other means.

Mechanical or Abrasive Methods. Mechanical treatments include dry or wet blasting, using abrasive grits, such as sand, dolomite powder, aluminum oxide, ground-walnut shells, sodium bicarbonate (baking soda), and others; high-pressure water washing; and mechanical sanding or grinding. All of these abrasive methods will cause damage to masonry and, in most instances, should never be considered as a method of removing graffiti from historic masonry. Abrasive methods used mistakenly by untrained workers to remove graffiti usually result in etching the outline of the graffiti permanently into the masonry (Fig. 7). Some historic masonry materials can be easily damaged by pressure washing even at low or moderate pressures (100-400 psi). Occasionally, however, under very controlled circumstances, a *micro-abrasive* technique may be appropriate for removing graffiti from delicate masonry surfaces, if used at low pressures of 35-40 psi with fine abrasives. This treatment, which must be done very slowly and carefully to avoid damaging the masonry, should be tested first, and undertaken only by a professional conservator. Another exception, even though it is not strictly an abrasive treatment, is using a razor blade as a first step to remove spray paint or felt-tip marker from polished granite. However, this too, should be undertaken only by a *professional conservator*, and only on *polished granite*, which is very hard and generally impervious to scratches.

Laser Cleaning. Although not in general use as a cleaning technique, laser technology offers great promise in the future as a non-damaging method of graffiti removal.





Figure 7 (a-b). The first time this spray-painted graffiti appeared it was removed abrasively. As a result, the graffiti was permanently etched into the limestone and cannot be concealed even by the pigmented barrier coating painted over it later. The barrier coating did, however, facilitate non-abrasive removal of graffiti the next time it was applied. Photos: Anne Grimmer.

Testing

Before selecting a removal method, all cleaning materials and techniques for removing graffiti from a historic masonry building should be tested on mock-ups or areas of the resource that are not highly visible, but which are representative of typical conditions. Visual observation should be supplemented by the use of a magnifying glass, and spot tests should be carried out with various solvents to help identify the specific graffiti medium, which will aid in its removal. More complex testing using laboratory equipment and more scientific analytical processes may sometimes be necessary in complex situations. Sample areas that represent the desired degree of "cleanliness" should be approved in writing by client, architect, conservator or other appropriate authority. The materials and all the other data necessary to reproduce the desired cleaning results should be meticulously recorded and the accepted sample area preserved for reference until the end of the job. The existence of a "clean" sample for comparison and a signed agreement can avoid unpleasant surprises, misunderstandings, and perhaps legal actions.

When a type of graffiti appears for the first time that was executed with a material not immediately recognizable and for which no countermeasures have been developed, tests may need to be carried out by an architectural conservator to identify the material and to determine effective removal treatments. Agencies with large inventories of graffiti-prone buildings and structures should watch for graffiti made with new materials and experiment with different cleaning methods in order to be prepared when it appears. Such early action can save large sums of money in the long term. (See "Development of a Treatment Plan.")

Development of a Treatment Plan

For managers or owners of historic masonry buildings, or agencies responsible for large inventories of graffiti-prone properties, including parks, highway and railroad bridges and viaducts, bus, train and subway stations, and cemeteries, the development of a treatment plan may be the first step toward an effective graffiti-removal program. It is becoming increasingly common for large or important historic properties to have regular maintenance and disaster plans that include graffiti removal.

When feasible, a separate treatment plan should be prepared for each structure. However, if this is not possible, it is advisable to prepare a variety of treatment plans for specific masonry types. Plans should be prepared to cover all types of masonry that fall under one jurisdiction, management or ownership that are potential targets for graffiti.

Guidance contained in treatment plans should be based on the results of carefully controlled testing to remove a wide variety of common graffiti materials safely, and without damaging the various types of masonry. Individual treatment plans should address all parts of the building or structure that could be disfigured by graffiti, and any features too fragile to be cleaned by anyone other than a conservator should be noted on the plan.

A treatment plan is essentially a cleaning specification, but it should also include information on the following:

- the types and conditions of masonry likely to be targeted by graffiti;
- methods, materials and techniques known to work most successfully in the removal of specific types of graffiti from the surface of each type of masonry;
- sources for materials;
- a list of contractors with expertise in graffiti removal, including names, telephone numbers, information on emergency access to the property, and storage location of materials;
- graffiti-removal methods which may be harmful to the masonry surface;
- contractors or consultants who are **not acceptable** and should not be considered for graffiti removal;
- scaffolding, pumps, or safety equipment that might be required, where it is available, and costs involved; and
- health and safety concerns regarding specific removal treatments, product literature and Material Safety Data Sheets (MSDS).

Health and Safety Considerations

Most of the chemicals used for graffiti removal are dangerous to workers, as well as to others who may be in the vicinity. Organic solvents are toxic by ingestion, inhalation, and skin contact. Material Safety Data Sheets (MSDS), available from the product manufacturer for all paint-removal products, should always be consulted and followed. Identification of hazardous components and checking with chemical reference works will help assure that the least hazardous, but most effective, products are selected.

Generally speaking, it is a sensible policy to carry out all graffiti removal in well-ventilated conditions. Some solvents can be used only outdoors, and sometimes forced ventilation may be necessary even *there*, requiring workers to use air-fed respiratory equipment to avoid wind-blown fumes. Smoking, eating or drinking must not be allowed when cleaning is in progress.

Some materials used for graffiti removal are so corrosive that accidental contact can cause serious, permanent scarring and painful injuries. Wearing appropriate protective clothing must be strictly enforced. Mandatory personal protective equipment (PPE) normally includes face shields or safety glasses; long, chemical-resistant gloves; face masks with respirators for organic solvents; and possibly, full protective clothing with an independent air supply.

All smoking and open flames should be rigorously excluded from work areas; many solvents are flammable or highly explosive in vapor or liquid form when mixed with air. Solvent residue, used swabs, cloths, overalls and all other solvent-contaminated items should be safely and legally disposed of, or properly stored—even overnight—away from potential sources of fire. Electrical equipment may require explosion-proof fittings when used with certain solvents.

When electric pumps and pressure-spraying equipment are used, it is especially important that all necessary precautions be taken to avoid electric shock. Water sprays and puddles on the ground present a potentially dangerous situation, if they come into contact with temporary wiring at worksites where graffiti is being removed. Such hazards must be carefully monitored and controlled.

As with any construction project, attention should always be directed toward the general safety of the workers and passers-by, but also toward possible damage to the resource itself that might result from careless placement of ladders, or scaffolding. Chemicals used for masonry cleaning can also damage adjacent metals, glass, and painted surfaces, as well as vegetation (Fig. 8). Product manufacturers' instructions should always be closely followed to avoid such inadvertent "collateral" damage.

Environmental Considerations

To protect against environmental contamination, including the formation of unwanted ozone at ground level and damage to the ozone layer in the earth's outer atmosphere, legislation has been enacted in some states making it illegal to use even moderate quantities of some solvents — *volatile organic compounds (VOCs)* contained in paint removers. In response to this legislation, many new products are being developed that do not contain VOCs.

After completing graffiti removal, the disposal of chemical products and rinsing effluent must be taken into account. Arrangement for disposal of the cleaning waste should be made *prior* to beginning graffiti removal, especially if it is a project of considerable size. In many places it is illegal to discharge solvents and/or paint residues into sewers or storm drains. The owner or manager of a historic property, or in some cases the individual or firm doing the cleaning or graffiti removal, is responsible for being informed of, and complying with, relevant laws and regulations. Under provisions of the National Historic Preservation Act of 1966, as amended, approval may be required from a state or federal preservation agency before any work can be undertaken on buildings or structures listed in or eligible for listing in the National Register of Historic Places, if such a project involves federal funding or licensing. Many state and local historic district commissions and review boards have their own regulations that require approval for cleaning or graffiti removal work that is undertaken on landmarks or properties in locally designated historic districts.

Barrier Coatings

Anti-graffiti or barrier coatings are intended to facilitate the removal of graffiti from porous as well as non-porous surfaces. These coatings are most commonly transparent, but may also be pigmented. They are available in a variety of formulations designed to serve different needs. The use of barrier coatings to protect graffiti-prone historic masonry surfaces may seem to be an easy preventive solution to a persistent graffiti problem. However, for the most part, these coatings are not the panacea that some advertising might suggest. Some of them simply do not work, and others may cause physical or aesthetic changes or damage to the masonry.

Transparent Coatings. Transparent coatings serve as a barrier between the masonry surface and graffiti, preventing graffiti from penetrating into the masonry. They are also intended to make graffiti removal easier since most graffiti does not adhere well to them. Generally, graffiti applied over transparent barrier coatings can be removed with low-pressure water and a detergent, or with a solvent.

There are basically two kinds of transparent barrier coatings: temporary and permanent. Temporary, or "sacrificial" coatings are removed when graffiti is removed and then must be reapplied. Permanent transparent barrier coatings are more resistant to the water or solvents used to remove graffiti, and remain on the masonry surface when graffiti is removed (although this type of coating also must usually be reapplied after several cleanings). A third type of transparent barrier coating combines temporary and permanent coatings, based on a two-part system. A water-based acrylic sealer is first applied to the masonry surface, after which a sacrificial layer consisting of a polyethylene wax emulsion or dispersion coat is applied over the sealer. When graffiti is removed, the sealer coat remains on the masonry, but the sacrificial coat dissolves and is removed with the graffiti, and thus must be reapplied. (With this two-part system, even the first coat will eventually wear off after multiple cleanings, and must also be reapplied.)

Unfortunately, in application, there are a number of negative aspects of transparent barrier coatings that generally prevent their being recommended for use on historic masonry. First, clear coatings may alter the color of the masonry surface and add a gloss that may be highly visible, or apparent only in certain lighting conditions or when it rains. Second, clear coatings may reduce the water-vapor permeability of the masonry, thereby contributing to possible water-related deterioration. Third, the coating may discolor and change over time. Exposure to ultra-violet light can cause a coating to yellow; dirt build-up may darken the treated surface; and some coatings acquire a sheen when rubbed or brushed against. Such changes are especially noticeable when only a portion of the building has been coated. Furthermore, if coatings are not maintained on a regular basis, usually through periodic removal and reapplication, many coatings tend to fail. What often results is an uneven, "patchy" look to the masonry that can have a very negative impact on the character of the historic building (Fig. 9).

Despite these potential drawbacks, there may be some instances in which the graffiti problem or frequency of occurrence is so severe that application of a transparent barrier coating on historic masonry may be worth considering. Some water-based polysaccharide coatings, and silicone and silicone-based coatings have been used with success on masonry structures. They are essentially

Criteria to Consider Before Selecting a Barrier Coating as the Primary Protective Means of Combating Graffiti

What to look for in a Barrier Coating:

- Water-vapor permeable, or "breathable".
- "Invisible" without gloss or sheen, when applied to masonry.
- No change in appearance from uncoated areas when masonry is wet.
- Does not discolor or attract dirt.
- Weathers evenly.

Questions to Ask:

- Will the coating last long enough to offset its cost?
- Will the application and reapplication of the coating be cost effective?
- Will the coating be effective against more than one type of graffiti?
- Can the coating be completely and thoroughly removed, so that, if necessary, paint, or another coating will adhere to the masonry surface?
- Will the building ever need to be repointed or patched? A barrier coating may make this difficult or even impossible.

Before Application:

- Seek advice of an architectural conservator.
- Test coating on an inconspicuous area of masonry, or study the success/failure of the coating in other locations where it has been used.

Figure 8. The cast-iron railing and light fixtures on this stone stoop have been wrapped with plastic sheeting to protect them from damage by chemicals being used to remove the graffiti. Photo: Mark A. Weber.

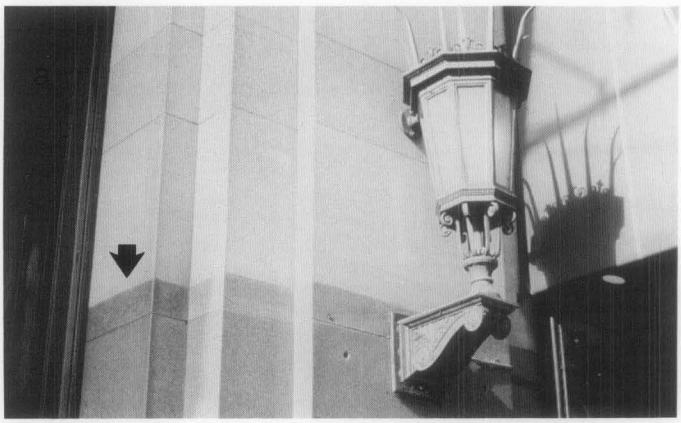






Figure 9. These photographs illustrate some of the problems inherent in clear barrier coatings. (a) The transparent coating applied to the lower portion of this granite entranceway has darkened it, thus changing the character of the historic masonry. (b) But it is not nearly so obvious or damaging to the building's historic character as the thick and shiny clear coating applied here which resembles a plastic sheathing over the brick. Scratches are highly visible and a surface haze indicates that the coating has begun to deteriorate. (c) This transparent coating is peeling and has failed completely; not only is it an eyesore, but it may also be hard to remove from the brick. Photos: (a-b) Mark A. Weber, (c) Martin E. Weaver.

invisible, and do not change the natural appearance of the masonry. Although less durable than solvent-borne coatings, they are water-vapor permeable (breathable), and may be reapplied to the masonry surface immediately after removing graffiti, while the surface is still damp.

However, extreme caution must be exercised before applying a transparent barrier coating. Experimental test applications should always be tried first on discrete areas that are not highly visible, and the treated areas evaluated over a period of time. Laboratory test results on the performance of coatings applied to samples of like masonry types may be useful to some extent. But because the tests are carried out in a controlled environment, they may not be as accurate or reliable as tests actually carried out on-site where the factors of weather and pollution are the same as those at the location where the coating will be used. If circumstances warrant, and the use of a barrier coating is determined necessary, an architectural conservator should evaluate the test performance of a variety of coatings before selecting one to be applied to historic masonry. Because of the potential for disfigurement, owners of landmark-designated buildings are required by some preservation review boards and landmark commissions to obtain approval before they apply a barrier coating.

Pigmented Coatings. A pigmented barrier coating may be used on masonry as a permanent, preventive barrier coating, or as a *temporary* means of concealing graffiti until it can be removed.

Like a transparent barrier coating, a pigmented barrier coating facilitates the removal of graffiti because graffiti does not adhere well to it. Pigmented barrier coatings that are water-vapor permeable may sometimes be used as a *permanent* barrier coating on non-historic masonry where there is frequent recurrence of graffiti, and when constant surveillance is not possible (Fig. 10). Although there are some instances in which pigmented barrier coatings may be appropriate on painted historic masonry, they are **not** recommended for unpainted historic masonry because they will change the appearance of the masonry. There is also another kind of pigmented coating that is specially formulated to be used as a *temporary* measure to conceal graffiti that cannot be removed right away. This temporary, vapor-permeable paint is removed when the graffiti is removed.

Pigmented coatings are also not generally recommended as a permanent measure to cover up graffiti. Some graffiti materials, particularly felt markers, bleed through the coating; and repeated applications of the coating or paint can result in a heavy paint build-up on a masonry surface. Another disadvantage of using paint or a pigmented coating to hide graffiti is that it usually appears as an obvious patch on unpainted masonry and tends to attract more graffiti unless the paint can be applied in a discrete, and well-defined area (Fig. 11). If incompatible with either the masonry or the graffiti, such a coating may peel off the masonry surface in an unsightly manner. Like transparent coatings, pigmented coatings may be difficult or impossible to remove completely once their performance or appearance is no longer satisfactory (Fig. 12).

Preventing and Controlling Graffiti

Experience shows that prompt removal of graffiti is one of the most effective measures against its recurrence. Graffiti that is not removed quickly tends to attract more graffiti. Often motivated by a need to have their work seen, graffitists tend to be discouraged from repeating their efforts in a location where their work is quickly removed.





Figure 10 (a) It may be appropriate to consider the application of a barrier coating in order to facilitate removal in some out-of-the-way locations where full-time security is not possible, such as this stairway and bridge underpass next to the C&O Canal. (b) Overpainting graffiti on the stone wall at the left has not been successful; it has resulted in highlighting the defaced stones, thereby attracting more graffiti. Photos: Anne Grimmer.





Figure 11. (a) The first floor of this limestone storefront was painted in an effort to cover graffiti. However, because the paint is poorly matched to the color of the building stone, it is highly visible and now acts as a "magnet" for new graffiti. (b) Similarly, the lowest horizontal band on this stone building, overpainted to cover graffiti, has also attracted more graffiti. Photos: (a) Mark A. Weber, (b) Martin E. Weaver

Apart from removal, effective graffiti-prevention measures can be considered under two headings. The first consists of physical measures involving maintenance, lighting, security and the erection of barriers on or around the property itself. The second focuses on community awareness programs that include neighborhood patrols, community service programs and educational programs in the schools.

Maintenance and Security. Neglect invites vandalism, whereas a well-maintained property encourages civic pride. Thus, careful attention should be given to establishing regular maintenance programs which do not allow properties to reach a point of obvious deterioration or abandonment. Cyclical maintenance also makes good sense economically.

Graffiti is less likely to occur if graffitists can be clearly seen. It is often recommended that accessible, graffiti-prone areas be illuminated with floodlighting or spotlights. Graffiti may also be reduced or prevented by the presence of security guards, park rangers or police officers, or by the visible presence of surveillance cameras. Publicity about arrests and punitive measures against the graffitists, and the general vigilance of the security system may also reduce graffiti.

If they are historically appropriate and compatible with the historic property, soft barriers in the form of low, possibly thorny, shrubs and bushes or other forms of landscaping and planting may be effective deterrents. Such plantings can make it difficult to reach the property by any route other than the approved secure one. Hard barriers provided by fences and transparent screens or shields, such as clear acrylic or other polycarbonate sheets, may also afford some degree of protection. But these can have a negative aesthetic impact on the property's appearance, particularly if the barriers themselves become disfigured by graffiti.

Community Awareness. Community action and education often play an important role in a successful anti-graffiti program. Neighborhood watches can effectively deter graffitists, and can help police and other security agencies in

the detection and prevention of graffiti. Intensive public campaigns against graffiti, including presentations in schools, developing programs to foster community pride, and sentencing offenders to remove graffiti in their own community can also be useful. Publicity concerning arrests of graffitists can be a useful preventive tool. (But, on the other hand, frequent newspaper coverage of graffiti outbreaks or even of new community efforts at deterring graffiti can sometimes have the opposite effect by challenging the "creativity" of graffitists.) Community groups trained in proper cleaning techniques can also assist property owners in prompt and non-damaging graffiti removal.

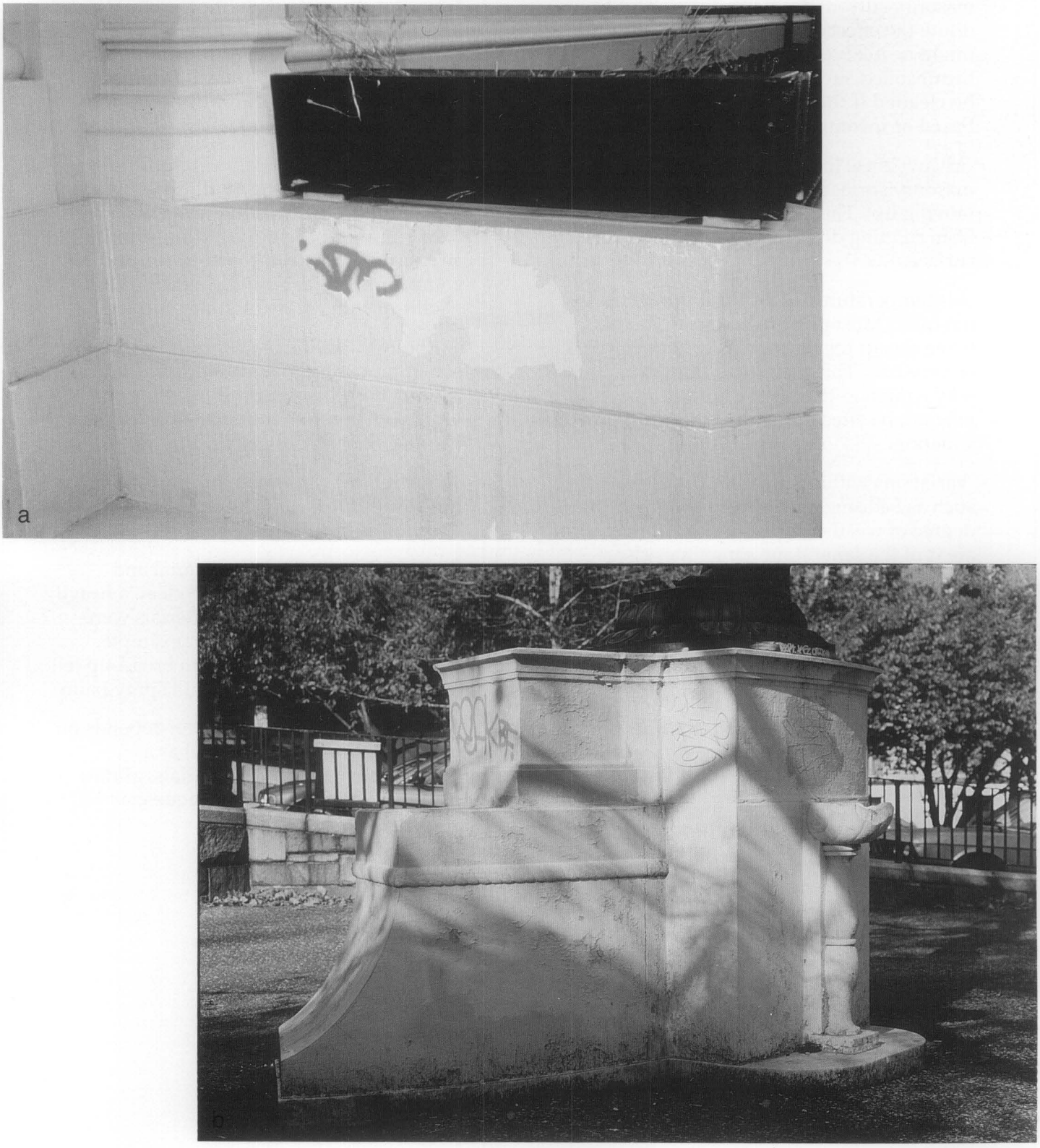


Figure 12. (a) Graffiti that was overpainted has been exposed here as a result of the coating's failure. The uneven edges where the overpainting has peeled away will make inconspicuous touch-up difficult. (b) The unsightliness of graffiti bleeding through layers of cracked and peeling paint makes an obvious point that using a pigmented coating was not an appropriate maintenance technique for this stone sculpture base. Photos: (a) Martin E. Weaver, (b) Judith M. Jacob.

Tips for Successful Graffiti Removal

- It is important to pre-wet the masonry surface when using an alkaline paint remover; it is also advisable to pre-wet the masonry surrounding a graffitied area to dilute the effect of any cleaning agents that might be inadvertently splashed or spilled on the unsoiled surface. **Do not wet the area to be cleaned if the cleaning agent is solvent-based or incompatible with water.**

- Always rinse the cleaning agent off the masonry surface starting at the bottom and moving up. This prevents the cleaning agent from running down and staining a lower surface.

- Air temperature can be a factor in graffiti removal. Most paint removers do not work when the air temperature is either very cold or very hot. This may sometimes explain why a method that worked in one instance may not be effective again in another, similar situation.

- Variations within the same type of stone, such as bedding planes, density, finish, or degree of weathering, may explain why some areas of the same stone sometimes clean better that others.

- Even if advance testing has been done and a treatment plan exists, at least some on-the-spot testing will probably be necessary.

- Mortar joints react differently from masonry units, and may require a different cleaning material and/or method to be cleaned effectively.

- Graffiti removal may result in an obviously "clean" spot. Always clean the entire masonry unit that is bounded by mortar joints (but not the joints themselves, unless necessary). The prominence of the clean spot may be minimized by fanning the cleaning out from the spot, and "feathering" it by gradually reducing the strength or thoroughness of the cleaning.

- If it is not possible to completely remove all traces of graffiti without removing some of the masonry surface, it may be preferable to leave the masonry alone. Some graffiti ghosts become less noticeable with time due to fading of the dyes used in paints and markers. Sometimes it may be possible to conceal more obvious graffiti ghosts with carefully-matched paint.

- After graffiti removal, the masonry surface should always be tested with pH strips to make sure all the cleaning materials have been completely removed. Non-staining pH strips, available from chemical supply companies, will indicate whether acids or alkalis remain on the masonry surface.

- Although alkaline paint removers are sometimes ineffective on modern formulations of aerosol paints, they can work well in removing multi-layered graffiti because they last longer.

- What removes graffiti in one instance may not always work again even in what appears to be an identical situation.

- More than one cleaning material and technique may be required to clean a heavily graffitied area if different materials were used to make the graffiti. For example, shapes are often outlined with broad-tip felt markers and then filled in with spray paint.

- Effective graffiti removal often depends on trial-and-error testing, as well as a knowledge of masonry materials, graffiti materials and cleaning techniques.

Suggestions for Removing Graffiti from Historic Masonry

Graffiti	Removal Method	Health and Safety Cautions
Pencil	1. *Erase* with non-abrasive **pencil eraser**. 2. *Wash* with **water and non-ionic detergent.** 3. *Rinse* with **water.**	None.
Chalk/Pastel (not wax or oil-base)	1. *Brush* off with **bristle brush.** 2. *Wash* with **water and non-ionic detergent.** 3. *Rinse* with **water.**	None.
Paint Spray (aerosol) Non-spray paint	1. *Poultice* with **paint remover*, organic solvent, or petroleum-based compound**.** 2. *Rinse* with **water, denatured alcohol or mineral spirits.** 3. *Wash* with **water and non-ionic detergent.** 4. *Rinse* with **water.**	+See cautions below for NMP, solvents and petroleum-based compounds. Wear proper respirator, gloves and eye protection.
Permanent (felt-tip) Marker	1. *Wash* with **water and non-ionic detergent,** if necessary. 2. *Poultice* with **bleach***, paint remover*, organic solvent** or **petroleum-based compound**.** 3. *Wash* with **water and non-ionic detergent.** 4. *Rinse* with **water.**	+See cautions below for NMP, solvents and petroleum-based compounds. Bleach is corrosive, causes chemical burns, and forms toxic gases (chlorine). Wear proper respirator, gloves and eye protection.
Water Soluble (felt-tip) Marker	1. *Wash* with **water and non-ionic detergent.** 2. *Poultice* with **bleach***.** 3. *Wash* with **water and non-ionic detergent.** 4. *Rinse* with **water.**	Bleach is corrosive, causes chemical burns, and forms toxic gases (chlorine). Wear proper respirator, gloves and eye protection.
Ballpoint Pen	1. *Erase* with **non-abrasive pencil eraser.** 2. *Poultice* with **organic solvent** or **petroleum-based compound**.** 3. *Wash* with **water and non-ionic detergent.** 4. *Rinse* with **water.**	+See cautions below for NMP, solvents and petroleum-based compounds. Wear proper respirator, gloves and eye protection.
Crayon Lipstick Shoe Polish	1. *Poultice* with **denatured alcohol, paint remover*** or **organic solvent**.** 2. *Wash* with **water and non-ionic detergent**. 3. *Rinse* with *water.*	+See cautions below for NMP, solvents and petroleum-based compounds. Wear proper respirator, gloves and eye protection.

* Paint Remover based on N-methyl-2-pyrrolidone (NMP).
** Organic Solvent such as acetone, lacquer-thinner, or petroleum-based compound such as dimethyl adipate.
*** Bleach such as calcium hypochlorite.
\+ N-methyl-2-pyrrolidone (NMP) is mildly toxic and may have adverse reproductive effects. Solvents and petroleum-based compounds have toxic vapors, are flammable, and require well-ventilated conditions.

These are *suggestions* to assist in graffiti removal. Methods should always be tested first under the supervision and guidance of an architectural conservator.

Summary

Although rapid graffiti removal is the most effective weapon in eliminating graffiti and preventing its recurrence in the same location, hasty, untested removal attempts can disfigure and cause harm to historic masonry. Thus, it is important that the owner or manager of a historic masonry building or structure be prepared with a plan to ensure the prompt removal of graffiti when it occurs. Regularly scheduled maintenance and cleaning programs to eliminate graffiti from historic masonry properties may be assisted by the installation of physical barriers, security systems and lighting, as well as increased community involvement. Successful graffiti removal from historic masonry requires knowledge of a variety of cleaning methods and materials, and an awareness that what works to remove graffiti from one kind of masonry surface may not remove it from another. By testing different cleaning methods in advance, treatment plans will be available, when needed, to provide guidance for safe and sensitive graffiti removal from historic masonry.

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This publication has been prepared pursuant to the National Historic Preservation Act of 1966, as amended, which directs the Secretary of the Interior to develop and make available information concerning historic properties. Comments on the usefulness of this publication may be directed to: Technical Preservation Services, Preservation Assistance Division, Center for Cultural Resource Stewardship and Partnerships, National Park Service, P.O. Box 37127, Washington, DC 20013-7127, or Technical Services Center, New York Landmarks Conservancy, 141 Fifth Avenue, NY, NY 10010. This publication is not copyrighted and can be reproduced without penalty. Normal procedures for credit to the author, the National Park Service, and the New York Landmarks Conservancy are appreciated.

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*The word *graffito (graffiti,* plural) — is derived from the old Italian diminutive of graffio — to scratch, and the Latin *graphire* — to write. *Graffiti* in contemporary usage has come to mean an inscription, drawings, or markings. Except in very formal or technical applications, *graffiti* is generally considered a "mass" noun and paired with a singular verb.

Cover Photograph: Sandstone gatepost, Springfield Armory National Historic Site, Springfield, Massachusetts. Photo: Judith M. Jacob.

SECTION 040120.63 –

BRICK MASONRY REPAIR

(Reference Preservation Briefs & Match Existing)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes repairing brick masonry, including replacing units.

1.2 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices."

1.3 DEFINITIONS

A. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and locations of replacement masonry units on the structure.
2. Show provisions for expansion joints or other sealant joints.

C. Samples: For each exposed product and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

A. Quality-control program.

1.6 QUALITY ASSURANCE

A. Brick Masonry Repair Specialist Qualifications: Engage an experienced brick masonry repair firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing masonry is insufficient experience for masonry repair work.

B. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.

C. Mockups: Prepare mockups of brick masonry repair to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation.

1. Masonry Repair: Prepare sample areas for each type of masonry repair work performed. If not otherwise indicated, size each mockup not smaller than two adjacent whole units or approximately 48 inches (1200 mm) in least dimension. Construct sample areas in locations in existing walls where directed by Architect unless otherwise indicated. Demonstrate quality of materials, workmanship, and blending with existing work.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

A. Face Brick: **As required to complete brick masonry repair work.**

1. Brick Matching Existing: Units with colors, color variation within units, surface texture, size, and shape that match existing brickwork.
    a. Physical Properties: According to ASTM C 67.
    b. For existing brickwork that exhibits a range of colors or color variation within units, provide brick that proportionally matches that range and variation rather than brick that matches an individual color within that range.
2. Special Shapes:
    a. Provide molded, 100 percent solid shapes for applications where core holes or "frogs" could be exposed to view or weather when in final position and where shapes produced by sawing would result in sawed surfaces being exposed to view.
    b. Provide specially ground units, shaped to match patterns, for arches and where indicated.
    c. Mechanical chopping or breaking brick, or bonding pieces of brick together by adhesive, are unacceptable procedures for fabricating special shapes.

B. Building Brick: ASTM C 62, Grade SW where in contact with earth or Grade SW, MW, or NW for concealed backup; and of same vertical dimension as face brick, for masonry work concealed from view.

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or Type II, except Type III may be used for cold-weather construction; **white gray, or both required for color matching of mortar.**

1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Masonry Cement: ASTM C 91/C 91M.

D. Mortar Cement: ASTM C 1329/C 1329M.

E. Mortar Sand: ASTM C 144.

1. Exposed Mortar: Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
2. Colored Mortar: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.

F. Mortar Pigments: ASTM C 979/C 979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.

G. Water: Potable.

2.3 MANUFACTURED REPAIR MATERIALS

A. Brick Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching brick masonry.

1. Use formulation that is vapor and water permeable (equal to or more than the masonry unit), exhibits low shrinkage, has lower modulus of elasticity than masonry units being repaired, and develops high bond strength to all types of masonry.
2. Formulate patching compound in colors and textures to match each masonry unit being patched.

2.4 ACCESSORY MATERIALS

A. Setting Buttons and Shims: Resilient plastic, nonstaining to masonry, sized to suit joint thicknesses and bed depths of masonry units, less the required depth of pointing materials unless removed before pointing.

B. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:
   1. Previous effectiveness in performing the work involved.
   2. Minimal possibility of damaging exposed surfaces.
   3. Consistency of each application.
   4. Uniformity of the resulting overall appearance.
   5. Do not use products or tools that could leave residue on surfaces.

2.5 MORTAR MIXES

A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.
   1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black which is limited to 2 percent.

C. Do not use admixtures in mortar unless otherwise indicated.

D. Mixes: Mix mortar materials in the following proportions:
   1. Rebuilding (Setting) Mortar by Type: ASTM C 270, Proportion Specification, **Type N** unless otherwise indicated; with cementitious material limited to **portland cement and lime, masonry cement, or mortar cement**.
   2. Pigmented, Colored Mortar: Add mortar pigments to produce exposed, setting (rebuilding) mortar of colors required.

PART 3 - EXECUTION

3.1 PROTECTION

A. Remove all items in the way, preventing proper review, required for scope of work and to be demolished; conduits, gutters, boxes, fans, door & windows, downspouts, brackets, clips, lights, etc. all affecting work adjacent to masonry. Store any items indicated to be used or re-installed, during masonry repair. Reinstall when repairs are complete.
   1. Provide temporary rain drainage during work to direct water away from building.

3.2 BRICK REMOVAL AND REPLACEMENT

A. Remove Bricks at locations indicated, soft, damaged, deteriorated, and or spalled. Carefully remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.

B. Support and protect remaining masonry that surrounds removal area.

C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.

D. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.

E. Remove in an undamaged condition as many whole bricks as possible.
   1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
   2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.

F. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for brick replacement.

G. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
   1. Maintain joint width for replacement units to match existing joints.

2. Use setting buttons or shims to set units accurately spaced with uniform joints.

H. Lay replacement brick with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. (30 g/194 sq. cm per min.) Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
   1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
   2. Rake out mortar used for laying brick before mortar sets according to Section 040120.64 "Brick Masonry Repointing." Point at same time as repointing of surrounding area.
   3. When mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.

I. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
   1. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.3 MASONRY UNIT PATCHING

A. Patching Bricks:
   1. Remove loose material from masonry surface. Carefully remove additional material so patch does not have feathered edges but has square or slightly undercut edges on area to be patched and is at least 1/4 inch (6 mm) thick, but not less than recommended in writing by patching compound manufacturer.
   2. Mask adjacent mortar joint or rake out for repointing if patch extends to edge of masonry unit.
   3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
   4. Rinse surface to be patched and leave damp, but without standing water.
   5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
   6. Place patching compound in layers as recommended in writing by patching compound manufacturer, but not less than 1/4 inch (6 mm) or more than 2 inches (50 mm) thick. Roughen surface of each layer to provide a key for next layer.
   7. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of masonry unit. Shape and finish surface before or after curing, as determined by testing, to best match existing masonry unit.
   8. Keep each layer damp for 72 hours or until patching compound has set.

3.4 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low pressure spray.
   1. Do not use metal scrapers or brushes.
   2. Do not use acidic or alkaline cleaners.

END OF SECTION 040120.63

SECTION 040120.64

BRICK & MASONRY REPOINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes repointing joints with mortar.

B. Base Bid: Contractor to include costs for full tuck-pointing (100%) at Buildings A & B (Travis School and Cafeteria)

C. Alternate Bid #1: Contractor to include costs for Unit Prices as described in Section -12200 “Unit Prices”.

1.2 UNIT PRICES

A. Work of this Section is affected by unit prices specified in **Section 012200 "Unit Prices."**

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at **Project site**.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

A. Quality-control program.

1.6 QUALITY ASSURANCE

A. Brick Masonry Repointing Specialist Qualifications: Engage an experienced brick masonry repointing firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing masonry is insufficient experience for masonry repointing work.

B. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.

C. Mockups: Prepare mockups of brick masonry repointing to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Repointing: Rake out joints in two separate areas, each approximately 36 inches (900 mm) high by 48 inches (1200 mm) wide, unless otherwise indicated, for each type of repointing required, and repoint one of the areas.

PART 2 - PRODUCTS

2.1 MORTAR MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or Type II, except Type III may be used for cold-weather construction; **white gray, or both where required for color matching of mortar**.

1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.
C. Masonry Cement: ASTM C 91/C 91M.
D. Mortar Cement: ASTM C 1329/C 1329M.
E. Mortar Sand: ASTM C 144.
   1. **Match size, texture, and gradation of existing mortar sand as closely as possible**. Blend several sands if necessary to achieve suitable match.
   2. Color: Provide natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.

F. Mortar Pigments: ASTM C 979/C 979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.
G. Water: Potable.

2.2 MORTAR MIXES

A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
   1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again, adding only enough water to produce a damp, unworkable mix that retains its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.
B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.
   1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black which is limited to 2 percent.
C. Do not use admixtures in mortar unless otherwise indicated.
D. Mixes: Mix mortar materials in the following proportions:
   1. Pointing Mortar by Type: ASTM C 270, Proportion Specification, **Type N** unless otherwise indicated; with cementitious material limited to **portland cement and lime masonry cement or mortar cement**. **Add mortar pigments to produce mortar colors required.**

PART 3 - EXECUTION

3.1 PROTECTION

A. Remove all items in the way, preventing proper review, required for scope of work and to be demolished; conduits, gutters, boxes, fans, door & windows, downspouts, brackets, clips, lights, etc. all affecting work adjacent to masonry. Store any items indicated to be used or re-installed, during masonry repair. Reinstall when repairs are complete.
   1. Provide temporary rain drainage during work to direct water away from building.

3.2 REPOINTING MASONRY

A. Rake out and repoint joints to the following extent:

1. All joints in areas indicated.
2. Joints indicated as sealant-filled joints. Seal joints according to Section 079200 "Joint Sealants."
3. Joints at locations of the following defects:

    a. Holes and missing mortar.
    b. Cracks that can be penetrated 1/4 inch (6 mm) or more by a knife blade 0.027 inch (0.7 mm) thick.
    c. Cracks **1/16 inch (1.6 mm)** or more in width and of any depth.
    d. Hollow-sounding joints when tapped by metal object.
    e. Eroded surfaces 1/4 inch (6 mm) or more deep.
    f. Deterioration to point that mortar can be easily removed by hand, without tools.
    g. Joints filled with substances other than mortar.

B. Do not rake out and repoint joints where not required.

C. Rake out joints as follows, according to procedures demonstrated in approved mockup:
1. Remove mortar from joints to depth of **2 times joint width**, but not less than **3/4 inch (20 mm)** or not less than that required to expose sound, unweathered mortar. Do not remove unsound mortar more than **2 inches (50 mm)** deep; consult Architect for direction.
2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
3. Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by Architect.

D. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.

E. Pointing with Mortar:
1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than **3/8 inch (9 mm)** until a uniform depth is formed. Fully compact each layer, and allow it to become thumbprint hard before applying next layer.
3. After deep areas have been filled to same depth as remaining joints, point joints by placing mortar in layers not greater than **3/8 inch (9 mm)**. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
6. Hairline cracking within mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

F. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

3.3 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, applied by low pressure spray.
   1. Do not use metal scrapers or brushes.
   2. Do not use acidic or alkaline cleaners.

END OF SECTION 040120.64

SECTION 04100

MORTAR AND MASONRY GROUT

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Mortar and grout for masonry, to match existing.

1.02 GENERAL
- A. All notes or specifications on structural drawings shall override any discrepancies listed.

1.03 SUBMITTALS
- A. Submit under provisions of the General Requirements.
- B. Include design mix, indicate whether the Proportion or Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.

1.04 QUALITY ASSURANCE
- A. Perform Work in accordance with ACI 530 and ACI 530.1 .

1.05 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle products to site under provisions of the General Requirements.
- B. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.06 ENVIRONMENTAL REQUIREMENTS
- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 MATERIALS
- A. Portland Cement: ASTM C150, Type I.
- B. Masonry Cement: ASTM C91, Type S.
- C. Premix Mortar: ASTM C387, Type S.
- D. Mortar Aggregate: ASTM C144, standard masonry type.
- E. Hydrated Lime: ASTM C207, Type S.
- F. Water: Clean and potable.
- G. Bonding Agent: Latex or Epoxy type.

2.02 MORTAR COLOR
- A. Mortar Color: Mineral oxide pigment; color to match adjacent CMU color, as selected by Architect.

2.03 MORTAR MIXES
- A. Mortar For Load Bearing Walls and Partitions: ASTM C270, Type M or S using the Property specification.
- B. Mortar For Non-Load Bearing Walls and Partitions: ASTM C270, Type M or S using the Property specification.
- C. Mortar For Engineered Masonry: ASTM C270, Type M or S using the Property specification.
- D. Pointing Mortar: ASTM C270, Type N or O using the Property specification.

2.04 MORTAR MIXING
- A. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Add mortar color and admixtures in accordance with manufacturer’s instructions. Provide uniformity of mix and coloration.
- D. Do not use anti-freeze compounds to lower the freezing point of mortar.
- E. If water is lost by evaporation, re-temper only within two hours of mixing.

F. Use mortar within two hours after mixing at temperatures of 90 degrees F (32 degrees C), or two-and-one-half hours at temperatures under 40 degrees F.

2.05 GROUT MIXES

A. Bond Beams, and Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; premixed type in accordance with ASTM C94.

B. Engineered Masonry: 3,000 psi strength at 28 days; 8-10 inches slump; premixed type in accordance with ASTM C94.

2.06 GROUT MIXING

A. Mix grout in accordance with ASTM C94.

B. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

C. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 EXECUTION

3.01 EXAMINATION

A. Request inspection of spaces to be grouted.

3.02 INSTALLATION

A. Install mortar and grout in accordance with premix mortar manufacturer's instructions.

B. Install mortar and grout in accordance with ASTM C270.

C. Work grout into masonry cores and cavities to eliminate voids.

D. Do not install grout in lifts greater than 16 inches or two CMU courses without consolidating grout by rodding.

E. Do not displace reinforcement while placing grout.

F. Remove excess mortar from grout spaces.

END OF SECTION 04100

SECTION 04300

UNIT MASONRY SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Concrete masonry or brick units.
- B. Reinforcement, anchorage, and accessories.

1.02 SUBMITTALS
- A. Submit under provisions of the General Requirements.
- B. Product Data: Provide data for masonry and brick units and fabricated wire reinforcement.

1.03 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect and handle products to site under provisions of the General Requirements.
- B. Accept units on site. Inspect for damage.

1.05 ENVIRONMENTAL REQUIREMENTS
- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.
- C. Hot Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Hot or Cold Weather Masonry Construction.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS
- A. Non-Load Bearing Block Units (CMU): ASTM C90, Light weight. Type I - Moisture Controlled.
- B. Size and Shape: Nominal modular size of 8 and 4 x 16 x 8 inches. Provide special units for 90 degree corners.
- C. Style and Color.
  1. Moisture controlled with coloring additive. Coloring to be determined by Architect.
  2. Provide as indicated on drawings:

2.02 REINFORCEMENT AND ANCHORAGE
- A. Single Wythe Joint Reinforcement: Truss type; steel wire, hot dip galvanized to ASTM A641 after fabrication, No. 9 side rods with No. 9 cross ties.
  1. Manufacturers:
     a. DUR-O-WALL
     b. TRU-MESH
     c. BET-R-WALL
- B. Reinforcing Steel: ASTM A615, 40 or 60 ksi yield grade, deformed billet bars, uncoated finish.
- C. Wall Ties: Formed steel wire, 3/16 inch thick, adjustable, hot dip galvanized to ASTM A123 steel finish.
  1. Manufacturers:
     a. DUR-O-WALL
     b. TRU-MESH
     c. BET-R-WALL

2.03 MORTAR AND GROUT
- A. Mortar and Grout: As specified in Section 04100.

2.04 FLASHINGS
- A. Plastic Flashings: Sheet polyvinyl chloride or polyethylene; 20 mil thick.
- B. Lap Sealant: Butyl type as specified in Section 07900.

2.05 ACCESSORIES

A. Preformed Control Joints: Rubber, Neoprene, Polyvinyl chloride material. Provide with corner and tee accessories, heat or cement fused joints.
B. Joint Filler: Closed cell polyvinyl chloride, polyethylene, polyurethane or rubber; oversized 50 percent to joint width; self expanding.
C. Building Paper: No. 30 asphalt saturated felt.
D. Nailing Strips: Softwood, preservative treated for moisture resistance, dovetail shape, sized to masonry joints.
E. Weeps: Preformed plastic cotton wick filled, or cotton rope.
F. Cavity Vents: Molded polyvinyl chloride grilles; insect resistant.
G. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.
B. Verify items provided by other sections of work are properly sized and located.
C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other sections.
B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.
B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
C. Concrete Masonry Units:
    1. Bond: Running unless otherwise indicated.
    2. Coursing: One unit and one mortar joint to equal 8 inches.
    3. Mortar Joints: Concave, unless noted otherwise.
D. Brick Units:
    1. Bond: Running, unless noted otherwise.
    2. Coursing: Three units and three mortar joints to equal 8 inches.
    3. Mortar Joints: Concave, unless noted otherwise.

3.04 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
B. Lay hollow masonry units with face shell bedding on head and bed joints.
C. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
D. Remove excess mortar as work progresses.
E. Interlock intersections and external corners.
F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
H. Cut mortar joints flush where wall tile is scheduled, resilient base is scheduled, cavity insulation vapor barrier adhesive is applied, or bitumen damp proofing is applied.
I. Isolate masonry partitions from vertical structural framing members with a control joint.
J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.05 WEEPS

A. Install weeps in veneer at 32 inches oc horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

3.06 CAVITY WALL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weeps.
B. Build inner wythe ahead of outer wythe to receive cavity insulation and air/vapor barrier adhesive.

3.07 REINFORCEMENT AND ANCHORAGE

A. Install horizontal joint reinforcement 16 inches oc.
B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
C. Place joint reinforcement continuous in first and second joint below top of walls.
D. Lap joint reinforcement ends minimum 6 inches.
E. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
F. At masonry veneer, embed wall ties in masonry back-up to bond veneer at maximum 16 inches oc vertically and 36 inches oc horizontally. Place at maximum 3 inches oc each way around perimeter of openings, within 12 inches of openings.

3.08 MASONRY FLASHINGS

A. Extend flashings horizontally at foundation walls, above ledge or shelf angles and lintels, under parapet caps, and at bottom of walls.
B. Turn flashing up minimum 8 inches and bed into mortar joint of masonry, seal to concrete, seal or underlap at sheathing over framed back-up.
C. Lap end joints minimum 6 inches and seal watertight.
D. Turn flashing, fold, and seal at corners, bends, and interruptions.

3.09 GROUTED COMPONENTS

A. Reinforce bond beam as indicated or detailed.
B. Lap splices minimum 24 bar diameters.
C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
D. Place and consolidate grout fill without displacing reinforcing.
E. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.10 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control and expansion joints.
B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
C. Size control joint in accordance with Section 07900 for sealant performance.
D. Form expansion joint as detailed.

3.11 BUILT-IN WORK

A. As work progresses, install built-in metal door and glazed frames, fabricated metal frames, window frames, wood nailing strips, fireplace accessories, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.
B. Install built-in items plumb and level.
C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
D. Do not build in organic materials subject to deterioration.

3.12 TOLERANCES

A. Maximum Variation From Alignment of Columns: 1/4 inch.
B. Maximum Variation From Unit to Adjacent Unit: 1/32 inch.
C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.13 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.14 CLEANING

A. Remove excess mortar and mortar smears as work progresses.
B. Replace defective mortar. Match adjacent work.
C. Clean soiled surfaces with cleaning solution.
D. Use non-metallic tools in cleaning operations.

3.15 PROTECTION OF FINISHED WORK

A. Protect finished Work.

B. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION 04300

PRESERVATION BRIEFS 42

The Maintenance, Repair and Replacement of Historic Cast Stone

- An Imitative Building Material with Many Names
- History of Use and Manufacture
- Mechanisms and Modes of Deterioration
- Maintenance of Cast Stone Installations
- Methods of Repair
- Replacement of Historic Cast Stone Installations
- Appropriateness of GFRC as a Replacement Material

An Imitative Building Material with Many Names

The practice of using cheaper and more common materials on building exteriors in imitation of more expensive natural materials is by no means a new one. In the eighteenth century, sand impregnated paint was applied to wood to look like quarried stone. Stucco scored to simulate stone ashlar could fool the eye as well. In the 19th century, cast iron was also often detailed to appear like stone. Another such imitative building material was "cast stone" or, more precisely, precast concrete building units.

Cast stone was just one name given to various concrete mixtures that employed molded shapes, decorative aggregates, and masonry pigments to simulate natural stone. The basic mixtures included water, sand, coarse aggregate, and cementing agents. Natural cements, portland cements, oxychloride cements, and sodium silicate based cements were all used as binding agents. The differences in the resulting products reflected the different stone aggregates, binding agents, methods of manufacture and curing, and systems of surface finishing that were used to produce them. Versatile in representing both intricately carved ornament and plain blocks of wall ashlar, cast stone could be tooled with a variety of finishes.

During a century and a half of use in the United States, cast stone has been given various names. While the term "artificial stone" was commonly used in the 19th century, "concrete stone," "cast stone," and "cut cast stone" replaced it in the early 20th century. In addition, Coignet Stone, Frear Stone, and Ransome Stone were all names of proprietary systems for pre-cast concrete building units, which experienced periods of popularity in different areas of the United States in the 19th century. These systems may be contrasted with "Artistic Concrete," decorative molded concrete construction, both precast and cast-in-place, which made little effort to simulate natural stone.

Having gained popularity in the United States in the 1860s, cast stone had become widely accepted as an economical substitute for natural stone by the early decades of the 20th century. Now, it is considered an important historic material in its own right with unique deterioration problems that require traditional, as well as innovative solutions. This Preservation Brief discusses in detail the maintenance and repair of historic cast stone-precast concrete building units that simulate natural stone. It also covers the conditions that warrant replacement of historic cast stone with appropriate contemporary concrete products and provides guidance on their replication. Many of the issues and techniques discussed here are relevant to the repair and replacement of other precast concrete products, as well.

History of Use and Manufacture

Early Patented Systems

While some use of cast stone may be dated to the Middle Ages, more recent efforts to replicate stone with cementitious materials began in England and France at the end of the 18th century. Coade Stone, one of the best known of the early English manufactures, was used for architectural ornament and trim, and saw limited use for interior decoration in the United States as early as 1800. Significant advances in the artificial stone industry in the United States were tied to the production of natural cement or hydraulic lime, which began about 1820.

A large number of patented American, English, and French systems were marketed immediately after the Civil War. One of the earliest American patents for cast stone was awarded to George A. Frear of Chicago in 1868. Frear Stone was a mixture of natural cement and sand, to which a solution of shellac was added to provide initial curing strength. Frear's system was widely licensed around the country, and the resultant variation in materials and manufacturing methods apparently resulted in some significant failures.

Another product which utilized natural cement as its cementing agent was Beton Coignet (literally, "Coignet concrete," also known as "Coignet Stone"). Francois Coignet was a pioneer of concrete construction in France. He received United States patents in 1869 and 1870 for his system of pre-cast concrete construction, which consisted of portland cement, hydraulic lime, and sand. In the United States the formula was modified to a mix of sand with Rosendale Cement (a high quality natural cement manufactured in Rosendale, Ulster County, New York). In 1870 Coignet's U.S. patent rights were sold to an American, John C. Goodrich, Jr., who formed the New York and Long Island Coignet Stone Company. This company fabricated the cast stone for one of the earliest extant cast stone structures in the United States, the Cleft Ridge Span in Prospect Park, Brooklyn, New York.
Some proprietary systems substituted other cements for the portland cement or hydraulic lime. The British patent process of Frederick Ransome utilized a mixture of sand and sodium silicate, combined with calcium chloride, to form blocks of calcium silicate. The sodium chloride by-product was intended to be removed with water washes during the curing process. The Sorel cement process, developed in 1853 and later applied to the manufacture of grindstones, tiles, and cast stone for buildings, combined zinc oxide with zinc chloride, or magnesium oxide and magnesium chloride, to form a hydrated oxychloride cement mixture that bound together sand or crushed stone. The Union Stone Company in Boston manufactured cast stone using the Sorel process. Ultimately, however, alternate cementing systems were abandoned in favor of portland cement, which proved to be more dependable and less expensive.

Late 19th and 20th Century Development

The use of cast stone grew rapidly with the extraordinary development of the portland cement and concrete industries at the end of the 19th century. In the early decades of the 20th century, cast stone became widely accepted as an economical substitute for natural stone. It was sometimes used as the only exterior facing material for a building, but was more often used as trim on a rock-faced natural stone or brick wall.
In most early 20th century installations, cast stone was used for exterior window and door surrounds or lintels, copings, parapets and balustrades, banding courses, cornices and friezes, and sculptural ornament. On occasion, decorative interiors were also finished with cast stone, although elaborate interior cornices and ornaments were more frequently fabricated of plaster.

Manufacture

Manufacturers of cast stone used graded mixes of crushed marble, limestone, granite, and smelting slag to produce a variety of stone effects. A light cement matrix with an aggregate of crushed marble could replicate limestone, while a mix of marble and small amounts of smelting slag would give the effect of white granite. Some manufacturers added masonry pigments and varied colors on the faces of the stone to give a somewhat stylized effect of variegated sandstone. Each manufacturer prepared a variety of stock mixes as well. Not surprisingly, aggregates varied in different localities. In New York State, for example, crushed Gouverneur and Tuckahoe marbles were popular facing aggregates; in other areas crushed feldspar or granite and even silica sand were commonly used.
The two basic cast stone production systems were "dry tamp" and "wet cast." The dry tamp process employed a stiff, low slump concrete mix that was pressed and compacted into the molds. The decorative aggregate mix was frequently distributed only on the exterior facing of the cast units (typically 3/4" to 1 Ω" thick,) while the cores of the units were common concrete. Because of the stiff mix, dry tamp units required a relatively short period of time in the molds, which could then be used several times a day. After removal from the molds, the dry tamp units were often cured in steam rooms to assure proper hydration of the cement. The wet cast process, on the other hand, used a much more plastic concrete mix that could be poured and vibrated into the molds. This system used significantly more water in the mix, assuring proper hydration of the cement mix without elaborate curing, but requiring that the units be left in the molds for at least a day. Because of this method of fabrication, wet cast products necessarily distributed their decorative aggregate mix through the entire unit, rather than simply an outer facing.
Concrete was cast in molds of wood, plaster, sand and, early in the 20th century, even hide glue or gelatin, depending upon the production method, the intricacy of the piece to be cast, and the number of units to be manufactured. Metal molds were sometimes used for stock ornamental items, less frequently for custom architectural work. When the units were adequately hard, finish surfaces were worked to expose the decorative stone aggregate. When removed from the mold, wet cast units exhibit a surface film of cement paste, which must be removed to expose the aggregate. Partially cured units could be sprayed with water, rubbed with natural bristle brushes, etched with acid, or sandblasted to remove the cement layer. The surface of dry tamp products required less finishing.

High quality cast stone was frequently "cut" or tooled with pneumatic chisels and hammers similar to those used to cut natural stone. In some cases, rows of small masonry blades were used to create shallow parallel grooves similar to lineal chisel marks. The results were often strikingly similar in appearance to natural stone. Machine and hand tooling was expensive, however, and simple molded cut cast stone was sometimes only slightly less costly than similar work in limestone. Significant savings could be achieved over the cost of natural stone when repetitive units of ornate carved trim were required.

Finally, cast stone is sometimes today used to replace natural stone when the original historic stone is no longer available, or the greater strength of reinforced concrete is desired. Reinforced cast stone columns, for instance, are frequently used to replace natural stone columns in seismic retrofits of historic structures. Fine-grained stones, such as sandstones, may be very successfully replicated with cast stone. Coarse-grained granites and marbles with pronounced patterns or banding are, for obvious reasons, not so successfully matched with cast stone. The replacement of natural stone with cast stone requires careful attention to selection of fine aggregates and the pigmentation of the cementing matrix. Coarse aggregate, which is generally used in cast stone to control shrinkage and assure adequate compressive strength, can present an aesthetic problem if it is visible at the surface of cast stone elements which simulate sandstone. Careful control of aggregate sizes in the mix formulation can reduce this problem.

Mechanisms and Modes of Deterioration

The best historic cast stone can rival natural stone in longevity. Many quality cast stone installations from the first decades of the twentieth century are still in excellent condition, and require little repair. Like any other building material, however, cast stone is subject to deterioration, which may occur in several ways:

- Separation of the facing and core layers
- Deterioration of the aggregate
- Deterioration or erosion of the cementing matrix
- Deterioration of the iron or steel reinforcement
- Deterioration of cramps and anchors used in its installation.

Separation of the Facing and Core Layers

Separation of the facing and core layers of dry tamp units is not uncommon, and often reflects fabrication defects such as poor compaction, lengthy fabrication time, or improper curing. Where separation of facing and core layers is suspected, cast stone units may be "sounded" to establish the extent of delamination.

Deterioration of the Aggregate

Cast stone failure caused by deterioration of the aggregate is uncommon. Granites, marbles, and silica sand are generally durable, although limestone and marble aggregate are subject to the same dissolution problems that affect quarried units of these stones. In rare instances, a reaction between the alkalis in the cement matrix and the stone aggregate may also cause deterioration.

Deterioration or Erosion of the Cementing Matrix

While it is relatively uncommon in twentieth century cast stone, serious deterioration of the cementing matrix can cause extensive damage to cast stone units. A properly prepared cementing mix will be durable in most exterior applications, and any flaking of exterior surfaces signals problems in the cementing mix and in the method of manufacture. The use of poor quality or improperly stored cement, impure water, or set accelerators can cause cement problems to occur years after a structure is completed. Improper mixing and compaction can also result in a porous concrete that is susceptible to frost damage and scaling. Severe cement matrix problems may be impossible to repair properly and often necessitate replacement of the deteriorating cast stone units.

More common and less serious than flaking or scaling caused by deterioration of the cementing matrix is the erosion of the surface of the matrix. This usually occurs on surfaces of projecting features exposed to water runoff, such as sills, water tables, and window hoods. In these areas, the matrix may erode, leaving small grains of aggregate projecting from the surface. The resultant rough surface is not at all the intended original appearance. In some historic cast stone installations, the thin layer of cement and fine sand at the surface of the cast stone units was not originally tooled from the molded surface, but was finished with patterns of masonry pigments in a stylized imitation of highly figured sandstones or

limestones. Erosion of the pigmented surface layer on this type of cast stone results in an even more dramatic change in appearance.

Deterioration of the Iron or Steel Reinforcement

During their original manufacture, unusually long and thin cast stone units, such as window sills or balustrade railings, and units requiring structural capacity, such as lintels, were generally reinforced with mild steel reinforcing bars. Large pieces sometimes had cable loops or hooks cast into them to facilitate handling and attachment. On occasion, this reinforcement and wire may be too close (less than 2") to the surface of the piece and rusting will cause spalling of the surface. This frequently happens to sills, copings, and water tables where repeated heavy wetting leads to loss of alkalinity in the concrete, allowing the reinforcement to rust. If damage from the deteriorating reinforcement is extensive, as for instance, the splitting of a baluster from the rusting of a central reinforcing rod, the cast stone unit may require replacement.

Deterioration of Cramps and Anchors

Even when reinforcement has not been added to individual cast stone units, mild steel cramps may have been used to anchor a cast stone veneer to backup masonry. Where spalls have occurred primarily at the tops of ashlar or frieze units, this is generally the cause.

Maintenance of Cast Stone Installations

Cleaning

Cast stone installations with marble or limestone aggregates may sometimes be cleaned with the same alkaline pre-wash/acid afterwash chemical cleaning systems used to clean limestone and other calcareous natural stones. If no marble or limestone aggregates are present, acidic cleaners, such as those used for natural granites and sandstones, may be used.

In either case, dark particulate staining in protected areas may be persistent, however, and require experimentation with other cleaning methods. Some micro-abrasive cleaning techniques used under very controlled circumstances by skilled cleaning personnel can be appropriate for removing tenacious soiling. Ordinary sand blasting or wet grit blasting can seriously damage the surface of the cast stone and should not be used.

Repointing

Early cast stone installations may have been constructed with natural cement mortars, but in late nineteenth century and twentieth century installations, cast stone units were generally bedded and pointed with mortars composed of portland cement, lime, and sand. When repointing or replacement of the historic mortar is required, a Type N mortar (about one part cement, and one part lime to six parts of sand) is generally appropriate. When repointing any historic masonry, it is important to match both the character and color of the sand and color of the cement matrix in the historic mortar. Cement matrix color can often be adjusted by using combinations of white, "light," and gray portland cement in the mortar.

Joints in historic cast stone installations can be quite thin and the dense mortar thus difficult to remove. Unnecessary repointing can cause significant damage to historic cast stone. Cracked and open joints will most often be found on exposed features such as balustrades and copings and, of course, require repointing. When a hard and tenacious mortar was used in the original installation or a later repointing, the removal of the mortar can easily chip the edges of the cast stone units.

While the careless use of "grinders" to remove mortar has damaged countless historic masonry buildings, a skilled mason may sometimes use a hand held grinder fitted with a thin diamond blade to score the center of a joint, and then remove the rest of the mortar with a hand chisel. If this method is not done carefully, however, wandering of the blade can widen or alter joints and cause significant damage to the cast stone. Care must be taken to prevent damage from over cutting of vertical joints by stopping blades well short of adjacent units. The use of small pneumatic chisels, such as those used to tool stone, can also work well for mortar removal, but even this method can cause chipping to the edges of cast stone units if it is not done carefully.

Methods of Repair

Much historic cast stone is unnecessarily replaced when it could easily be repaired in situ, or left untreated. This is especially true of areas that exhibit isolated spalls from rusting reinforcement bars or anchorage, or installations where erosion of the matrix has left a rough surface of exposed aggregate. The weathering of cast stone, while different from that of natural stone, produces a patina of age, and does not warrant large-scale replacement, unless severe cement matrix problems or rusting reinforcement bars have caused extensive scaling or spalling. Severe rusting of reinforcement bars on small decorative features, such as balusters, may signal carbonation (loss of alkalinity) of the matrix. Where carbonation of the matrix has occurred, untreated reinforcement will continue to rust. Replacement may be an acceptable approach for exposed and severely deteriorated features, such as hand railings, roof balustrades, or wall copings, where disassembly is unlikely to damage adjacent construction. Conversely, small areas of damage should generally be repaired with mortar "composites," or left alone.

Re-securing Separated Surface Facing

Where the decorative facing of dry tamped cast stone has separated from core layers, injected grouts may be used to re-secure the facing. Re-attachment of a separated facing layer may be time consuming, and should be undertaken by a conservator, rather than a mason. This technique may be the best, most economical, approach for repair of figurative sculpture or unique elements that are not repeated elsewhere on a building. Theoretically, cementitious grouts are most appropriate for re-attaching separated facings, but hairline fissures may require the use of resin adhesives. Low-viscosity epoxies have been used for this purpose, and may be applied through small injection ports. Cracks that would allow adhesive to leak must be repaired prior to injection, of course. Holes made for adhesive injection will require patching after re-attachment is complete.

Repairing Reinforcement Spalls and Mechanical Damage

Drilled holes, mechanically damaged corners, and occasional spalls from rusting reinforcement bars and anchorage are repairable conditions that do not warrant the replacement of cast stone. Small "composite " repairs to damaged masonry units can be made with mortar formulated to visually match the original material, and may be successfully undertaken by a competent and sensitive mason. If deterioration appears widespread, however, or if large surface areas are spalling or cracking and replacement appears necessary, the owner may wish to consult a preservation architect or consultant to determine the cause of deterioration and to specify necessary repairs or replacement, as appropriate.

The methods of composite repair used for stone masonry are also generally applicable for the repair of historic cast stone. For repairs to damaged cast stone to be successful, however, both the cement matrix color and the aggregate size and coloration must match that of the historic unit. Crushed stone and slag (such as "Black Beauty" abrasive grit), which are similar to many common traditional aggregates, are widely available, although some additional crushing and/or sieving may be necessary to obtain aggregate of an appropriate size. Remember that half or more of a weathered surface is exposed aggregate, so careful aggregate selection and size grading is extremely important for patching. Even differences in aggregate angularity (rounded pebbles vs. crushed stone) will be noticeable in the final repair. If more than one aggregate was used in the cast stone, the ratio of the selected aggregates in the mix is, of course, equally important. Variation in coloring of the cement matrix may be achieved through the use of either white, "light, " or gray portland cement. If additional tinting is required, only inorganic alkali-resistant masonry pigments should be used. Because most historic cast stone was manufactured primarily from portland cement and aggregate (with a less than 15% lime/cement ratio), it is not necessary to add large amounts of hydrated lime to cast stone composite repair mixtures. Small amounts of lime may be added for plasticity of the working mix.

To repair a spall caused by deterioration of a ferrous reinforcement bar or anchorage, it is necessary to remove all cracked concrete adjacent to the spall; grind and brush the reinforcement to remove all rust and scale; and paint the metal with a rust-inhibiting primer prior to applying the cast stone composite. If the reinforcement bar is much too close to the surface of the stone, it may be advisable to cut out the deteriorating section of reinforcement after consultation with a structural engineer. If deteriorating cramps are removed, it may be necessary to install new stainless steel anchorage.

Where spalls have a feather edge, it will be necessary to cut back the repair area to a uniform depth (1/2" or more). As with natural stone composite repairs, a bonding agent may assist adhesion of the repair material to the original concrete. For unusually large or deep patches, mechanical anchoring of the repair with small nylon or stainless steel rods may be required. If the adjacent cast stone is tooled or

weathered, it will be necessary to scribe or brush the repaired area to give it a matching surface texture. Adding enough coarse aggregate to match adjacent original material will sometimes interfere with adhesion of the composite, and it may be necessary to press additional aggregate into the applied patch prior to finishing. If this is not skillfully done, however, the surface of the patch may take on a mosaic appearance. For this reason, it is advisable to undertake test composite repairs in an unobtrusive location first.

Surface Refinishing

While re-tooling of deteriorated natural stone may sometimes be appropriate, restoring the original appearance of cast stone where surface erosion has occurred is difficult or impossible.
Tooling or grinding of the surface of the cast stone may expose coarse aggregate beneath the surface and will not, in any case, restore original patterned pigmentation that has weathered away. Silicate paints or masonry stains may be applied in patterns to replicate the original appearance, but may not be durable or completely successful aesthetically. Where matrix has eroded, it is advisable to accept the weathered appearance of the cast stone, unless extensive replacement is mandated by other factors. Because cast stone depends on exposed aggregate to achieve its aesthetic effect, the use of an applied cementitious surface coating dramatically alters the visual effect of the material and is inappropriate as a cast stone repair technique. A cementitious surface coating can also trap moisture in the cast units and cause surface spalling.

Replacement of Historic Cast Stone Installations

Individual cast stone units, which are subject to repeated wetting (such as copings, railings and balusters) and exhibit severe failure due to spalling or reinforcement deterioration, may require replacement with new cast stone and can replicate deteriorated units in existing buildings.
Fortunately, a number of companies custom manufacture precast concrete units. The variables involved in manufacture are considerable, and it is wise to use a firm with experience in ornamental and custom work rather than a precast concrete firm which manufactures stock structural items, concrete pipe, or the like. Several trade organizations, including the Cast Stone Institute, the National Precast Concrete Association, and the Architectural Precast Association, have developed recommendations and/or guide specifications for the manufacture of cast stone and precast concrete. These specifications set standards for characteristics such as compressive strength and water absorptivity, and discuss additives such as air entraining agents and water reducing agents, which influence the longevity of new cast stone. Trade references and guide specifications should be consulted before contracting for replacement of historic cast stone.
Fabrication defects in new cast stone. While the cement matrix coloration and aggregate considerations previously mentioned require the most careful attention, project staff should also look for defects which are common to cast stone fabrication:

Air bubbles. Small pits on the surface of the stone may form if the unit is not given adequate vibration to release trapped air during pouring. Bubbles can also be a problem when end casting long items such as columns or railings, where it is difficult to vibrate bubbles away from the finish surface of the unit.

Surface cracking or checking. Overly wet mixes and insufficient moisture during curing can result in surface cracking of large castings, such as columns. Such cracking dramatically reduces the durability of new cast stone. Small reinforced elements, such as balusters, also frequently crack at thin "necks" in the castings.

Aggregate segregation. Cast stone formulations generally include a range of coarse aggregates (crushed stone) and fine aggregates (sand). When units are vibrated to assure compaction of the mix and liberate trapped air bubbles, coarse aggregates may begin to settle and separate from the paste of cement and sand. Aggregate segregation results in a visible concentration of coarse aggregate at one end of the casting. Segregation is more problematic when end casting long pieces such as columns.

Surface rippling or irregularity. Production molds for fabrication are often made of rubber mold facings encased in larger "mother molds" of plaster and wood. Vibration can loosen the rubber facing from the outer mold and result in rippling or irregularities on the surface of the finished casting. Even when rippling is not noticeable, irregularity caused by mold movement can make it difficult to line up surfaces of adjacent units when assembling cast stone installations.

Mold lines. Freestanding elements, such as columns, must be cast in two-part molds, which are separated to release the completed cast piece. If the mold parts do not join tightly, some leakage of cement paste will occur at the mold joint, resulting in a projecting line on the surface of the casting. This is generally tooled off before the casting completely cures. A mold line will be visible on the completed piece if the projecting material is not completely removed, or if the tooling at the mold line does not match the adjacent surface of the casting. Tooling at mold lines may also expose contrasting coarse aggregate beneath the surface of the casting.

Other Considerations for Replacement of Cast Stone

Several other considerations are worth noting when it is necessary to replace historic cast stone elements with matching new cast stone.

Reinforcement. The alkalinity of new concrete generally provides adequate protection to steel reinforcement. In exposed areas where deterioration due to rusting of reinforcement has previously been a problem, however, the use of stainless steel reinforcement is recommended.

Surface finishing. Post-fabrication surface tooling of new cast stone is not currently common. Sandblasting is typically used to remove the surface film of cement and expose the aggregate. For replacement units replicating historic cast stone pieces in highly visible locations, it is sometimes possible to make a mold of a sound or repaired existing piece to incorporate the original tooling in the casting process. If the historic unit is too deteriorated to use as a pattern, a plaster model may be made to replicate the damaged piece. This is tooled to replicate the desired surface treatment or appearance, and a production mold is then made from the plaster model.

Moist curing. Surface crystallization of soluble salts (efflorescence) during curing may lighten the surface of some precast units, especially those simulating darker stone. Some manufacturers use a series of wet/dry curing cycles or washing with acetic acid to remove soluble salts that might otherwise discolor finished surfaces. For most wet cast products, simple moist curing under a plastic cover is sufficient.

Appropriateness of Glass Fiber Reinforced Concrete as a Replacement Material

Light-Weight Alternative

GFRC is sometimes used to replicate deteriorated elements of cast or fine grained natural stone. Because the GFRC element is a rigid, but relatively thin shell, it must be supported and attached with an interior framework of steel.

The attachment hardware inside this GFRC cartouche (left) will not be visible when the unit is installed (armature visible at right). Photos: Towne House Restorations, Inc

Glass fiber reinforced concrete (GFRC) is more and more frequently encountered in building restoration and is used to replicate deteriorated stone and cast stone, and even architectural terra cotta. This is a relatively new material that uses short chopped strands of glass fiber to reinforce a matrix of sand and cement. GFRC has become a popular low cost alternative to traditional precast concrete or stone masonry for some applications. Fabricators use a spray gun to spray the mortar-like mix into a mold of the shape desired. The resulting concrete unit, typically only æ" thick, is quite rigid, but requires a metal frame or armature to secure it to the building substrate. The metal frame is joined to the GFRC unit with small "bonding pads" of GFRC. GFRC has a dramatic advantage over traditional precast concrete where the weight of the installation is a concern, such as with cornices or window hoods. Many cast stone mixes can successfully be replicated with GFRC. Where it is used to simulate natural stone, GFRC, like cast stone, is most appropriate for simulation of fine-grained sandstones or limestones.

Not for Use in Load Bearing Applications

Because the GFRC system is in effect a "skin," GFRC cannot be used for load bearing applications without provision of additional support. This makes it unsuitable for some tasks such as replacement of individual ashlar units. It is also not appropriate for small freestanding elements such as balusters, or for most columns, unless they are engaged to surrounding masonry or can be vertically seamed, which may significantly alter the historic appearance. GFRC units must also allow for expansion and contraction, and are generally separated by sealant joints, not by mortar. A sealant joint may be unacceptable for

some historic applications; however, substitution of GFRC for cast stone may be appropriate when an entire assembly, such as a cornice, roof dormer, or window hood, requires replacement. Great care must be taken when detailing a GFRC replacement for existing cast stone.

Deterioration of GFRC

Because it is a relatively new material, the long term durability of GFRC is still untested. When GFRC was first introduced, some installations experienced deterioration caused by alkaline sensitivity of the glass fiber reinforcement. Alkali resistant glass is now used for GFRC manufacture. Even when the GFRC skin is well manufactured, however, the steel armature and bonding pad system used to mount the material is vulnerable to damage from leakage at sealant joints or small cracks in wash surfaces. The use of galvanized or stainless steel armatures, and stainless steel fasteners and bonding pad anchors is advisable.

Summary and References

Cast stone-a mixture of water, sand, coarse aggregate, and cementing agents—has proven over time to be an attractive and durable building material, when properly manufactured. It gained popularity in the 1860s and, by the early decades of the 20th century, became widely accepted as an economical substitute for natural stone. Unfortunately, much historic cast stone is unnecessarily replaced when it could easily be repaired and preserved in situ, or left untreated. Appropriate repair of damaged units can extend the life of any cast stone installation. Because of the necessity of matching both matrix color and aggregate size and ratio, conservation projects which involve repair or replication of cast stone should allow adequate lead time for the assembly of materials and the preparation of test samples. Understanding which conditions require repair, which warrant replacement, and which should be accepted as normal weathering is key to selecting the most appropriate approach to the protection and care of historic cast stone.

SECTION 047200

CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cast-stone trim.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For cast-stone units, include dimensions and finishes.

B. Shop Drawings: Show fabrication and installation details for cast-stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

C. Samples:
   1. For each color and texture of cast stone required.
   2. For colored mortar.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast-stone units similar to those indicated for this Project that has sufficient production capacity to manufacture required units, and is a plant certified by **the Cast Stone Institute the Architectural Precast Association or the Precast/Prestressed Concrete Institute for Group A**.

PART 2 - PRODUCTS

2.1 CAST-STONE UNITS

A. Cast-Stone Units: Comply with ASTM C 1364.
   1. Units shall be manufactured using the **vibrant dry tamp** or **wet-cast** method to best match existing.
   2. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

B. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
   1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
   2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
   3. Provide drips on projecting elements unless otherwise indicated.

C. Cure Units as Follows:
   1. Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F (38 deg C) for 12 hours or 70 deg F (21 deg C) for 16 hours.
   2. Keep units damp and continue curing to comply with one of the following:
      a. No fewer than five days at mean daily temperature of 70 deg F (21 deg C) or above.

D. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

E. Colors and Textures: **Match existing units**.

2.2 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from **steel complying with ASTM A 36/A 36M and hot-dip galvanized to comply with ASTM A 123/A 123M**.

B. Dowels: 1/2-inch- (12-mm-) diameter round bars, fabricated from **steel complying with ASTM A 36/A 36M and hot-dip galvanized to comply with ASTM A 123/A 123M**.

C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast-stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.3 MORTAR

A. Comply with requirements in Section 042000 "Unit Masonry" for mortar mixes.
   1. For setting mortar, use **Type N**.
   2. For pointing mortar, use **Type N**.

B. Pigmented Mortar: Use colored cement product **or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products**.

2.4 SOURCE QUALITY CONTROL

A. Engage a qualified independent testing agency to sample and test cast-stone units according to ASTM C 1364.
   1. Include one test for resistance to freezing and thawing.

PART 3 - EXECUTION

3.1 SETTING CAST STONE IN MORTAR

A. Install cast-stone units to comply with requirements in Section 042000 "Unit Masonry."

B. Set units in full bed of mortar with full head joints unless otherwise indicated.
   1. Fill dowel holes and anchor slots with mortar.
   2. Fill collar joints solid as units are set.
   3. Build concealed flashing into mortar joints as units are set.
   4. Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant.
   5. Keep joints at shelf angles open to receive sealant.

C. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

D. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

E. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness. **Match Existing**

F. **Where indicated**, Rake out joints for pointing with sealant to depths of not less than 3/4 inch (19 mm). Scrub faces of units to remove excess mortar as joints are raked.

G. Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.
   1. Keep joints free of mortar and other rigid materials.
   2. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.2 SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS

A. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
   1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
   2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.

B. Fill anchor holes with sealant.
   1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.

C. Set cast stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.

D. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch (1.5 mm), except where variation is due to warpage of units within tolerances specified.

3.4 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.
   1. Remove mortar fins and smears before tooling joints.
   2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
   3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
   5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
   6. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 047200

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Structural steel framing members and support members.
B. Base plates.
C. Grouting under base plates.

1.02 GENERAL
A. All notes or specifications on structural drawings shall override any discrepancies listed.

1.03 SUBMITTALS
A. Submit under provisions of the General Requirements.
B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, and locations of structural members, openings, attachments and fasteners.
   2. Connections and Connections not detailed.
   3. Cambers, and loads.
   4. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.
C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.04 QUALITY ASSURANCE
A. Fabricate structural steel members in accordance with AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
B. Perform Work in accordance with AISC - Specification for Architectural Exposed Structural Steel.

1.05 QUALIFICATIONS
A. Fabricator: Company specializing in performing the work of this Section with minimum 5 years' documented experience.
B. Erector: Company specializing in performing the work of this Section with minimum 5 years' documented experience.

1.06 FIELD MEASUREMENTS
A. Verify that field measurements are as shown on shop drawings and/or as instructed by the manufacturer.

1.07 MISCELLANEOUS ITEMS
A. All miscellaneous items required to complete the work in accordance with the intent of the Drawings and Specifications, shall be furnished and installed, regardless of whether or not specifically shown or described. Such items include masonry anchors, dovetail slots, dowels and cramps, loose or embedded items of structural shapes, plates, bars, shield, and other fastening devices which may or may not be provided with the indicated or specified items shall also be furnished and installed as required for attachment and support.

PART 2 PRODUCTS

2.01 MATERIALS
A. Reference drawings and notes on the drawings.

2.02 FINISH
A. Prepare structural component surfaces in accordance with SSPC SP 2.
B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete or high strength bolts.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 ERECTION

A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
B. Field weld components and shear studs indicated on Drawings and/or shop drawings.
C. Do not field cut or alter structural members without approval of Architect/Engineer.
D. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.
E. Grout under base plates as indicated.

3.03 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION 05120

SECTION 05400

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Interior non-load-bearing wall framing
   2. Ceiling joist framing.

B. Related Sections include the following:
   1. Division 05 Section "Metal Fabrications" for masonry shelf angles and connections.
   2. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.
   3. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of **1 inch.**

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
   1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
   2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.4 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

B. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

C. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. Allied Studco.
2. AllSteel Products, Inc.
3. California Expanded Metal Products Company.
4. Clark Steel Framing.
5. Consolidated Fabricators Corp.; Building Products Division.
6. Craco Metals Manufacturing, LLC.
7. Custom Stud, Inc.
8. Dale/Incor.
9. Design Shapes in Steel.
10. Dietrich Metal Framing; a Worthington Industries Company.
11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. Steel Construction Systems.
18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: 50 KSI.
2. Coating: **G60**.

B. Steel Sheet for **Vertical Deflection** Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: **50 (340), Class 1 or 2**.
2. Coating: G60.

2.3 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 20 gauge, 30 mil
2. Flange Width: **1-5/8 inches (41 mm)**.
3. Sizes: As indicated on drawings

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: **Matching steel studs**.
2. Flange Width: **1-1/4 inches (32 mm)**.

C. Vertical Deflection Clips: Manufacturer's standard **bypass** clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Dietrich Metal Framing; a Worthington Industries Company.
   b. MarinoWare, a division of Ware Industries.
   c. SCAFCO Corporation
   d. The Steel Network, Inc.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Minimum Base-Metal Thickness: **0.0428 inch (1.09 mm)**.
   3. Flange Width: 2 ½".

2.4 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, **unpunched,** with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: **0.0329 inch (0.84 mm)**.
   2. Flange Width: **1-5/8 inches (41 mm).**

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. Anchor clips.
   5. End clips.
   6. Foundation clips.
   7. Gusset plates.
   8. Stud kickers, knee braces, and girts.
   9. Joist hangers and end closures.
   10. Hole reinforcing plates.
   11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade **36** threaded carbon-steel **hex-headed bolts headless, hooked bolts** and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by **mechanically deposition according to ASTM B 695, Class 50**.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: **ASTM A 780**.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
   4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
   1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to bottom track, unless otherwise indicated. Space studs as follows:
1. Stud Spacing: **16 inches (406 mm)**.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to **infill** studs and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within [**12 inches (305 mm)** of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
a. Install solid blocking at **96-inch centers.**
2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:
1. Joist Spacing: **As indicated**.

D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.
E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated **on Shop Drawings**.
F. Install bridging at intervals indicated **on Shop Drawings**. Fasten bridging at each joist intersection as follows:
   1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
   2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.6 FIELD QUALITY CONTROL
A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
B. Field and shop welds will be subject to testing and inspecting.
C. Testing agency will report test results promptly and in writing to Contractor and Architect.
D. Remove and replace work where test results indicate that it does not comply with specified requirements.
E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION
A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Rough Hardware
   2. Loose Steel Lintels
   3. Ladders:
      a. Elevator Pit Ladder
   4. Support Angles for Elevator Door Sills
   5. Elevator Sump Pit Cover
   6. Pipe Bollards
   7. Miscellaneous Metal Trim
   8. Steel Framing and Supports for Applications where framing and supports are not specified in other Sections

1.02 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
B. Submit "Letter of Conformance" in accordance with Section 01330.
   1. Include supporting product data for products used in miscellaneous metal fabrications, including paint products and grout.
C. Submit Shop Drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.
D. Submit samples representative of materials and finished products as may be requested by Owner's Representative.

1.03 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.
B. Installer Qualifications: Arrange for installation of metal fabrications specified in this Section by same firm that fabricated them.
C. Quality welding processes and welding operators in accordance with the following:
   1. AWS D1.1 "Structural Welding Code - Steel"
   2. D1.3 "Structural Welding Code - Sheet Steel"
   3. D1.2 "Structural Welding Code - Aluminum"
D. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.04 PROJECT/SITE CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

1.05 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.01 FERROUS METALS

A. Metal Surfaces, General: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.

B. Steel Plates, Shapes, and Bars: ASTM A 36

C. Steel Pipe: ASTM A53

1. Black finish, unless otherwise indicated.
2. Galvanized finish for exterior installations, unless shown to receive special coatings.
3. Type E, OR S, Grade B, Fy = 35 KSI, unless otherwise indicated, or another weight, type, and grade required by structural loads.

D. Gray Iron Castings: ASTM A 48, Class 30

E. Malleable Iron Castings: ASTM A 47, Grade 32510

F. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

G. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.

H. Welding Rods: Select in accordance with AWS Specifications for the metal alloy to be welded.

2.02 FASTENERS

A. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required for each application and complying with applicable standards.

1. Bolts and Nuts: Regular hexagon head bolts, ASTM A-307, Grade A with hex nuts ASTM A 563; and, where indicated, flat washers.
2. Structural bolts and Nuts: A-325 bolts as specified on drawings
3. Anchor Bolts: ASTM F 1554, Grade30
4. Lag Bolts: Square head type, ASME B18.2.1
5. Machine Screws: Cadmium plated steel, ASME B18.6.3
6. Wood Screws: Flat head carbon steel, ASME B18.6.1
7. Plain Washers: Round, carbon steel, ASME B18.22.1
8. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1
9. Epoxy Anchors: Hilti HIT HY-200 as specified on drawings.
10. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.03 GROUT AND ANCHORING CEMENT

A. Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior heavy-duty loading applications of type specified in this Section.

B. Interior Anchoring Cement: Factory-prepackaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Use for interior applications only.

C. Erosion-Resistant Anchoring Cement: Factory-prepackaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.

2.04 CONCRETE FILL AND REINFORCING MATERIALS

A. Concrete Materials and Properties: Comply with requirements of Section 03300, and as shown on Drawings, with minimum 28-day compressive strength of 3,000 PSI, unless otherwise indicated.

B. Non-slip Aggregate Finish: Factory-graded, packaged material containing fused aluminum oxide grits or crushed emery as abrasive aggregate; rustproof and non-glazing; unaffected by freezing, moisture, or cleaning materials.

C. Reinforcing Bars: ASTM A-615, Grade 60, unless noted otherwise.

2.05 PAINT

A. Shop Primer for Ferrous Metal: Manufacturer's or fabricator's standard, fast-curing, lead and chromate-free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure complying with performance requirements of FS TT-P-664.

B. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint-20.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.

2.06 FABRICATION - GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Allow for thermal movement resulting from the following maximum change (range) of exterior metalwork in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss. Temperature Change (Range): 120 Degrees F., ambient; 130 degrees F., material surfaces.

C. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flathead (countersunk) screws or bolts. Locate joints where least conspicuous.

D. Weld corners and seams continuously to comply with AWS recommendations and the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

F. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.07 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.08 STEEL LADDERS

A. General: Fabricate ladders for the locations shown, with dimensions, spacings, and anchorages as indicated. Comply with requirements of ANSI A14.3.
B. Siderails: Continuous, steel, 1/2" x 2-1/2" flat bars, with eased edges, space 18" apart.
C. Bar Rungs: 3/4" diameter steel bars, spaced 12" o.c.
D. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
E. Support each ladder at top and bottom and at intermediate points space not more than 5' o.c. with welded or bolted steel brackets.
F. Provide nonslip surfaces on top of each rung, either by coating the rung with aluminum-oxide granules set in epoxy-resin adhesive, or by using a type of manufacture rung that is filled with aluminum-oxide grout.
G. Provide ladder safety cages where required by local codes, to comply with ANSI A14.3.

2.09 LOOSE STEEL LINTELS

A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.
B. Hot-dipped galvanize loose steel lintels located in exterior walls.
C. Size loose lintels for equal bearing of one inch per foot of clear span but not less than 8 inches bearing at each side of openings, if not indicated on Drawings.

2.10 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.
B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
    1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed. Spacing of anchors shall not be more than 24" o.c.

2.11 PIPE BOLLARDS

A. ASTM A153 galvanized schedule 40 steel pipe with concrete fill, as detailed on Drawings. Provide smooth radius for concrete top to prevent accumulation of rainwater. Provide field painted finish.

2.12 MISCELLANEOUS STEEL TRIM

A. Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.
    1. Galvanize miscellaneous framing and supports in exterior locations and where shown to be painted.

2.13 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for “Architectural and Metal Products” for recommendations relative to application and designations of finishes. Finish metal fabrications after assembly.

2.14 STEEL AND IRON FINISHES

A. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process in compliance with the following requirements:
   1. ASTM A-153 for galvanizing iron and steel hardware.
   2. ASTM A-123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.

B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications: Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning".

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting. Stripe paint all edges, corners, crevices, bolts, welds, and sharp edges.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

B. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

3.02 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correctly welding work, and the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.03 INSTALLING PIPE BOLLARDS

A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's written instructions. Slope group up approximately 1/8" toward bollard.

B. Paint bollards yellow in front of dumpsters.

3.04 TOUCH-UP PAINTING: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA1 requirements for touch-up of field painted surfaces.

A. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 05500

SECTION 05520

HANDRAILS AND RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Steel pipe, tube handrails, balusters, and fittings.

1.02 DESIGN REQUIREMENTS
A. Railing assembly, wall rails, and attachments to resist lateral force of 75 lbs. at any point without damage or permanent set.

1.03 SUBMITTALS
A. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.04 FIELD MEASUREMENTS
A. Verify that field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.01 STEEL RAILING SYSTEM
A. Rails and Posts: As detailed and indicated on the drawings.
B. Fittings: Elbows, T-shapes, wall brackets, escutcheons; machined steel.
C. Mounting: Adjustable brackets and flanges, with steel inserts for casting in concrete and/or steel brackets for embedding in masonry. Prepare backing plate for mounting in wall construction.
D. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.
E. Splice Connectors: Steel concealed spigots, welding collars.

2.02 FABRICATION
A. Fit and shop assemble components in largest practical sizes, for delivery to site.
B. Fabricate components with joints tightly fitted and secured.
C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
E. Continuously seal joined pieces by continuous welds.
F. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
G. Accurately form components to suit stairs and landings, to each other and to building structure.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that field conditions are acceptable and are ready to receive work.
B. Beginning of installation means erector accepts existing conditions.

3.02 PREPARATION
A. Clean and strip primed steel items to bare metal where site welding is required.
B. Supply items required to be cast into concrete and/or embedded in masonry, placed in partitions with setting templates, to appropriate Sections.

3.03 INSTALLATION
A. Install in accordance with manufacturer's instructions.
B. Install components plumb and level, accurately fitted, free from distortion or defects.
C. Provide anchors, plates angles required for connecting railings to structure. Anchor railing to structure.

D. Field weld anchors as indicated on Drawings. Touch-up welds with primer. Grind welds smooth.
E. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 ERECTION TOLERANCES
A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION 05520

SECTION 06100

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Framing with dimension lumber.
   2. Framing with timber.
   3. Framing with engineered wood products.
   4. Wood blocking, cants, and nailers.
   5. Utility shelving.
   6. Wood furring.
   7. Sheathing.
   8. Subflooring and underlayment.
   9. Plywood backing panels.
   10. Building wrap.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

B. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

C. Source Limitations for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product through one source from a single producer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
   3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
   4. Provide dressed lumber, S4S, unless otherwise indicated.
   5. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.
   6. Provide dry lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

B. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
   1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Wood Structural Panels:
   1. Plywood: DOC PS 1.
   2. Oriented Strand Board: DOC PS 2.
   3. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
   4. Comply with "Code Plus" provisions in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial."
   5. Factory mark panels according to indicated standard.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2 lumber except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and one of the following:
      a. Chromated copper arsenate (CCA).
      b. Ammoniacal copper zinc arsenate (ACZA).
      c. Ammoniacal, or amine, copper quat (ACQ).
      d. Copper bis (dimethyldithiocarbamate) (CDDC).
      e. Ammoniacal copper citrate (CC).
      f. Copper azole, Type A (CBA-A).
      g. Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.
   2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

D. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
   3. Wood framing members less than 18 inches above grade.
   4. Wood floor plates that are installed over concrete slabs directly in contact with earth.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWPA C20 lumber and AWPA C27 plywood. Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber and ASTM D 5516, for plywood
   2. Use treatment that does not promote corrosion of metal fasteners.
   3. Use Exterior type for exterior locations and where indicated.
   4. Use Interior Type A High Temperature (HT), unless otherwise indicated.

B. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

2.4 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

B. Non-Load-Bearing Interior Partitions: Construction, Stud, or No. 2 grade.

C. Exterior and Load-Bearing Walls Construction or No. 2 grade.

D. Ceiling Joists (Non-Load-Bearing): Construction or No. 2 grade.

E. Joists, Rafters, and Other Framing Not Listed Above: Construction or No. 1 grade.

2.5 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including the following:
   1. Rooftop equipment bases and support curbs.
   2. Blocking.
   3. Cants.
   4. Nailers.
   5. Furring.
   6. Grounds.

B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 15 percent maximum moisture content.

C. For exposed boards, provide lumber with 15 percent maximum moisture content.

D. For concealed boards, provide lumber with 15 percent maximum moisture content.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 ENGINEERED WOOD PRODUCTS

A. Veneer Lumber: A composite of wood veneers with grain primarily parallel to member lengths, manufactured with an exterior-type adhesive complying with ASTM D 2559.

B. Parallel-Strand Lumber: A composite of wood strand elements with grain primarily parallel to member lengths, manufactured with an exterior-type adhesive complying with ASTM D 2559.

C. Wood I-Joists: Prefabricated units complying with APA PRI-400; depths and performance ratings not less than those indicated.

D. Rim Boards: Performance-rated product complying with APA PRR-401.

2.7 SHEATHING

A. Reference drawings, the following are minimums where sheathing is not noted on drawings.

B. Plywood Wall Sheathing: Exposure 1, Structural I sheathing.
   1. Span Rating: Not less than 24/0.
   2. Thickness: Not less than 1/2 inch.

C. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.
   1. Span Rating: Not less than 24/0.
   2. Thickness: Not less than 1/2 inch.

D. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
   1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum Corp.
   2. Type and Thickness: Regular, 5/8 inch thick.
   3. Size: 48 by 96 inches for vertical installation.

E. Plywood Roof Sheathing: Exterior, Structural I sheathing.
   1. Span Rating: Not less than 32/16.
   2. Thickness: Not less than 5/8 inch.

F. Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I sheathing.
   1. Span Rating: Not less than 32/16.
   2. Thickness: Not less than 5/8 inch.

2.8 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch thick.

2.9 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A with ASTM A 563 hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.10 METAL FRAMING ANCHORS

A. General: Provide framing anchors made from metal indicated, of structural capacity, type, and size indicated, and as follows:
1. Research/Evaluation Reports: Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show compliance of metal framing anchors, for application indicated, with building code in effect for Project.
2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

C. Stainless-Steel Sheet: ASTM A 666, Type 304.
1. Use for exterior locations and where indicated.

D. Joist Hangers: U-shaped joist hangers with 2-inch- long seat and 1-1/4-inch- wide nailing flanges at least 85 percent of joist depth.
1. Thickness: 0.050 inch.

E. I-Joist Hangers: U-shaped joist hangers with 2-inch- long seat and 1-1/4-inch- wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord.
1. Thickness: 0.050 inch.

F. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
1. Strap Width: 1-1/2 inches.
2. Thickness: 0.050 inch.

G. Bridging: Rigid, V-section, nailless type, 0.062 inch thick, length to suit joist size and spacing.

H. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2-inch- minimum side cover, socket 0.062 inch thick, and standoff and adjustment plates 0.108 inch thick.

I. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
1. Width: 3/4 inch.
2. Thickness: 0.050 inch.
3. Length: 16 inches.

J. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. Tie fastens to side of rafter or truss, face of top plates, and side of stud below.

K. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.

L. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, 1-1/4 inches wide by 0.050 inch thick by 36 inches long.

M. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.

N. Wall Bracing: T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches wide by 9/16 inch deep by 0.034 inch thick with hemmed edges.

O. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch thick with hemmed edges.

2.11 MISCELLANEOUS MATERIALS

A. Building Paper: Asphalt-saturated organic felt complying with ASTM D 226, Type I (No. 15 asphalt felt), unperforated.

B. Building Wrap: Air-retarder sheeting made from polyolefins; cross-laminated films, woven strands, or spun-bonded fibers; coated or uncoated; with or without perforations; and complying with ASTM E 1677, Type I.

1. Thickness: Not less than 3 mils
2. Permeance: Not less than 10 perms
3. Flame-Spread Index: 25 or less per ASTM E 84.
4. Allowable Exposure Time: Not less than three months.

C. Building Wrap Tape: Pressure-sensitive plastic tape recommended by building wrap manufacturer for sealing joints and penetrations in building wrap.

D. Sheathing Tape: Pressure-sensitive plastic tape for sealing joints and penetrations in sheathing and recommended by sheathing manufacturer for use with type of sheathing required.

E. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch ; selected from manufacturer's standard widths to suit width of sill members indicated.

F. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

G. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers.

H. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. CABO NER-272 for power-driven fasteners.
2. Published requirements of metal framing anchor manufacturer.
3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in the Uniform Building Code.
4. Table 2305.2, "Fastening Schedule," in the BOCA National Building Code.
5. Table 2306.1, "Fastening Schedule," in the Standard Building Code.
6. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in the International One- and Two-Family Dwelling Code.

E. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.

F. Use finishing nails for exposed work, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FRAMING INSTALLATION, GENERAL

A. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Do not splice structural members between supports.

D. Where built-up beams or girders of 2-inch nominal- dimension lumber on edge are required, fasten together with 2 rows of 20d nails spaced not less than 32 inches o.c. Locate one row near top edge and other near bottom edge.

3.4 WALL AND PARTITION FRAMING INSTALLATION

A. General: Arrange studs so wide face of stud is perpendicular to direction of wall or partition and narrow face is parallel. Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Anchor or nail plates to supporting construction, unless otherwise indicated.

1. For exterior walls, provide 2-by-4-inch nominal- size wood studs spaced 16 inches o.c., unless otherwise indicated.
2. For interior partitions and walls, provide 2-by-4-inch nominal-size wood studs spaced 16 inches o.c., unless otherwise indicated.

B. Construct corners and intersections with three or more studs. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

C. Fire block concealed spaces of wood-framed walls and partitions at each floor level and at ceiling line of top story. Where fire blocking is not inherent in framing system used, provide closely fitted wood blocks of 2-inch nominal- thick lumber of same width as framing members.

D. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.

1. For non-load-bearing partitions, provide double-jamb studs with headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
2. For load-bearing walls, provide double-jamb studs for openings 72 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated.

E. Provide bracing in exterior walls, at both walls of each external corner, full-story height, unless otherwise indicated. Provide one of the following:

F. Provide bracing in walls, at locations indicated, full-story height, unless otherwise indicated. Provide one of the following:

1. Diagonal bracing at 45-degree angle using let-in 1-by-4-inch nominal- size boards.
2. Diagonal bracing at 45-degree angle using metal bracing.
3. Plywood panels not less than 48 by 96 inches applied vertically.
4. Oriented-strand-board panels not less than 48 by 96 inches applied vertically.
5. Particleboard sheathing panels not less than 48 by 96 inches applied vertically.
6. In lieu of bracing at corners or at locations indicated, continuous gypsum sheathing may be provided in panels not less than 48 by 96 inches applied vertically.
7. In lieu of bracing at corners or at locations indicated, continuous fiberboard sheathing, intermediate type, may be provided in panels not less than 48 by 96 inches applied vertically.

3.5 CEILING JOIST AND RAFTER FRAMING INSTALLATION

A. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.

1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal- size or 2-by-4-inch nominal- size stringers spaced 48 inches o.c. crosswise over main ceiling joists.

B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.

1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.

2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.

C. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal-size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.

D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions, if any.

3.6 FIBERBOARD SHEATHING INSTALLATION

A. Fasten fiberboard sheathing panels to intermediate supports and then at edges and ends. Use galvanized roofing nails; comply with manufacturer's recommended spacing and referenced fastening schedule. Drive fasteners flush with surface of sheathing and locate perimeter fasteners at least 3/8 inch from edges and ends.

B. Install sheathing vertically with long edges parallel to, and centered over, studs. Install solid wood blocking where end joints do not occur over framing. Allow 1/8-inch open space between edges and ends of adjacent units. Stagger horizontal joints, if any.

C. Cover sheathing as soon as practical after installation to prevent deterioration from wetting.

3.7 BUILDING PAPER APPLICATION

A. Apply building paper horizontally with 2-inch overlap and 6-inch end lap; fasten to sheathing with galvanized staples or roofing nails. Cover upstanding flashing with 4-inch overlap.

3.8 BUILDING WRAP APPLICATION

A. Cover wall sheathing with building wrap as indicated.
1. Comply with manufacturer's written instructions.
2. Cover upstanding flashing with 4-inch overlap.
3. Seal seams, edges, and penetrations with tape.
4. Extend into jambs of openings and seal corners with tape.

3.9 SHEATHING TAPE APPLICATION

A. Apply sheathing tape to joints between sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

END OF SECTION 06100

SECTION 06114

WOOD BLOCKING

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Roof curbs and cants.
- B. Blocking in wall and roof openings.
- C. Wood furring and grounds.
- D. Concealed wood blocking for support of toilet and bath accessories, wall cabinets, and wood trim.
- E. Telephone and electrical panel boards.

PART 2 PRODUCTS

2.01 MATERIALS
- A. Miscellaneous Blocking: Minimum stud grade.
- B. Plywood: APA Rated Sheathing, Grade C-D; Exposure Durability 1; sanded.

2.02 ACCESSORIES
- A. Fasteners and Anchors:
  1. Fasteners: Hot-dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
  2. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

PART 3 EXECUTION

3.01 FRAMING
- A. Set members level and plumb, in correct position.
- B. Place horizontal members flat, crown side up.
- C. Space framing and furring 16 inches o.c.

3.02 SHEATHING
- A. Secure sheathing to framing members with ends over firm bearing and staggered.
- B. Install telephone and electrical panel boards with plywood sheathing material where required. Over size the panel by 12 inches on all sides.

END OF SECTION 06114

SECTION 06200

FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Finish carpentry items, other than shop prefabricated casework.
- B. Hardware and attachment accessories.

1.02 QUALITY ASSURANCE
- A. Perform work in accordance with AWI Custom.

1.03 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle products to site under provisions of the General Requirements.
- B. Protect work from moisture damage.

1.04 FIELD MEASUREMENTS
- A. Verify that field measurements are as indicated on shop drawings and as instructed by the manufacturer.

1.05 COORDINATION
- A. Coordinate the work with plumbing and electrical rough-in, and installation of associated and adjacent components.

PART 2 PRODUCTS

2.01 LUMBER MATERIALS
- A. Softwood Lumber: PS 20; Graded in accordance with AWI Custom; maximum moisture content of 6 percent; suitable for prime and paint.
- B. Hardwood Lumber: Graded in accordance with AWI prime and paint.

2.02 SHEET MATERIALS
- A. Exterior Plywood: Exposed to weather shall be group 1, Exterior type, Grade A-B or A-C as required for exposure.
- B. Interior Plywood: Interior or Exterior type, Group 1 or 2, Grade B-D where concealed, Grade A-C one side exposed and Grade A-A two sides exposed.
- C. Wood Particleboard: ANSI A208.1 Type 1; AWI standard, composed of wood chips, medium density, made with high waterproof resin binders; of grade to suit application; sanded faces.

2.03 FASTENERS
- A. Fasteners: Of size and type to suit application; galvanized finish in concealed locations and brass or chrome finish in exposed locations.

2.04 FABRICATION
- A. Fabricate to AWI Custom standards.
- B. Shop assemble work for delivery to site, permitting passage through building openings.
- C. Fit exposed sheet material edges with 3/8 inch matching hardwood edging. Use one piece for full length only.
- D. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.05 SHOP FINISHING
- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler which matches surrounding surfaces and of types recommended for applied finishes.
- D. Seal, stain, and varnish exposed to view surfaces. Brush apply only.
- E. Prime paint. Seal surfaces in contact with cementitious materials.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION
- A. Install work in accordance with AWI Custom Quality Standard.
- B. Set and secure materials and components in place, plumb, and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.
- D. Install components trim with nails, screws, bolts with blind fasteners or wall adhesive by gun application.
- E. Install hardware in accordance with manufacturer's instructions.

3.03 SITE APPLIED WOOD TREATMENT
- A. Apply preservative treatment in accordance with manufacturer's instructions.
- B. Brush apply two coats of preservative treatment on wood in contact with cementitious materials, roofing and related metal flashings. Treat site-sawn cuts.
- C. Allow preservative to dry prior to erecting members.

3.04 PREPARATION FOR SITE FINISHING
- A. Site Finishing: Refer to Section 09900.
- B. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.05 SCHEDULE
- A. Interior:
  1. Trim & Accents: Primed and painted.
  2. Loose Shelving: Melamine finished, color to be selected.
  3. Window Sills: Primed and painted.
  4. Wood Base: Primed and painted.

END OF SECTION 06200

SECTION 071900

WATER REPELLENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Water Repellent Treatment Applied to Exterior Exposed [Masonry Unit] [Precast Concrete] [Walls][Floors].

B. Related Sections:
   1. Section 01 33 00 - Submittal Procedures.
   2. Section 03 01 40.51- Cleaning of Precast Concrete.
   3. Section 03 40 00- Precast Concrete.
   4. Section 04 01 10- Unit Masonry Cleaning.
   5. Section 04 20 00- Unit Masonry.

1.02 REFERENCES

A. Definitions:
   1. Wet-on-Wet Application: Wet-on-wet is a technique in which the water-repellent is applied to the previously applied, still wet, application of the water repellent.

B. Reference Standards:
   1. The date of the standard is that in effect as the date of receipt of bids for the project.
   2. ASTM International (ASTM):
      a. C67- Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
      b. C97- Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
      c. C140- Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
      d. D2369- Standard Test Method for Volatile Content of Coatings.
      e. D6490- Standard Test Method for Water Vapor Transmission of Non-Film Forming Treatments Used on Cementitious Panels.
      f. D6532- Standard Test Method for Evaluation of the Effect of Clear Water Repellent Treatments on Water Absorption of Hydraulic Cement Mortar Specimens.
      g. E96- Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
      h. E514- Standard Test Method for Water Penetration and Leakage Through Masonry.

1.03 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 01 General Requirements specification sections.
   1. Submit product data including detailed test results of materials applied to surfaces similar to requirements of this Section.
   2. Submit manufacturer's instructions for methods and application procedures.
   3. Submit manufacturer's certification indicating water repellent treatment conforms to or exceeds requirements stated herein.

1.04 QUALITY ASSURANCE

A. The Contractors involved with work covered by this Section shall have had a minimum of five years' experience using specified techniques for water repellent treatment application.

B. Tradesman must be competent and experienced and shall demonstrate reasonable care during performance of operations described in this Section.

C. Tests and Approvals:
   1. Sample Area:
      a. Contractor shall apply a test area of wall surface from four square feet in size for inspection and approval by the Owner's Representative after treatment has cured. Test area shall be available for comparison during the specified scope of work.

b. Samples of adjacent materials shall be tested for possible reaction with the water repellent treatment. Such samples shall be available for inspection by the Owner's Representative.

2. If any part of this work shall be found defective (because of improper preparation of surfaces or application of water repellent treatment) at any time before the final acceptance of the item, the Contractor shall, at his own expense, make good such defect to the satisfaction of the A/E.

1.05 PROJECT CONDITIONS

A. Protection:

1. Contractor shall provide, at all times, covered access to premises and necessary utilities, space for storage of material and equipment, etc.
2. All activities shall be in compliance with local and governmental regulations and codes.
3. The surface and atmospheric temperature should be at least 40 degrees F. and rising during application and for eight hours following. Surface and air temperatures should not exceed 90 degrees F.
4. Surfaces should be dry.
5. Apply only in well ventilated areas.
6. All caulking (sealants) should be applied a minimum of 24 hours prior to application, or as required by sealant manufacturer, whichever is greater, before application of water repellent treatment.
7. The Contractor shall require applicators to observe safety precautions as outlined on containers and labels. It is the responsibility of the Contractor to provide well ventilated areas for all workmen as well as to observe safety precautions as stipulated on labels and instructions of all materials used, and as required by governing authorities during application and drying.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Water-Based Silane/Siloxane Water Repellent Treatment:

1. Use water-based silane/siloxane water repellent for dense or porous concrete, masonry, brick, unpolished sandstone, and cementitious stucco surfaces to protect them from water penetration without altering the natural appearance.
2. Physical and Performance Properties:
   a. Comply with national, state, and district AIM VOC regulations.
   b. Validated and certified to comply with the Sealant-Waterproofing & Restoration Institute's (SWRI) Clear Penetrating Vertical Water Repellent Validation Program.
   c. Water Absorption, Wall Assembly per ASTM E514 at 4 hours:
      1) Brick: Greater than 86 percent effectiveness.
      2) CMU: Greater than 97 percent effectiveness.
   d. Water Absorption Reduction (Brick) per ASTM C 67: Greater than 96 percent.
   e. Water Absorption Reduction (Sandstone) per ASTM C97: Greater than 85 percent.
   f. Water Absorption Reduction (Mortar) per ASTM D6532: Greater than 98 percent.
   g. Water Absorption Reduction per ASTM C 140:
      1) Concrete: Greater than 93 percent.
      2) Precast Concrete (Sandblast Finish): Greater than 94 percent.
      3) Medium Weight CMU: Greater than 93 percent.
      4) Split Face CMU: Greater than 95 percent.
   h. Water Vapor Transmission per ASTM E96:
      1) Sandstone: Greater than 78 percent.
      2) Medium Weight CMU: Greater than 90 percent.
      3) Heavy Weight Smooth-Face CMU: Greater than 100 percent.
      4) Brick: Greater than 100 percent.
      5) Precast Concrete: Greater than 84 percent.
   i. Water Vapor Transmission WVT per ASTM D 6490: Minimum 96 percent retention.

3. Approved Products:
   a. "Sure Klean Weather Seal Siloxane PD "; PROSOCO, Inc. (800-255-4255) (Basis of Design).

PART 3 EXECUTION

3.01 PREPARATION

A. Verify surfaces to receive water repellent treatment are clean, free of efflorescence, oil, grease, or other foreign matter detrimental to application.
B. Remove loose particles and foreign matter. Remove grease or oil with a solvent, effective alkaline cleaner, or detergent as instructed by water repellent manufacturer. Scrub surfaces with water.
C. Allow surfaces to dry prior to application.
D. Protect all surrounding areas as recommended by the manufacturer or as directed by the Architect.
   1. Windows: Windows shall be protected from contact with materials by masking with polyethylene or other approved techniques.
   2. All polished stone, metal, or non-masonry surfaces shall be protected from contact with the material by masking with polyethylene.
   3. Masonry surfaces must be in good repair. All new construction or repointed surfaces must be allowed to cure for a minimum of 28 days prior to application. Surfaces must be completely dry.
E. Verify all windows, exterior intakes and air conditioning vents are covered and air handling equipment is shut down during application and until vapors have dissipated.
F. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

3.02 WATER- BASED SILANE/SILOXANE WATER REPELLENT TREATMENT APPLICATION (VERTICAL APPLICATION)

A. Test each surface and/or material to be treated to ensure compatibility and water repellent treatment results. The surface to be treated must be clean and free of all foreign matter and as dry as possible to ensure proper penetration of water repellent treatment.
B. Dilute water repellent based on mock-up testing and manufacturer's recommendations.
C. Proceed with application of diluted water repellent treatment in an orderly manner once application rate has been tested; work from bottom to top of each scaffold width and from one end of each elevation to the other.
D. Apply diluted water repellent treatment wet-on-wet to visibly dry and absorbent vertical surfaces and comply with manufacturer's written instructions; use a brush or spray application methods, at the Contractor's option.
E. Preferred method of application is with high volume, low pressure, airless diaphragm-type spray equipment. Fan spray tips are recommended to avoid atomization. Do not spray apply at pressures exceeding 50 psi.
   1. Apply with a roller or brush for small-scale applications or when spray application is not appropriate.
F. Spray Application:
   1. Apply diluted water repellent treatment per manufacturer's published written instructions, from bottom- up using a wet-on-wet application, creating a 4 to 8 inch rundown below the spray contact point. Let the first application penetrate for 2 to 3 minutes then reapply. Apply in accordance with manufacturer recommendation.
G. Roller or Brush Application:
   1. Thoroughly saturate the surface uniformly with water repellent treatment for 2 to 3 minutes. Avoid excessive overlapping. Back roll or brush out heavy runs and drips that do not penetrate.

3.03 WATER- BASED SILANE/SILOXANE WATER REPELLENT TREATMENT APPLICATION (HORIZONTAL APPLICATION)

A. Test each surface and/or material to be treated to ensure compatibility and water repellent treatment results. The surface to be treated must be clean and free of all foreign matter and as dry as possible to ensure proper penetration of water repellent treatment.
B. Dilute water repellent based on mock-up testing and manufacturer's recommendations.
C. Proceed with application of the diluted water repellent treatment in an orderly manner once application rate has been tested.
D. Apply the diluted water repellent treatment to horizontal surfaces and comply with manufacturer's written instructions; use brush or spray application methods, at Contractor's option.
E. Apply diluted water repellent treatment in a single application. Use enough to keep the surface wet for 2 to 3 minutes before penetration. Broom out puddles until they penetrate the surface.

3.04 PROTECTION

A. Protect adjacent surfaces not scheduled to receive water repellent treatment. If applied on unscheduled surfaces, remove immediately, by manufacturer-approved method.
B. Protect from foot and vehicle traffic until visibly dry.
C. Protect treated surfaces from rain for four (4) hours.
D. Correct damage by cleaning, repairing or replacing, and repainting, as approved by A/E.

END OF SECTION 071900

SECTION 07213

BATT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Thermal Batt insulation
- B. Sound batt insulation.

1.02 REFERENCES
- A. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- B. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

1.03 SYSTEM DESCRIPTION
- A. Materials of This Section: Provide continuity of thermal barrier at building enclosure with thermal insulating materials in attic and walls. Overlap insulations to ensure complete thermal envelope at all exterior surfaces.

1.04 COORDINATION
- A. Coordinate the work with all related Sections for installation of vapor retarder and other forms of insulation.

PART 2 PRODUCTS

2.01 MANUFACTURERS - INSULATION MATERIALS
- A. OWENS-CORNING Pink Next Gen Fiberglas Insulation, Unfaced
- B. Substitutions: Under provisions of the General Requirements.

2.02 MATERIALS
- A. Batt Insulation, Walls: ASTM C665; preformed glass fiber batts; loose laid and taped, conforming to the following:
  1. Thermal Resistance: R-21 min.
  2. Facing: Kraft-Faced
  3. Batt Sizes: 6”
- C. Sound Batt Insulation:
  1. Batt size: 3-1/2” and 5-1/2”
  2. Facing: Unfaced.
- D. Tape: Self-adhering type as recommended by the manufacturer, mesh reinforced, 2 inches wide.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify site conditions.
- B. Verify that substrate, adjacent materials, and insulation are dry and ready to be installed.

3.02 INSTALLATION
- A. Install insulation and vapor retarder in accordance with manufacturer’s instructions.
- B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- C. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.
- D. Install with applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane, caulk or tape.
- E. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

F. Place loose-fill insulation into spaces and onto surfaces as shown, either by pouring or by machine blowing to comply with ASTM C 1015. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.
   1. For cellulosic loose-fill insulation, comply with the Cellulose Insulation Manufacturers Association's Special Report #3, "Standard Practice for Installing Cellulose Insulation."
   2. **IECC 2021** installation requirements, follow all requirements and recommendations.

END OF SECTION 07213

SECTION 072729

LIQUID-APPLIED ROUGH OPENING FLASHING MEMBRANE
FOR RESTORATION OF EXISTING CONDITIONS

PART 1 - GENERAL

1.1 SUMMARY:
- A. Section Includes:
  1. Window and door flashing restoration, using a liquid applied air and water barrier membrane system, and accessory materials for application to existing exterior building envelope substrates, as indicated on the drawings.
- B. Related Requirements:
  1. Section 01 33 00- Submittal Procedures.
  2. Section 01 45 80- Testing Laboratory Services.
  3. Section 01 60 00- Product Requirements.
  4. Section 07 65 00- Flexible Flashing.

1.2 REFERENCES
- A. The date of the standard is that in effect as the date of receipt of bids for the project.
- B. Living Building Challenge (LBC).
- C. ASTM International (ASTM).

1.3 ADMINISTRATIVE REQUIREMENTS:
- A. Pre-installation conference: Prior to beginning installation of the fluid applied rough opening system, hold a pre-installation conference to review work to be accomplished.
  1. Owner’s Representative, Contractor, Architect, installing subcontractor, membrane system manufacturer's representative, roofing and foundation subcontractors, waterproofing subcontractors, and all subcontractors who have materials penetrating membrane system or finishes covering membrane system shall be present.
  2. Contractor shall notify Architect at least seven days prior to time for conference.
  3. Contractor shall record minutes of meeting and distribute to attending parties.
  4. Agenda: As a minimum discuss:
     a. Surface preparation of restoration area and surrounding wall interfaces.
     b. Existing substrate condition and pretreatment.
     c. Minimum curing period.
     d. Special details and/or sheet flashing for liquid applied rough opening installation.
     e. Sequence of construction, responsibilities, and schedule for subsequent repair operations.
     f. Installation procedures.
     g. Inspection procedures.
     h. Protection and repair procedures.
     i. Review and approval of all glazing applications to include the installation of the windows and related interior perimeter sealant joint.

1.4 PERFORMANCE REQUIREMENTS:
- A. Performance requirements: Comply with the specified performance requirements and characteristics as herein specified.
- B. Performance description:
  1. Wall penetrations (windows, doors, etc.) shall be constructed with a continuous, air and water barrier to control water and air leakage into and out of the conditioned space around the [existing] [new] windows and doors replacements.
  2. Joints, penetrations, and paths of water and air infiltration shall be made watertight and airtight.
  3. System shall be capable of withstanding positive and negative combined wind, stack and HVAC pressures on the rough openings and building envelope without damage or displacement.
  4. System shall be installed in an airtight and flexible manner, allowing for the relative movement of remediated systems due to thermal and moisture variations.

1.5 SUBMITTALS:

A. Product data: Submit manufacturer's product data and installation guidelines including membrane and accessory material types, technical and test data, composition, descriptions and properties, installation instructions and substrate preparation requirements.

B. Certificates:

1. Certificates by manufacturer stating that manufacturer and installer meet qualifications as herein specified.

C. VOC Certification: Submit certification that products furnished comply with regulations controlling use of volatile organic compounds (VOC).

1.4 QUALITY ASSURANCE:

A. Applicable standards, as referenced herein: ASTM International (ASTM).

B. Manufacturer's qualifications: Air and water barrier systems shall be manufactured and marketed by a firm with an Air Barrier Association of America membership for at least five [5] years. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include certification of ABAA membership for a least five [5] years.

C. Installer's qualifications: The installer shall demonstrate qualifications to perform the work of this section by submitting the following:

1. Verification that installer has been trained by and is approved to perform work as herein specified by air and water barrier system manufacturer.
2. List of at least three (3) projects completed of similar scope and complexity to this project carried out by the firm and site supervisor.

D. Inspection and testing: Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover installed products or assemblies until they have been inspected, tested, and approved.

E. Sole source: Obtain materials within the scope of this specification from a single manufacturer.

F. Regulations: Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOC).

G. Mock-up:

1. Prior to installation and start of Work of the fluid applied rough opening system a field-constructed mock-up shall be applied to verify details and tie-ins, to demonstrate the required installation.
   a. Allow 72 hours for inspection and testing of mock-up before proceeding with water and air barrier work.
   b. Coordinate construction of mockups to permit inspection by [Architect] [Owner's Representative] of air barrier before beginning installation.
   c. Approved, undamaged mock-up must remain as part of the work.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage, weather, excessive temperatures, and construction operations. Remove damaged material from site and dispose of in accordance with applicable regulations.

B. Protect air and water barrier components from freezing and extreme heat.

C. Sequence deliveries to avoid delays, and to minimize on-site storage.

1.6 FIELD CONDITIONS:

A. Environmental conditions:

1. Comply with manufacturer's written instructions for substrate temperature and moisture content and other conditions affecting performance requirements.

B. Weather conditions:

1. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials used.

C. Proceed with installation only when the substrate construction and preparation work is complete and in condition to receive the membrane system.

D. Ultra-violet Exposure:

1. Do not expose air barrier materials to sunlight longer than as recommended by the material manufacturer.

1.7 WARRANTY:

A. Manufacturer's warranty requirements:
   1. Submit manufacturer's five (5) year limited warranty stating:
      a. The products have been tested in accordance with national standards for air and water-resistive barriers and passed those tests with effectiveness and durability indicating their suitability for performance as an air and water-resistive barrier system when properly applied.
      b. The products shall be free from defects in material for a period of [five] years after the substantial completion of the material application.
      c. That the products will not disintegrate and will maintain their integrity over the life of the warranty.

B. Warranty period: Five (5) years from Date of Substantial Completion.

PART 2 – PRODUCTS

2.1 MANFACTURERS

A. Substitutions: [No Substitutions] [In accordance with Section 01 25 00 – Substitution Procedures].

2.2 MATERIALS

A. WATER BASED PRIMER FOR RAW GYPSUM BOARD EDGES
   1. Primer to seal the cut edges of gypsum wall boards where they are exposed in rough openings for windows and doors. The sealed edge makes a compatible surface for easy application of liquid applied fiber-reinforced fill coat and seam treatment for through-wall components.
      a. Product: PROSOCO R-Guard PorousPrep, manufactured by PROSOCO, Inc., Lawrence, KS, (800) 255-4255, www.prosoco.com.
   2. Subject to compliance with the following physical and performance requirements:
      a. Breathable liquid primer.
      b. Comply with national, state and district AIM VOC regulations and be 100 g/L or less.
      c. Living Building Challenge 2.0/2.1/3.0/3.1 Red List.
      d. Total Solids: 16 percent.

B. LIQUID APPLIED FILL COAT AND SEAM FILLER
   1. High modulus, gun-grade, crack and joint filler, adhesive and detailing compound that combines the best silicone and polyurethane properties. The single-component, Silyl-Terminated-Polymer (STP) prepares open joints, seams and cracks before installing primary water and air barrier system to prevent the movement of water and air through building envelopes.
      a. Product: PROSOCO R-Guard Joint & Seam Filler, manufactured by PROSOCO, Inc., Lawrence, KS, (800) 255-4255, www.prosoco.com.
   2. Subject to compliance with the following physical and performance requirements:
      a. Living Building Challenge 2.0/2.1/3.0/3.1 Red List.
      b. Comply with national, state and district AIM VOC regulations and be 30 g/L or less.
      c. Water vapor transmission: Minimum 19 perms at 20 mils when tested in accordance with ASTM E-96.
      d. Tensile strength: 70 psi when tested in accordance with ASTM D412.
      e. Elongation at break: Greater than 180 percent when tested in accordance with ASTM D412.
      f. Peel strength: Greater than 25 pli when tested in accordance with ASTM D1781.
      g. Total solids: 99 percent.

C. LIQUID-APPLIED FLASHING AND DETAILING MEMBRANE
   1. Gun-grade, spread and tool or roller apply waterproofing, adhesive and detailing compound that combines the best of silicone and polyurethane properties. The single component, Silyl-Terminated-Polymer (STP) produces a highly durable, seamless, elastomeric flashing membrane in rough openings, to fill joints and seams, to counter flash and transition waterproofing and air barrier components in new wall assemblies, and to seal around penetrations or protect countersunk fasteners.

a. Product: PROSOCO R-Guard FastFlash manufactured by PROSOCO, Inc., Lawrence, KS, (800) 255-4255, www.prosoco.com.

2. Subject to compliance with the following physical and performance requirements:
   a. Living Building Challenge 2.0/2.1/3.0/3.1 Red List.
   b. AAMA 714-12 Voluntary Specification for Liquid-Applied Flashing Used to Create a Water-Resistive Seal Around Exterior Wall Openings in Buildings.
   c. ICC-ES AC 212 Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers Over Exterior Sheathing.
   d. Comply with national, state and district AIM VOC regulations and be 30 g/L or less.
   e. Water vapor transmission: 21 perms when tested in accordance with ASTM E96.
   f. Tensile strength: Greater than 150 psi when tested in accordance with ASTM D412.
   g. Elongation at break: Greater than 350 percent when tested in accordance with ASTM D412.
   h. Total Solids: 99 percent.

D. SEALANT FOR INTERIOR WINDOWS AND DOORS
1. High performance, gun-grade waterproofing sealant that combines the best of silicone and polyurethane properties. Single component, Silyl-Terminated-Polymer (STP) that is durable and stops the movement of moist air through cracks surrounding windows and doors.
2. Product: PROSOCO R-Guard AirDam, manufactured by PROSOCO, Inc., Lawrence, KS, (800) 255-4255, www.prosoco.com.
   Subject to compliance with the following physical and performance requirements:
   a. Living Building Challenge 2.0/2.1/3.0/3.1 Red List.
   b. Comply with national, state and district AIM VOC: less than 30 grams per Liter
   c. Sealant Validation from Sealant Waterproofing & Restoration Institute (SWRI).
   d. Elongation at break: Greater than1000 percent when tested in accordance with ASTM D412.
   e. Peel strength: 25 pli when tested in accordance with ASTM C794
   f. Total solids: 98 percent.
3. Backer rod: In deep joints, control sealant depth by installing closed cell backer road. Diameter of the soft-backer rod should be 25 percent greater than the joint width. Do not puncture backer rod.

PART 3 - EXECUTION

3.1 EXAMINATION AND SURFACE PREPARATION

A. Examine conditions for compliance with system manufacturer's requirements for installation, and other specific conditions affecting performance of air and water barrier system.

B. All surfaces must be sound, clean, and free of grease, dirt, excess mortar or other contaminants. Fill or bridge damaged surfaces, voids, or gaps larger than one- inch. Fill voids and gaps measuring one- inch or less with liquid applied fill coat and seam filler as necessary to ensure continuity.
1. Surfaces to receive STP fluid applied accessories must be dry, damp, or wet to the touch. Brush away any standing water present before application. The products will tolerate rain immediately after application.

C. Refer to manufacturer's product data sheets for requirements for condition of and preparation of substrates.
1. Surfaces shall be sound and free of voids, spalled areas, loose aggregate, and sharp protrusions.
2. Remove contaminants such as grease, oil and wax from exposed surfaces.
3. Remove dust, dirt, loose stone, and debris.
4. Use repair materials and methods that are acceptable to manufacturer of the air and water-resistive barrier system.
5. Refer to manufacturer's product data sheets and manufacturer's installation guidelines for additional information on preparing structural walls to receive the primary air and water resistive barrier.

D. Exterior sheathing:
1. Ensure that sheathing is properly installed with ends, corners and edges properly fastened. Remove and replace damaged sheathing.

2. Mechanical fasteners used to secure sheathing boards or penetrate sheathing boards shall be set flush with sheathing, and spot overdriven fasteners with liquid applied fill coat and seam filler.
3. Seal the cut edges of gypsum wall boards exposed in rough openings for windows and doors at corners, as recommended by manufacturer.

E. Masonry and concrete substrates:
1. Masonry head and bed joints should be fully filled and tooled.
2. Mechanically remove loose mortar fins, mortar accumulations and protrusions, and debris.
3. Fill cracks, joints, and gaps with liquid applied fill coat and seam filler as herein specified.

3.2 FIBER REINFORCED FILL COAT AND SEAM FILLER

A. General: Comply with air and water barrier manufacturer's installation instructions, temperature limitations, product data and shop drawings.
B. Apply liquid applied fill coat and seam filler for seams, joints, cracks, gaps, primed rough gypsum edges at sheathing, and rough openings per manufacturer's written instructions.

3.3 LIQUID APPLIED FLASHING AT WINDOWS, DOORS OPENINGS AND PENETRATIONS

A. General: Comply with air and water barrier manufacturer's installation instructions, temperature limitations, product data and shop drawings.
B. Apply liquid flashing membrane to seal and waterproof rough openings per manufacturer's written instructions. Spread the wet product to create an opaque, monolithic flashing membrane which surrounds the rough opening and extends 4 to 6 inches over the face of the structural wall. Apply additional coats as needed to achieve void- and pinhole-free surface.

3.4 FLUID-APPLIED FLASHING TRANSITIONS

A. General: Comply with water and air barrier manufacturer's installation instructions, temperature limitations, product data and shop drawings.
B. Apply fiber reinforced fill coat and seam filler and liquid flashing membrane as a liquid flashing membrane to waterproof the transitions in rough opening and between dissimilar materials per manufacturer's written instructions.
1. Fill any voids between the top of the flashing leg and the vertical wall with fiber reinforced fill coat and seam filler.
2. Spread the wet liquid flashing membrane to create a monolithic "cap-flash" flashing membrane per manufacturer's written instructions.
3. Apply additional coats as needed to achieve void- and pinhole-free surface.
4. Allow treated surfaces to skin before installing other wall assembly, waterproofing or air barrier components.

3.5 INTERIOR SEALANT FOR WINDOWS AND DOORS INSTALLATION

A. General: Comply with air and water barrier manufacturer's installation instructions, temperature limitations, product data and shop drawings.
B. Apply interior waterproofing sealant per manufacturer's written instructions.
1. Install Backer rod: Compressible, closed cell rod stock as recommended by manufacturer for compatibility with sealant. Install Backer Rod as necessary per manufacturer's written instructions.
2. Apply interior waterproofing sealant in continuous beads without gaps or air pockets.

3.6 PROTECTION

A. Coordinate scheduling within installation of cover materials to ensure that fluid-applied air barrier system is not exposed to sunlight and weather longer than recommended by the system manufacturer.
B. Ensure that the top edge of the fluid-applied membrane and the existing air barrier system is sealed and protected from water intrusion. Ensure the continuity of the fluid-applied air barrier system has been achieved.

END OF SECTION 072729

SECTION 07533

ELASTOMERIC SHEET ROOFING MECHANICALLY ATTACHED

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Membrane Roofing system 20-year warranty, complete with flashings and terminations
- **B.** Insulation and cover board, mechanically attached approved by manufacturer. **Including tapered EPS at no less than 1/8" per ft slope.**
- C. Expansion joints, cant strips, and counter flashings.
- D. Roof system shall meet UL 90 and FM I90 requirements for 90 mph uplift.
- E. Must meet the minimum Roof Reflectance and Emittance Options (Per 2021 IECC, Table C402.3)
  - a. Three-year-aged solar reflectance of 0.55 and 3-year aged thermal emittance of 0.75 OR
  - b. Three-year-aged solar reflectance index of 64

1.02 RELATED SECTIONS
- A. Section 06114 - Wood Blocking and Curbing: Wood nailers and cant strips.
- B. Section 07620 - Sheet Metal Flashing and Trim: Counter flashing.

1.03 REFERENCES
- A. ASTM C177 - Test Method for Steady-State Thermal Transmission Properties by Means of the Guarded Hot Plate.
- B. Factory Mutual (FM) Engineering Corporation - Roof Assembly Classifications.
- C. National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual.
- D. Underwriters Laboratories (UL) - Fire Hazard Classifications.

1.04 SYSTEM DESCRIPTION.
- A. Elastomeric Sheet Membrane Conventional Roofing System: One ply mechanically attached membrane system, slip sheet,1/2" min. Dens Deck rigid insulation, over existing structural deck. System shall comply with UL 90 requirements. **Installation & Warranty shall be as required for a 20-year manufacturer's weather tightness warranty covering material and workmanship**.

1.05 SUBMITTALS
- A. Submit under provisions of the General Requirements.
- B. Shop Drawings: Indicate setting plan for flat and tapered insulation, joint or termination detail conditions.
- C. Product Data: Provide characteristics on membrane materials, flashing materials, insulation.
- D. Manufacturer's Installation Instructions: Indicate special precautions required for seaming the membrane.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Samples: Submit two membrane samples, 3-1/2" x 3-1/2" in size, illustrating color and material.

1.06 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing the products specified in this section with five years documented experience.
- B. Applicator: Company specializing in performing the work of this section with five years experience and approved by system manufacturer.
- C. Work of this section to conform to manufacturer's instructions.

1.07 REGULATORY REQUIREMENTS
- A. Underwriters Laboratories, Inc. (UL): UL 90, Class A minimum Fire Hazard Classification.
- B. Factory Mutual Engineering Corporation (FM): Roof Assembly Classification, of Class 1 Construction, wind uplift requirement of I90.

1.08 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle products to site in accordance with manufacturer's instructions.
- B. Deliver products in manufacturer's original containers, dry, undamaged, seals, and labels intact.
- C. Store products in weather protected environment, clear of ground and moisture.

1.09 ENVIRONMENTAL REQUIREMENTS
- A. Do not apply roofing membrane during inclement weather, ambient temperatures below 45 degrees F.
- B. Do not apply roofing membrane to damp or frozen deck surface.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.10 COORDINATION
- A. Coordinate the work with the installation of associated metal flashings, as the work of this section proceeds.

1.11 WARRANTY
- A. Provide roofer's Two-year warranty covering all materials (including insulation and flashings) and workmanship.
  1. Provide **Manufacturer's 20-year warranty**. The roofing system shall be approved and installed to provide manufacturer's twenty-year total system warranty, covering materials and workmanship, and weather tightness. **Warranty shall be Non-Prorated, No Limit type.**

PART 2 PRODUCTS

2.01 MANUFACTURERS - MEMBRANE MATERIAL
- A. Approved Manufacturers: DURO-LAST Roofing Inc, Firestone, Carlisle.
- B. I/B Roof Systems. 60 mil membrane
- C. Must meet the minimum **Roof Reflectance and Emittance Options** (Per 2021 IECC, Table C402.3)
  a. Three-year-aged solar reflectance of 0.55 and 3-year aged thermal emittance of 0.75 OR
  b. Three-year-aged solar reflectance index of 64

2.02 MEMBRANE AND ASSOCIATED MATERIALS
- A. Membrane: FVC; .06 inch thick, color - white.
- B. Seaming Materials: As required or recommended by membrane manufacturer.

2.03 SUBSTRATE COVERING MATERIALS
- A. Membrane manufacturers: Conforming to UL requirements, fire resistant sheet vapor retarder.
- B. Dens Deck, 5/8" installed and approved by manufacturer.
- C. Cover board, ½" installed and approved by manufacturer.
- D. Vapor Barrier, 15 mil., installed and approved by manufacturer.

2.04 MANUFACTURERS - INSULATION
- A. Polyisocyanurate Foam - Roofing manufacturer approved. Minimum 1.5 lb density.
- B. Substitutions under provisions of the General Requirements.

2.05 INSULATION
- A. Insulation: Dow Styrofoam Deckmat Board; extruded polystyrene board to ASTM C578, Type IV, rigid, closed cell type, with integral high-density skin. **Provide Tapered EPS, as required to provide Min. slope 1/8" per FT.**

Board Size:	Maximum 48 x 96 inch, Flat & Tapered as indicated.
Board Thickness:	**4" min thickness,** 2 layer minimum. Two boards with staggered joints, **minimum R value (25**), 5 per inch of thickness min.
Density:	25 psi.
Thermal Conductivity:	**R-Value of 5 per inch, Min R-25.**
Board Edges:	Square
Water Absorption:	ASTM C209, less than .7% volume

2.06 SHEET METAL FLASHING AND TRIM
- A. Pre-Coated Galvanized Steel: ASTM A446, Grade A, G90 zinc coating; 24 gage core steel, exposed flashings shall be shop prefinished with KYNAR coating of color as selected.

2.07 FLASHINGS
- A. Flexible Flashings: Same material as membrane, Duro-Last, color to be selected.
- B. Counterflashings: Galvanized metal, as specified in Section 07620. Kynar finish.
- C. Edge Drip Flashing: Aluminum or galvanized / prefinished to match existing.

2.08 ACCESSORIES

A. Fiber Cant and Tapered Edge Strips: Asphalt impregnated wood fiberboard, preformed to 45 degree angle, tapered edge strip, configuration as detailed.
B. **Tapered Insulation. Expanded polystyrene, tapered 1/8" inch per foot.**
C. Insulation Fasteners: As recommended by insulation manufacturer.
D. Insulation Joint Tape: Asphalt treated glass fiber reinforced; 6 inches wide; self adhering, or as recommended by insulation manufacturer.
E. Roofing Fasteners: Galvanized, hot dipped or non-ferrous type, size as required to suit application as recommended by manufacturer.
F. Sealants: As recommended by membrane manufacturer.
G. Strip Bar Devices: Galvanized steel; maximum possible lengths per location, with attachment flanges. Attachments shall be secured to building @ minimum 6" o.c.
H. Adhesive: As recommended by insulation manufacturer. Adhesives must be tested and approved for use in U.L. and F.M. uplift assemblies.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work and <u>all existing roofing materials have been properly removed and cleaned.</u>
B. <u>Verify flashings, anchors, attachments, caulk, roofing mastic, etc., have been proper removed cleaned and ready for new roof assembly.</u>
C. Verify deck is supported and secure, <u>any loose, damaged or rotted decking has been replaced</u>.
C. Verify deck is clean and smooth, free of depressions, waves, or projections.
D. Verify deck surfaces are dry and free of snow or ice. Confirm dry deck by moisture meter with 12 percent moisture maximum.
E. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, and cant strips and wood nailers are in place.

3.02 INSULATION APPLICATION

A. Ensure deck is clean and dry.
B. Insulation and substrate must be as recommended and approved by roofing manufacturer.
D. All insulation must be independently attached to the approved substrate using manufacturer approved adhesives, fasteners and plates, as per manufacturer's specifications.
E. Install Cover board and slip sheet as approved and recommended by manufacturer.

3.03 MEMBRANE APPLICATION

A. Apply membrane in accordance with manufacturer's instructions.
B. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
C. Bond sheet to substrate.
D. Overlap edges and ends and seal by contact adhesive, minimum 5 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
E. Shingle joints on sloped substrate in direction of drainage. Apply joint tape and seal.
F. Extend membrane up cant strips and minimum of 6 inches onto vertical surfaces.
G. Seal membrane around roof penetrations.
H. Apply double layer of membrane at splash areas from high roofs and condensate drains.

3.04 FLASHINGS AND ACCESSORIES

A. Apply flexible flashings to seal membrane to vertical elements.
B. Secure to nailing strips at 4 inches oc.
C. Fabricate roofing control and expansion joints to isolate roof into areas as indicated.
D. Coordinate installation of roof drains, sumps, related flashings and roof curbing.
E. Seal flashings and flanges of items penetrating membrane.

3.05 FIELD QUALITY CONTROL

A. Correct identified defects or irregularities.
B. Require site attendance of roofing manufacturer's representatives during completion of the Work, as required to meet manufacturer's warranty requirements.

3.06 CLEANING

A. In areas where finished surfaces are soiled by Work of this section, consult manufacturer of surfaces for cleaning advice and conform to their instructions.

B. Repair or replace defaced or disfigured finishes caused by Work of this section.

3.07 PROTECTION

A. Protect building surfaces against damage from roofing work.

B. Where traffic must continue over finished roof membrane, protect surfaces.

END OF SECTION 07533

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Cap and sill flashings.
- B. Scupperbox, leader head and downspouts
- C. Counterflashings at roof mounted equipment and vent stacks.
- D. Miscellaneous flashings and closure pieces.

1.02 SUBMITTALS
- A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.03 QUALITY ASSURANCE
- A. Perform work in accordance with SMACNA standard details and requirements.

1.04 QUALIFICATIONS
- A. Fabricator and Installer: Company specializing in sheet metal flashing work with three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect and handle products to site under provisions of the General Requirements.
- B. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials which may cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS
- A. Pre-Coated Galvanized Steel: ASTM A446, Grade A, G90 zinc coating; 24 gage core steel, exposed flashings shall be shop prefinished with KYNAR coating of color as selected.

2.02 ACCESSORIES
- A. Fasteners: Galvanized steel with soft neoprene washers.
- B. Underlayment: ASTM D2178, No. 30 asphalt saturated roofing felt.
- C. Slip Sheet: Rosin sized building paper.
- D. Primer: Zinc chromate type.
- E. Sealant: Polyurethane type, specified in Section 07900.
- F. Bedding Compound: Rubber-asphalt type.
- G. Plastic Cement: ASTM D4586, Type II.
- H. Reglets: Recessed type, galvanized steel; face and ends covered with plastic tape.
- I. Gutter and Downspout Anchorage Devices: SMACNA requirements. Type recommended by fabricator.

2.03 COMPONENTS
- A. Scupper box, leader head and associated flanges, flashing, fascia, etc.
- B. Downspouts: Rectangular profile.
- C. Accessories: Profiled to suit scuppers and downspouts.
- D. Downspout Boots: Flexible plastic or metal.

2.04 FABRICATION
- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of metal, same material as sheet, interlockable with sheet.
- C. Form pieces in longest possible lengths. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam and/or solder for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
G. Fabricate flashings to allow toe to extend 2 inches over roofing. Return and brake edges.

2.05 FINISH
A. Exposed metal shall pre-finished with Kynar finish color to be selected.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets in place, and nailing strips located.
B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION
A. Install starter and edge strips, and cleats before starting installation.
B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

3.03 INSTALLATION
A. Conform to drawing details included in the SMACNA manual unless otherwise indicated on the drawings.
B. Insert flashings into reglets to form tight fit. Secure in place with lead wedges. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.
C. Apply plastic cement compound between metal flashings and felt flashings.
D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
E. Seal metal joints watertight. Secure gutters and downspouts in place using fasteners. Set splash pans under downspouts. Seal metal joints watertight.

END OF SECTION 07620

SECTION 07900

JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Preparing substrate surfaces.
B. Sealant and joint backing.

1.02 QUALITY ASSURANCE
A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
B. Perform acoustical sealant application work in accordance with ASTM C919.

1.03 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
B. Applicator: Company specializing in performing the work of this section with minimum years documented experience.

1.04 WARRANTY
A. Provide five year warranty.
B. Warranty: Include coverage for installed sealants and accessories which fail to achieve air tight seal, water tight seal, and exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 SEALANTS
A. Acrylic Latex (Interior Minor Movement): ASTM C920, Single component, non-staining, non-bleeding, non-sagging; white color paintable; manufactured by Pecora AC 20 + silicone.
B. Butyl Sealant (Interior Minor Movement): ASTM C920 single component, solvent release, non-skinning, non-sagging, white, paintable; manufactured by Pecora BC 158.
C. Silicone Sealant (Exterior, Interior Major Movement and Water Resistant Areas): Single component, solvent curing, non-sagging, non-staining, fungus resistant, non-bleeding; color as selected or to match adjacent materials; manufactured by Pecora 895 silicone.
D. Bituminous Based (Paving): Single component, asphalt compound, elongation capability of 0 to 2 percent of joint width.

2.02 ACCESSORIES
A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
C. Joint Backing: ASTM D1056; round, closed or open cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.
D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that substrate surfaces and joint openings are ready to receive work.
B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION
A. Remove loose materials and foreign matter which might impair adhesion of sealant.
B. Clean and prime joints in accordance with manufacturer's instructions.
C. Perform preparation in accordance with manufacturer's instructions.
D. Protect elements surrounding the work of this section from damage or disfiguration.

3.03 INSTALLATION

A. Install sealant in accordance with manufacturer's instructions.
B. Measure joint dimensions and size materials to achieve required 2:1 width/depth ratios.
C. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.
D. Install bond breaker where joint backing is not used.
E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.04 SCHEDULE

A. Interior: Caulk around all frames, windows, doors, openings, trim, etc., as required to seal or fill gaps, cracks, to make material transitions watertight and/or visually tight and finished.
B. Exterior: Caulk around all frames, windows, doors, openings, trim, material transitions etc., as required to seal or fill gaps, cracks, to make material transitions watertight and/or visually tight finished.
C. Paving: Caulk as required to seal or fill gaps, expansion joints, and cracks to make transitions watertight and/or visually tight.

END OF SECTION 07900

SECTION 08111

STANDARD STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Non-rated, fire rated and thermally insulated steel doors and frames.
- B. Interior and exterior glazed light frames.

1.2 REFERENCES
- A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- B. ANSI/SDI-100 - Standard Steel Doors and Frames.
- C. Door Hardware Institute (DHI) - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
- D. NFPA 80 - Fire Doors and Windows.
- E. NFPA 252 - Fire Tests for Door Assemblies.
- F. UL 10B - Fire Tests of Door Assemblies.

1.3 SUBMITTALS
- A. Submit under provisions of the General Requirements.
- B. Shop Drawings: Indicate door and frame elevations, internal reinforcement, closure method, and cut-outs for glazing and finish.
- C. Product Data: Indicate door and frame configurations, anchor types and spacings, location of cut-outs for hardware reinforcement.
- D. Manufacturer's Installation Instructions: Indicate special installation instructions.

1.4 REGULATORY REQUIREMENTS
- A. Fire Rated Door and Frame Construction: Conform to ASTM E152 and NFPA 252.
- B. Installed Door and Panel Assembly: Conform to NFPA 80 for fire rated class as scheduled.

1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect, and handle products to site.
- B. Accept doors and frames on site in manufacturer's packaging. Inspect for damage.

1.6 FIELD MEASUREMENTS
- A. Verify that field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.1 DOOR MANUFACTURERS
- A. Ceco Door Products
- B. Steel Craft
- C. Curries Co.
- D. Substitutions: Under provisions of the General Requirements.

2.2 DOORS
- A. Exterior Insulated Doors Thermally Broken: SDI-100 Grade III.
- B. Interior Doors (Non-rated and Fire Rated): SDI-100 Grade III.

2.3 DOOR CONSTRUCTION
- A. Face: Steel sheet in accordance with ANSI/SDI-100.
- B. Core: Polystyrene foam.
- C. Thermal Insulated Door: Total insulation R value of 7.7, measured in accordance with ASTM C236.

2.4 FRAMES
- A. Exterior Frames: 16 gage thick material, base metal thickness.
- B. Interior Frames: 16 gage thick material, base metal thickness.

2.5 ACCESSORIES
- A. Removable Stops: Rolled steel channel shape, mitered corners; prepared for countersink style screws.
- B. Primer: Zinc chromate type.
- C. Silencers: Resilient rubber, fitted into drilled hole.

2.6 FABRICATION
- A. Astragals for Double Doors: Steel, T shaped, specifically for double doors.
- B. Fabricate doors with hardware reinforcement welded in place.
- C. Attach fire rated label to each door unit.
- D. Close top and bottom edge of exterior doors with flush end closure. Seal joints watertight.
- E. Configure exterior doors with special profile to receive recessed weatherstripping.
- F. Fabricate frames as welded unit.
- G. Mullions for Double Doors: Removable type, of same profiles as jambs.
- H. Transom Bars for Glazed Lights: Fixed type, of same profiles as jamb and head.
- I. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.
- J. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.
- K. Prepare frame for silencers. Provide three single silencers for single doors and mullions of double doors on strike side. Provide two single silencers on frame head at double doors without mullions.
- L. Configure exterior frames with special profile to receive recessed weather stripping.
- M. Fabricate frames to suit masonry wall coursing with 4 or 2 inch head member.

2.7 FINISH
- A. Steel Sheet: Galvanized to ASTM A525.
- B. Primer: Baked.
- C. Coat inside of frame profile with bituminous coating to a thickness of 1/16 inch.

PART 3 EXECUTION

3.1 EXAMINATION
- A. Verify that opening sizes and tolerances are acceptable.

3.2 INSTALLATION
- A. Install doors and frames in accordance with ANSI/SDI-100 and DHI.
- B. Coordinate installation of glass and glazing.
- C. Install door louvers, plumb and level.
- D. Coordinate installation of doors and frames with installation of frames and hardware specified in Section 08710.
- E. Coordinate with masonry and wallboard wall construction for anchor placement.
- F. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

3.3 ERECTION TOLERANCES
- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.4 ADJUSTING
- A. Adjust door for smooth and balanced door movement.

END OF SECTION 08111

SECTION 08211

PANEL MASONITE DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Masonite Panel doors; Panel Masonite doors as indicated on the drawings; fire rated and non-rated.

1.03 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, protect, and handle products to site
B. Accept doors on site in manufacturer's packaging. Inspect for damage. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges if stored more than one week. Break seal on-site to permit ventilation.

1.05 FIELD MEASUREMENTS
A. Verify that field measurements are as indicated on shop drawings.

1.06 COORDINATION
A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.07 WARRANTY
A. Provide warranty to the following term:
    1. Interior Doors: 1 year
B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Masonite Int Corp
B. Substitutions: Under provisions of the General Requirements.

2.02 DOOR TYPES
A. Panel Interior Doors: 1-3/4 inches thick
B. Type, Size and Style per construction drawings.

2.03 DOOR CONSTRUCTION
A. Core (Solid,Non-Rated).
B. Core (Solid, Fire Rated).

2.04 ACCESSORIES
A. Glazing Stops: Masonite, of same species as door facing Masonite with metal clips for rated doors, mitered corners; prepared for countersink style screws.

2.05 FABRICATION
A. Fabricate non-rated doors in accordance with Standard requirements.
B. Fabricate fire rated doors in accordance with Standards and to UL requirements. Attach fire rating label to door.
D. Provide lock blocks at lock edge and top of door for closer hardware reinforcement.
F. Fit door edge trim to edge of stiles after applying veneer facing.
G. Bond edge banding to cores.
H. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Provide solid blocking for through bolted hardware.
I. Factory pre-fit doors for frame opening dimensions identified on shop drawings.
J. Cut and configure exterior door edge to receive recessed weather stripping devices.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify that opening sizes and tolerances are acceptable.
- B. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION
- A. Install fire rated and non-rated doors in accordance with Standards requirements.
- B. Trim non-rated door width by cutting equally on both jamb edges.
- C. Trim door height by cutting bottom edges to a maximum of 3/4 inch (19 mm). Trim fire door height at bottom edge only, in accordance with fire rating requirements.
- D. Pilot drill screw and bolt holes. Use threaded through bolts for half surface hinges.
- E. Machine cut for hardware. Core for handsets and cylinders.
- F. Coordinate installation of glass and glazing.

3.03 INSTALLATION TOLERANCES
- A. Maximum Diagonal Distortion (Warp): 1/8 inch measured with straight edge or taught string, corner to corner, over an imaginary 36 x 84 inch surface area.
- B. Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taught string, top to bottom, over an imaginary 36 x 84 inch surface area.
- C. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taught string, edge to edge, over an imaginary 36 x 84 inch surface area.

3.04 ADJUSTING
- A. Adjust door for smooth and balanced door movement.

END OF SECTION 08211

SECTION 08410

ALUMINUM ENTRANCES, STOREFRONT, & WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Aluminum doors and frames.
- B. Vision glass and glass
- C. Door hardware
- D. **2021 International Energy Conservation Code** (Commercial) requirements apply
- E. Integral air and vapor barrier.
- F. Perimeter sealant.

1.02 SYSTEM DESCRIPTION
- A. Aluminum entrances, storefront system and curtain wall system includes tubular aluminum sections with supplementary internal support framing, shop fabricated, factory prefinished, vision glass, related flashings, anchorage and attachment devices.

1.03 PERFORMANCE REQUIREMENTS
- A. Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with codes.
- B. Limit mullion deflection to flexure limit of glass; with full recovery of glazing materials.
- C. System to accommodate, without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.
- D. Limit air leakage through assembly to 0.06 cfm/min/sq. ft. of wall area, measured at a reference differential pressure across assembly of psf as measured in accordance with AAMA 501.
- E. Water Leakage: None, when measured in accordance with AAMA 501 with a test pressure difference of 2.86 lbs/sq. ft.
- F. Maintain continuous air and vapor barrier throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.
- G. System to provide for expansion and contraction within system components caused by a cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental affect to system components.
- H. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.
- I. Window assemblies required to meet the **2021 IECC** energy requirements (This means full window system – not individual components). Reference Table C402.4. Abilene (Taylor County), Texas is allocated as a Climate Zone 3B.
    - **1. Required U-values**
        - a. Fixed Fenestration = Min. 0.42
        - b. Operable Fenestration = Min. 0.54
        - c. Entrance Doors = Min. 0.68
    - **2. Required SHGC Values**
        - a. Fixed Fenestration = Min. 0.25
        - b. Operable Fenestration = Min. 0.23

1.04 SUBMITTALS
- A. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.

1.05 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect and handle products to site.
- B. Protect pre-finished aluminum surfaces. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.06 ENVIRONMENTAL REQUIREMENTS
- A. Do not install sealants when ambient temperature is less than 40 degrees F during and 48 hours after installation.

1.07 FIELD MEASUREMENTS
A. Verify that field measurements are as indicated on shop drawings.

1.08 WARRANTY
A. Provide three year warranty.
B. Warranty: Include coverage for complete system for failure to meet specified requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Storefront System
1. Manufacturer - **Manko – 2450 series, Door series 150i Thermal Door**. All windows to have sub-sill, head and jamb receptors.
2. Other acceptable manufacturers offering equivalent Products.
a. Kawneer.
b. Amarlite.
c. EFCO.
3. Substitutions: Under provisions of the General Requirements.
B. Windows (Single Hung)
1. Manufacturer – **Manko – 725 Historical Single Hung & Fixed.** All windows to have sub-sill, head and jamb receptors.
2. Any and all substitution and alternates must be reviewed by architect and must be similar in profile and design to the Manko 725 Historical Single Hung & Fixed window.

2.02 MATERIALS
A. Extruded Aluminum: ANSI/ASTM B221; 6063 alloy, T5 temper. Colors: **Dark Bronze (Per Historic - Must be a Painted/Baked Kynar-type finish)**
B. Steel Sections: ANSI/ASTM A36; shaped to suit mullion sections.
C. Fasteners: Galvanized steel.

2.03 COMPONENTS
A. Storefront Frame: 4 1/2 x 2 inch nominal dimension; glazing stops; drainage holes; internal weep drainage system. **Subsill with end dams are required.**
C. Doors: 2 inches thick, 5-inch wide top rail, 5-inch wide vertical stiles, 10-inch wide bottom rail; square glazing stops.
D. Flashings: Aluminum, finish to match mullion sections where exposed.

2.04 GLASS AND GLAZING MATERIALS
A. Glass and Glazing Materials: As specified in Section 08800 of types described below:
1. Glass at Exterior and several Interior Lights (reference drawings): 1-inch insulated type, **Clear glazing (Per Historic),** tempered where required by Building codes, **Low-E coating**
a. **Guardian Superneutral 68, Solarban 60 or approved equal**

2.05 SEALANT MATERIALS
A. Sealant and Backing Materials: As specified in Section 07900.

2.06 HARDWARE
A. Weather Stripping, Sill Sweep Strips, Thresholds, Hinges, Tubular Pull Handles, Panic Device, Closer: Manufacturers' standard type to suit application, and finish, all provided by storefront manufacturer / supplier.

2.07 FABRICATION
A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
C. Prepare components to receive anchor devices. Fabricate anchors.
D. Arrange fasteners and attachments to conceal from view.
E. Prepare components with internal reinforcement for door hardware and door operator hinge hardware.

F. Reinforce framing members for imposed loads.

2.08 FINISHES
A. Finish coatings to conform to AAMA
B. **Exposed Aluminum Surfaces: Dark Bronze (Painted/Baked Kynar-type finish, per historic)**
1. Anodized finish ***not acceptable*** for The Secretary of the Interior's Standards for the Treatment of Historic Properties.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify site opening conditions.
B. Verify dimensions, tolerances, and method of attachment with other work.
C. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.

3.02 INSTALLATION
A. Install wall system in accordance with manufacturer's instructions and AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.
B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
C. Provide alignment attachments and shims to permanently fasten system to building structure.
D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
E. Provide thermal isolation where components penetrate or disrupt building insulation.
F. Install sill flashings and manufacturer's standard subsill, head and jamb systems.
G. Coordinate attachment and seal of perimeter air and vapor barrier materials.
H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
I. Set thresholds in bed of mastic and secure.
J. Install hardware using templates provided.
K. Install glass in accordance with Section 08800, to glazing method required to achieve performance criteria.
L. Install perimeter sealant to method required to achieve performance criteria, backing materials, and installation criteria in accordance with Section 07900.

3.03 TOLERANCES
A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 feet, whichever is less.
B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 ADJUSTING
A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING
A. Remove protective material from prefinished aluminum surfaces.
B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
C. Remove excess sealant by method acceptable to sealant manufacturer.

3.06 PROTECTION OF FINISHED WORK
A. Protect finished Work from damage.

END OF SECTION 08410

SECTION 08710

DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Hardware for wood, hollow steel, metal insulated and aluminum doors.
- B. Thresholds.
- C. Weatherstripping, seals and door gaskets.

1.03 REFERENCES
- A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

1.04 OPERATION AND MAINTENANCE DATA
- A. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.05 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 3 years' documented experience.
- B. Hardware Supplier: Company specializing in supplying commercial door hardware with 3 years' documented experience approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect and handle products to site.
- B. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.
- C. Deliver keys to Owner by security shipment direct from hardware supplier.

1.07 WARRANTY
- A. Provide five-year warranty.

1.08 MAINTENANCE MATERIALS
- A. Provide special wrenches and tools applicable to each different or special hardware component.
- B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 PRODUCTS

2.01 KEYING
- A. Door Locks:
  1. All apartment units to be keyed separately. Provide owner with 3 copies per apartment unit.
  2. All Mechanical (including mechanical closets inside apartment units) and I.T. rooms are to be keyed on a master key. Provide owner with 5 copies.
  3. Doors accessing Commercial Space 1 #102 are to be keyed on a master key. Provide owner with 5 copies.
  4. Doors accessing Commercial Space 2 #106 are to be keyed on a master key. Provide owner with 5 copies.
  5. Door accessing Leasing Office #107 is to be keyed on a master key. Provide owner with 5 copies.
  6. Exterior and interior doors accessing resident areas - coordinate access and security needs with owner.

2.02 HNGES
- A. Butts and Hinges: BHMA A156.1.
- B. Template Hinge Dimensions: BHMA A156.7.
- C. Manufacturers:
  1. Baldwin Hardware Corporation (BH).
  2. Bommer Industries, Inc. (BI).
  3. Cal-Royal Products, Inc. (CRP).
  4. Hager Companies (HAG).
  5. Lawrence Brothers, Inc. (LB).
  6. McKinney Products Company; an ASSA ABLOY Group company (MCK).
  7. PBB, Inc. (PBB).

8. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

2.03 LOCKS AND LATCHES, GENERAL

A. Accessibility Requirements: Comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." ANSI A117.1. FED-STD- 795, "Uniform Federal Accessibility Standards."
   1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

2.04 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
   7. Bored Locks: BHMA A156.2.
   2. Mortise Locks: BHMA A156.13.
   3. Interconnected Locks: BHMA A156.12.

B. Bored Locks:
   1. Manufacturers:
      a. Best Access Systems; Div. of The Stanley Works (BAS).
      b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
      c. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
      d. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
      e. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).

2.05 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:
   1. Master Key System: Cylinders are operated by a change key and a master key.

B. Keys: Nickel silver.
   1. Quantity: Reference above Section 201.A

2.06 CLOSERS

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with [the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG).", ANSI A117.1., FED-STD-795, "Uniform Federal Accessibility Standards."
   1. Comply with the following maximum opening-force requirements:
      a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
      b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
      c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.

D. Flush Floor Plates: Provide finish cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.

E. Recessed Floor Plates: Provide recessed floor plates with insert of floor finish material for floor closers unless thresholds are indicated. Provide extended closer spindle to accommodate thickness of floor finish.

F. Power-Assist Closers: As specified in Division 8 Section "Automatic Door Operators" for access doors for people with disabilities or where listed in the door hardware sets.

G. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

H. Surface Closers: Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
   1. Manufacturers:
      a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
      b. LCN Closers; an Ingersoll-Rand Company (LCN).
      c. Norton Door Controls; an ASSA ABLOY Group company (NDC).
      d. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
      e. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).

I. Concealed Closers:
   1. Manufacturers:

a. LCN Closers; an Ingersoll-Rand Company (LCN).
b. Norton Door Controls; an ASSA ABLOY Group company (NDC).
c. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).

2.07 STOPS AND HOLDERS

A. Stops and Bumpers:
1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.

B. Silencers for Wood Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum 5/8 by 3/4 inch (16 by 19 mm); fabricated for drilled-in application to frame.

C. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

D. Manufacturers:
1. Baldwin Hardware Corporation (BH).
2. Cal-Royal Products, Inc. (CRP).
3. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
4. Hager Companies (HAG).
5. Hiawatha, Inc. (HIA).
6. IVES Hardware; an Ingersoll-Rand Company (IVS).
7. Rockwood Manufacturing Company (RM).
8. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
9. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

2.08 DOOR GASKETING

A. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

B. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

C. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.
1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Gasketing Materials: ASTM D 2000 and AAMA 701/702.

G. Manufacturers:
1. Hager Companies (HAG).
2. National Guard Products (NGP).
3. Pemko Manufacturing Co. (PEM).
4. Zero International (ZRO).

2.09 THRESHOLDS

A. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with [the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG).", ANSI A117.1., FED-STD-795, "Uniform Federal Accessibility Standards."

B. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch (13 mm) high.

C. Manufacturers:
1. Hager Companies (HAG).
2. National Guard Products (NGP).
3. Pemko Manufacturing Co. (PEM).
4. Zero International (ZRO).

2.10 FABRICATION

A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal

to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

B. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
   1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
   2. Steel Machine or Wood Screws: For the following fire-rated applications:
      a. Mortise hinges to doors.
      b. Strike plates to frames.
      c. Closers to doors and frames.
   3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:
      a. Surface hinges to doors.
      b. Closers to doors and frames.
      c. Surface-mounted exit devices.
   4. Spacers or Hex Bolts: For through bolting of hollow-metal doors.
   5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.11 FINISHES

A. Standard: BHMA A156.18, as indicated in door hardware sets.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.

B. Verify that electric power is available to power operated devices and of the correct characteristics.

C. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

D. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer’s instructions.

B. Use templates provided by hardware item manufacturer.

C. Mounting heights for hardware from finished floor to center line of hardware item:
   1. Locksets: 40”
   2. Push/Pulls: 45”
   3. Dead Locks: 54”
   4. Exit Devices: 42”

D. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.03 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door. Requirements in paragraph below increase cost but are recommended as a good investment on substantial projects even though they may be difficult to monitor.

Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

END OF SECTION 08710

SECTION 08800

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Glass and glazing for Sections referencing this Section for products and installation.

1.02 PERFORMANCE REQUIREMENTS
- A. Glass and glazing materials of this Section shall provide continuity of building enclosure vapor and air barrier:
  1. To utilize the inner pane of multiple pane sealed units for the continuity of the air and vapor seal.
  2. Maintain continuous air and vapor barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.
- B. Size glass to withstand dead loads and positive and negative live loads acting normal to plane of glass as calculated in accordance with UBC 91 code.
- C. Limit glass deflection to 1/200 flexure limit of glass with full recovery of glazing materials, whichever is less.

1.03 ENVIRONMENTAL REQUIREMENTS
- A. Do not install glazing when ambient temperature is less than 50 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.04 FIELD MEASUREMENTS
- A. Verify that field measurements are as indicated on shop drawings.

1.05 COORDINATION
- A. Coordinate the Work with glazing frames, wall openings, and perimeter air and vapor seal to adjacent Work.

1.06 WARRANTY
- A. Provide five-year manufacturer's warranty.
- B. Warranty: Include coverage for sealed glass units from seal failure, inter-pane dusting or misting, reflective coating on mirrors, delamination of laminated glass and replacement of same.

PART 2 PRODUCTS

2.01 FLAT GLASS MATERIALS
- A. Float Glass (Type FG): Clear, 1/4-inch-thick minimum. (interior)
- B. Safety Glass (Type SG): Clear, fully tempered with horizontal tempering, 1/4-inch-thick minimum at all locations where glass is less than 18 inches above finished floor and all doors with glazing not specified to be fire-rated. (interior)
- C. Mirror Glass (Type MG): Clear with copper and silver coating, organic overcoating, beveled edges, 1/4-inch-thick minimum, sizes as indicated on drawings.
- D. Fire Rated Glass: Clear, thickness and assembly to meet required rating as listed on the drawings and schedules.

2.02 SEALED INSULATING GLASS MATERIALS
- A. Insulated Glass Units (Type IG): ASTM E774 and E773; 1" and ½" total thickness as detailed and noted, double pane with edge seal; outer pane of 1/4 inch glass at exterior, inner pane of 1/4 inch glass.
  1. All exterior glazing is to be **Clear, Low-E** per *The Secretary of the Interior's Standards for the Treatment of Historic Properties.*
  2. Products: **Guardian Superneutral 68, Solarban 60 or approved equal**

2.03 GLAZING COMPOUNDS

A. Exterior windows not shop installed shall be glazed with vinyl or neoprene gaskets, extruded elastic polybutene tape sealant, a combination of polysulphide base compound and elastic glazing compound, or a combination of extruded polysulphide tape, polysulphide base compound elastic glazing compound.

B. Doors and interior stopped -in glass shall be glazed using putty or elastic glazing compound and stop beads.

C. Exterior glazing of steel sash shall be DAP Metal Glaze. Interior glazing of steel sash shall be DAP Steel Sash Putty.

2.04 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene or Silicone, 80 - 90 Shore A durometer hardness, length of 0.1 inch for each square foot of glazing or minimum 4-inch x width of glazing rabbet space minus 1/16-inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene or Silicone, 50 - 60 Shore A durometer hardness, minimum 3-inch-long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 - 15 Shore A durometer hardness; coiled on release paper.

D. Glazing Clips: Manufacturer's standard type.

E. Mirror Attachment Accessories: Mirror adhesive, chemically compatible with mirror coating and wall substrate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Install glazing in accordance with Flat Jobbers Association Glazing Manual.

3.03 INSTALLATION - MIRRORS

A. Set mirrors with adhesive, applied in accordance with adhesive manufacturer's instructions.

B. Place plumb and level.

3.04 CLEANING

A. Remove glazing materials from finish surfaces. Remove labels after work is complete. Clean glass and mirrors.

3.05 PROTECTION OF FINISHED WORK

A. After installation, mark pane with an "X" by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

END OF SECTION 08800

SECTION 09016

TERRAZZO (FLOOR RESTORATION)

PART 1: GENERAL

1.01 SECTION INCLUDES

A. Refinishing terrazzo floors.
B. Provide all labor, material, and equipment necessary to complete the following terrazzo repair work
C. Preparation of all surfaces to receive patching compound
D. Repairs to delaminated areas
E. Repair of cracks (as per NTMA recommendations)
F. Placement of patching compounds/terrazzo matrix
G. Finish and curing of terrazzo

1.02 REFERENCE STANDARDS

A. NTMA – Terrazzo Specifications; The National Terrazzo and Mosaic Association, Inc.; current edition located at www.ntma.com
B. U.S Department of the Interior – The Secretary of the Interior's Standards for the Treatment of Historic Properties

1.03 SUBMITTALS

A. Product Data: Provide manufacturers technical data for sealer and cleaner and grout.
B. Cleaning products to be used and Terrazzo Maintenance Data/Protocols for facility managers
C. Submit letter clearly identifying the terrazzo system (Epoxy, Cement, etc) and that the products are suitable/compatible

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with not fewer than 5 years of documented experience.
   1. Installer shall be a contractor member of NTMA in good standing and shall perform all work in accordance with NTMA standards
   2. Use only skilled journeyman who are familiar and experienced with the materials and methods specified shall be used for terrazzo restoration/refinishing.
   3. Crack Repair: Prepare a sample area for each type of crack repair required (Hairline cracks 1/64" to 1/16" in size; Cracks and voids larger than 1/8") Repair shall demonstrate methods and quality of workmanship of crack repair.
   4. Patching: Prepare on-floor, a sample of patching. Patch shall demonstrate methods and quality of workmanship of patch repair

PART 2: PRODUCTS

2.01 MATERIALS

A. Cleaner: Potable water, free of iron, all cleaners (optional) must be pH neutral
B. Sealer: Liquid type to completely seal matrix surface; not detrimental to terrazzo components.
C. Grout: Color to match existing matrix.
D. Matrix: Pigmented epoxy to match sample submitted
E. Aggregates: Aggregates to match architects approved sample

2.02 EQUIPMENT

A. All work shall be executed with conventional terrazzo grinding equipment according to NTMA published trade practice.

PART 3: EXECUTION

3.01 GENERAL

A. Perform work in accordance with NTMA recommendations as posted on the NTMA website (www.ntma.com)

3.02 PREPARATION
A. Cover and protect all adjacent finished surfaces during restoration process.

3.03 CRACK REPAIR
A. Determination
1. The owner and contractor shall walk the entire floor and identify cracks and agree on
a. NA (No Action) RC (Repair Crack) or RT (Replace Terrazzo)
b. Hairline cracks are classified as less than 1/32” (0.030)
c. Replacement (RT) shall be from architectural break to architectural break
B. RC - Repair Crack
1. Clean crack of loose material, dirt or sealer
2. Fill with resin/to match existing. Use aggregate in the crack if crack is wider than ¼ inch.

3.04 RT- Replace Terrazzo (if repair is not to architectural break or existing terrazzo divider strip, the joining edge shall be a saw tooth (jagged edge)
A. Remove areas to be replaced
B. Clean area and prepare concrete for new terrazzo
C. Repair concrete, fill cracks in concrete substrate as needed. Fill cracks in concrete with hardening epoxy
1. Optional upgrade: Employ the use of a mesh (isolation membrane) to cover crack with liquid applied membrane (epoxy systems only)
D. Fill area with epoxy or cement /cement matrix and approved aggregate mixture/blend

3.05 INITIAL GRINDING
A. Wet or dry grind with appropriate medium diamonds/Stones

3.06 GROUTING
A. Cleanse floor with clean water and rinse. Wet grind with 50 or higher abrasive grit medium diamonds.
B. Remove excess water and machine or hand grout with cement or epoxy material to fill as needed.

3.07 CURING GROUT
A. Allow grout to cure a minimum of 12 hours. Maintain ambient air temperature between 70°F (21°C) and 80°F (27°C)

3.08 FINE (Final) GRINDING
A. Grind with 120 grit carborundum or 200 grit resin bond diamond until grout has been removed from the terrazzo surface.

3.09 CLEANING AND SEALING:
A. Rinse with clean water and allow too thoroughly dry.
B. Seal: Apply sealer per sealer manufacturer’s written directions
C. Remove protection and clean any adjacent surfaces effected by the refinishing process.

3.09 PROTECTION
A. General Contractor shall protect the finish floor from all site activity until Substantial Completion.

END OF SECTION 09016

RESERVATION BRIEF 21

Repairing Historic Flat Plaster Walls and Ceilings

- Historical Background
- Common Plaster Problems
- Repairing Historic Plaster
- When Damaged Plaster Cannot be Repaired
- Patching Materials
- Summary

Plaster in a historic building is like a family album. The handwriting of the artisans, the taste of the original occupants, and the evolving styles of decoration are embodied in the fabric of the building. From modest farmhouses to great buildings, regardless of the ethnic origins of the occupants, plaster has traditionally been used to finish interior walls.

A versatile material, plaster could be applied over brick, stone, half-timber, or frame construction. It provided a durable surface that was easy to clean and that could be applied to flat or curved walls and ceilings.

Plaster could be treated in any number of ways: it could receive stenciling, decorative painting, wallpaper, or whitewash. This variety and the adaptability of the material to nearly any building size, shape, or configuration meant that plaster was the wall surface chosen for nearly all buildings until the 1930s or 40s.

Historic plaster may first appear so fraught with problems that its total removal seems the only alternative. But there are practical and historical reasons for saving it. First, three-coat plaster is unmatched in strength and durability. It resists fire and reduces sound transmission. Next, replacing plaster is expensive. A building owner needs to think carefully about the condition of the plaster that remains; plaster is often not as badly damaged as it first appears.

Of more concern to preservationists, however, original lime and gypsum plaster is part of the building's historic fabric—its smooth troweled or textured surfaces and subtle contours evoke the presence of America's earlier craftsmen. Plaster can also serve as a plain surface for irreplaceable decorative finishes. For both reasons, plaster walls and ceilings contribute to the historic character of the interior and should be left in place and repaired if at all possible.

The approaches described in this Brief stress repairs using wet plaster, and traditional materials and techniques that will best assist the preservation of historic plaster walls and ceilings—and their appearance. Dry wall repairs are not included here, but have been written about extensively in other contexts. Finally, this Brief describes a replacement option when historic plaster cannot be repaired. Thus, a veneer plaster system is discussed rather than dry wall. Veneer systems include a coat or coats of wet plaster—although thinly applied—which can, to a greater extent, simulate traditional hand-troweled or textured finish coats. This system is generally better suited to historic preservation projects than dry wall.

To repair plaster, a building owner must often enlist the help of a plasterer. Plastering is a skilled craft, requiring years of training and special tools. While minor repairs can be undertaken by building owners, most repairs will require the assistance of a plasterer.

Historical Background

Plasterers in North America have relied on two materials to create their handiwork—lime and gypsum. Until the end of the 19th century, plasterers used lime plaster. Lime plaster was made from four ingredients: lime, aggregate, fiber, and water. The lime came from ground-and-heated limestone or oyster shells; the aggregate from sand; and the fiber from cattle or hog hair. Manufacturing changes at the end of the 19th century made it possible to use gypsum as a plastering material. Gypsum and lime plasters were used in combination for the base and finish coats during the early part of the 20th century; gypsum was eventually favored because it set more rapidly and, initially, had a harder finish.

Not only did the basic plastering material change, but the method of application changed also. In early America, the windows, doors, and all other trim were installed before the plaster was applied to the wall. Generally the woodwork was prime-painted before plastering. Obtaining a plumb, level wall, while working against built-up moldings, must have been difficult. But sometime in the first half of the 19th century, builders began installing wooden plaster "grounds" around windows and doors and at the base of the wall. Installing these grounds so that they were level and plumb made the job much easier

because the plasterer could work from a level, plumb, straight surface. Woodwork was then nailed to the "grounds" after the walls were plastered. Evidence of plaster behind trim is often an aid to dating historic houses, or to discerning their physical evolution.

Lime Plaster

When building a house, plasterers traditionally mixed bags of quick lime with water to "hydrate" or "slake" the lime. As the lime absorbed the water, heat was given off. When the heat diminished, and the lime and water were thoroughly mixed, the lime putty that resulted was used to make plaster.

When lime putty, sand, water, and animal hair were mixed, the mixture provided the plasterer with "coarse stuff." This mixture was applied in one or two layers to build up the wall thickness. But the best plaster was done with three coats. The first two coats made up the coarse stuff; they were the scratch coat and the brown coat. The finish plaster, called "setting stuff," contained a much higher proportion of lime putty, little aggregate, and no fiber, and gave the wall a smooth white surface finish.

Compared to the 3/8-inch-thick layers of the scratch and brown coats, the finish coat was a mere 1/8-inch thick. Additives were used for various finish qualities. For example, fine white sand was mixed in for a "float finish." This finish was popular in the early 1900s. (If the plasterer raked the sand with a broom, the plaster wall would retain swirl marks or stipples.) Or marble dust was added to create a hard-finish white coat which could be smoothed and polished with a steel trowel. Finally, a little plaster of Paris, or "gauged stuff," was often added to the finish plaster to accelerate the setting time.

Although lime plaster was used in this country until the early 1900s, it had certain disadvantages. A plastered wall could take more than a year to dry; this delayed painting or papering. In addition, bagged quick lime had to be carefully protected from contact with air, or it became inert because it reacted with ambient moisture and carbon dioxide. Around 1900, gypsum began to be used as a plastering material.

Gypsum Plaster

Gypsum begins to cure as soon as it is mixed with water. It sets in minutes and completely dries in two to three weeks. Historically, gypsum made a more rigid plaster and did not require a fibrous binder. However it is difficult to tell the difference between lime and gypsum plaster once the plaster has cured. Despite these desirable working characteristics, gypsum plaster was more vulnerable to water damage than lime. Lime plasters had often been applied directly to masonry walls (without lathing), forming a suction bond. They could survive occasional wind-driven moisture or water winking up from the ground. Gypsum plaster needed protection from water. Furring strips had to be used against masonry walls to create a dead air space. This prevented moisture transfer.

In rehabilitation and restoration projects, one should rely on the plasterer's judgment about whether to use lime or gypsum plaster. In general, gypsum plaster is the material plasterers use today. Different types of aggregate may be specified by the architect such as clean river sand, perlite, pumice, or vermiculite; however, if historic finishes and textures are being replicated, sand should be used as the base-coat aggregate. Today, if fiber is required in a base coat, a special gypsum is available which includes wood fibers. Lime putty, mixed with about 35% gypsum (gauging plaster) to help it harden, is still used as the finish coat.

Lath

Lath provided a means of holding the plaster in place. Wooden lath was nailed at right angles directly to the structural members of the buildings (the joists and studs), or it was fastened to nonstructural spaced strips known as furring strips. Three types of lath can be found on historic buildings.

Wood Lath

Wood lath is usually made up of narrow, thin strips of wood with spaces in between. The plasterer applies a slight pressure to push the wet plaster through the spaces. The plaster slumps down on the inside of the wall, forming plaster "keys." These keys hold the plaster in place.

Metal Lath

Metal lath, patented in England in 1797, began to be used in parts of the United States toward the end of the 19th century. The steel making up the metal lath contained many more spaces than wood lath had contained. These spaces increased the number of keys; metal lath was better able to hold plaster than wood lath had been.

Rock Lath

A third lath system commonly used was rock lath (also called plaster board or gypsum-board lath). In use as early as 1900, rock lath was made up of compressed gypsum covered by a paper facing. Some

rock lath was textured or perforated to provide a key for wet plaster. A special paper with gypsum crystals in it provides the key for rock lath used today; when wet plaster is applied to the surface, a crystalline bond is achieved.
Rock lath was the most economical of the three lathing systems. Lathers or carpenters could prepare a room more quickly. By the late 1930s, rock lath was used almost exclusively in residential plastering.

Common Plaster Problems

When plaster dries, it is a relatively rigid material which should last almost indefinitely. However, there are conditions that cause plaster to crack, effloresce, separate, or become detached from its lath framewor. These include:

- Structural problems
- Poor workmanship
- Improper curing
- Moisture

Structural Problems

Overloading

Stresses within a wall, or acting on the house as a whole, can create stress cracks. Appearing as diagonal lines in a wall, stress cracks usually start at a door or window frame, but they can appear anywhere in the wall, with seemingly random starting points.
Builders of now-historic houses had no codes to help them size the structural members of buildings. The weight of the roof, the second and third stories, the furniture, and the occupants could impose a heavy burden on beams, joists, and studs. Even when houses were built properly, later remodeling efforts may have cut in a doorway or window without adding a structural beam or "header" across the top of the opening. Occasionally, load-bearing members were simply too small to carry the loads above them. Deflection or wood "creep" (deflection that occurs over time) can create cracks in plaster.
Overloading and structural movement (especially when combined with rotting lath, rusted nails, or poor quality plaster) can cause plaster to detach from the lath. The plaster loses its key. When the mechanical bond with the lath is broken, plaster becomes loose or bowed. If repairs are not made, especially to ceilings, gravity will simply cause chunks of plaster to fall to the floor.

Settlement/Vibration

Cracks in walls can also result when houses settle. Houses built on clay soils are especially vulnerable. Many types of clay (such as montmorillonite) are highly expansive.
In the dry season, water evaporates from the clay particles, causing them to contract. During the rainy season, the clay swells. Thus, a building can be riding on an unstable footing. Diagonal cracks running in opposite directions suggest that house settling and soil conditions may be at fault. Similar symptoms occur when there is a nearby source of vibration-blasting, a train line, busy highway, or repeated sonic booms.

Lath Movement

Horizontal cracks are often caused by lath movement. Because it absorbs moisture from the air, wood lath expands and contracts as humidity rises and falls. This can cause cracks to appear year after year. Cracks can also appear between rock lath panels. A nail holding the edge of a piece of lath may rust or loosen, or structural movement in the wood framing behind the lath may cause a seam to open. Heavy loads in a storage area above a rock-lath ceiling can also cause ceiling cracks.
Errors in initial building construction such as improper bracing, poor corner construction, faulty framing of doors and windows, and undersized beams and floor joists eventually "telegraph" through to the plaster surface.

Poor Workmanship

In addition to problems caused by movement or weakness in the structural framework, plaster durability can be affected by poor materials or workmanship.

Poorly Proportioned Mix

The proper proportioning and mixing of materials are vital to the quality of the plaster job. A bad mix can cause problems that appear years later in a plaster wall. Until recently, proportions of aggregate and lime were mixed on the job. A plasterer may have skimped on the amount of cementing material (lime

or gypsum) because sand was the cheaper material. Over sanding can cause the plaster to weaken or crumble. Plaster made from a poorly proportioned mix may be more difficult to repair.

Incompatible Base Coats and Finish Coats
Use of perlite as an aggregate also presented problems. Perlite is a lightweight aggregate used in the base coat instead of sand. It performs well in cold weather and has a slightly better insulating value. But if a smooth lime finish coat was applied over perlited base coats on wood or rock lath, cracks would appear in the finish coat and the entire job would have to be redone. To prevent this, a plasterer had to add fine silica sand or finely crushed perlite to the finish coat to compensate for the dramatically differing shrinkage rates between the base coat and the finish coat.

Improper Plaster Application
The finish coat is subject to "chip cracking" if it was applied over an excessively dry base coat, or was insufficiently troweled, or if too little gauging plaster was used. Chip cracking looks very much like an alligatored paint surface. Another common problem is called map cracking—fine, irregular cracks that occur when the finish coat has been applied to an over sanded base coat or a very thin base coat.

Too Much Retardant
Retarding agents are added to slow down the rate at which plaster sets, and thus inhibit hardening. They have traditionally included ammonia, glue, gelatin, starch, molasses, or vegetable oil. If the plasterer has used too much retardant, however, a gypsum plaster will not set within a normal 20 to 30 minute time period. As a result, the surface becomes soft and powdery.

Inadequate Plaster Thickness
Plaster is applied in three coats over wood lath and metal lath—the scratch, brown, and finish coats. In three-coat work, the scratch coat and brown coat were sometimes applied on successive days to make up the required wall thickness. Using rock lath allowed the plasterer to apply one base coat and the finish coat—a two-coat job.
If a plasterer skimped on materials, the wall may not have sufficient plaster thickness to withstand the normal stresses within a building. The minimum total thickness for plaster on gypsum board (rock lath) is 1/2 inch. On metal lath the minimum thickness is 5/8 inch; and for wood lath it is about 3/4 to 7/8 inch. This minimum plaster thickness may affect the thickness of trim projecting from the wall's plane.

Improper Curing
Proper temperature and air circulation during curing are key factors in a durable plaster job. The ideal temperature for plaster to cure is between 55 to 70 degrees Fahrenheit. However, historic houses were sometimes plastered before window sashes were put in. There was no way to control temperature and humidity.

Dry Outs, Freezing, and Sweat-outs
When temperatures were too hot, the plaster would return to its original condition before it was mixed with water, that is, calcined gypsum. A plasterer would have to spray the wall with alum water to reset the plaster. If freezing occurred before the plaster had set, the job would simply have to be redone. If the windows were shut so that air could not circulate, the plaster was subject to sweat-out or rot. Since there is no cure for rotted plaster, the affected area had to be removed and replastered.

Moisture
Plaster applied to a masonry wall is vulnerable to water damage if the wall is constantly wet. When salts from the masonry substrate come in contact with water, they migrate to the surface of the plaster, appearing as dry bubbles or efflorescence. The source of the moisture must be eliminated before replastering the damaged area.

Sources of Water Damage
Moisture problems occur for several reasons. Interior plumbing leaks in older houses are common. Roofs may leak, causing ceiling damage. Gutters and downspouts may also leak, pouring rain water next to the building foundation. In brick buildings, dampness at the foundation level can wick up into the above-grade walls. Another common source of moisture is splashback. When there is a paved area next to a masonry building, rainwater splashing up from the paving can dampen masonry walls. In both cases water travels through the masonry and damages interior plaster. Coatings applied to the interior are not effective over the long run. The moisture problem must be stopped on the outside of the wall.

Repairing Historic Plaster

Many of the problems described above may not be easy to remedy. If major structural problems are found to be the source of the plaster problem, the structural problem should be corrected. Some repairs can be made by removing only small sections of plaster to gain access. Minor structural problems that will not endanger the building can generally be ignored. Cosmetic damages from minor building movement, holes, or bowed areas can be repaired without the need for wholesale demolition. However, it may be necessary to remove deteriorated plaster caused by rising damp in order for masonry walls to dry out. Repairs made to a wet base will fail again.

Canvassing Uneven Wall Surfaces

Uneven wall surfaces, caused by previous patching or by partial wallpaper removal, are common in old houses. As long as the plaster is generally sound, cosmetically unattractive plaster walls can be "wallpapered" with strips of a canvas or fabric-like material. Historically, canvassing covered imperfections in the plaster and provided a stable base for decorative painting or wallpaper.

Filling Cracks

Hairline cracks in wall and ceiling plaster are not a serious cause for concern as long as the underlying plaster is in good condition. They may be filled easily with a patching material. For cracks that reopen with seasonal humidity change, a slightly different method is used. First the crack is widened slightly with a sharp, pointed tool such as a crack widener or a triangular can opener. Then the crack is filled. For more persistent cracks, it may be necessary to bridge the crack with tape. In this instance, a fiberglass mesh tape is pressed into the patching material.

After the first application of a quick setting joint compound dries, a second coat is used to cover the tape, feathering it at the edges. A third coat is applied to even out the surface, followed by light sanding. The area is cleaned off with a damp sponge, then dried to remove any leftover plaster residue or dust.

When cracks are larger and due to structural movement, repairs need to be made to the structural system before repairing the plaster. Then, the plaster on each side of the crack should be removed to a width of about 6 inches down to the lath. The debris is cleaned out, and metal lath applied to the cleared area, leaving the existing wood lath in place. The metal lath usually prevents further cracking. The crack is patched with an appropriate plaster in three layers (i.e., base coats and finish coat). If a crack seems to be expanding, a structural engineer should be consulted.

Replacing Delaminated Areas of the Finish Coat

Sometimes the finish coat of plaster comes loose from the base coat. In making this type of repair, the plasterer paints a liquid plaster-bonding agent onto the areas of base-coat plaster that will be replastered with a new lime finish coat. A homeowner wishing to repair small areas of delaminated finish coat can use the methods described in "Patching Materials."

Patching Holes in Walls

For small holes (less than 4 inches in diameter) that involve loss of the brown and finish coats, the repair is made in two applications. First, a layer of base coat plaster is troweled in place and scraped back below the level of the existing plaster. When the base coat has set but not dried, more plaster is applied to create a smooth, level surface. One-coat patching is not generally recommended by plasterers because it tends to produce concave surfaces that show up when the work is painted. Of course, if the lath only had one coat of plaster originally, then a one-coat patch is appropriate.

For larger holes where all three coats of plaster are damaged or missing down to the wood lath, plasterers generally proceed along these lines. First, all the old plaster is cleaned out and any loose lath is re-nailed. Next, a water mist is sprayed on the old lath to keep it from twisting when the new, wet plaster is applied, or better still, a bonding agent is used.

To provide more reliable keying and to strengthen the patch, expanded metal lath (diamond mesh) should be attached to the wood lath with tie wires or nailed over the wood lath with lath nails. The plaster is then applied in three layers over the metal lath, lapping each new layer of plaster over the old plaster so that old and new are evenly joined. This stepping is recommended to produce a strong, invisible patch. Also, if a patch is made in a plaster wall that is slightly wavy, the contour of the patch should be made to conform to the irregularities of the existing work. A flat patch will stand out from the rest of the wall.

Patching Holes in Ceilings

Hairline cracks and holes may be unsightly, but when portions of the ceiling come loose, a more serious problem exists. The keys holding the plaster to the ceiling have probably broken. First, the plaster around the loose plaster should be examined.

Keys may have deteriorated because of a localized moisture problem, poor quality plaster, or structural overloading; yet, the surrounding system may be intact. If the areas surrounding the loose area are in reasonably good condition, the loose plaster can be reattached to the lath using flathead wood screws and plaster washers. To patch a hole in the ceiling plaster, metal lath is fastened over the wood lath; then the hole is filled with successive layers of plaster, as described above.

Establishing New Plaster Keys

If the back of the ceiling lath is accessible (usually from the attic or after removing floor boards), small areas of bowed-out plaster can be pushed back against the lath. A padded piece of plywood and braces are used to secure the loose plaster. After dampening the old lath and coating the damaged area with a bonding agent, a fairly liquid plaster mix (with a glue size retardant added) is applied to the backs of the lath, and worked into the voids between the faces of the lath and the back of the plaster. While this first layer is still damp, plaster-soaked strips of jute scrim are laid across the backs of the lath and pressed firmly into the first layer as reinforcement. The original lath must be secure, otherwise the weight of the patching plaster may loosen it.

Loose, damaged plaster can also be re-keyed when the goal is to conserve decorative surfaces or wallpaper. Large areas of ceilings and walls can be saved. This method requires the assistance of a skilled conservator—it is not a repair technique used by most plasterers.

The conservator injects an acrylic adhesive mixture through holes drilled in the face of the plaster (or through the lath from behind, when accessible). The loose plaster is held firm with plywood bracing until the adhesive bonding mixture sets. When complete, gaps between the plaster and lath are filled, and the loose plaster is secure.

Replastering Over the Old Ceiling

If a historic ceiling is too cracked to patch or is sagging (but not damaged from moisture), plasterers routinely keep the old ceiling and simply relath and replaster over it. This repair technique can be used if lowering the ceiling slightly does not affect other ornamental features. The existing ceiling is covered with 1x3-inch wood furring strips, one to each joist, and fastened completely through the old lath and plaster using a screw gun. Expanded metal lath or gypsum board lath is nailed over the furring strips. Finally, two or three coats are applied according to traditional methods. Replastering over the old ceiling saves time, creates much less dust than demolition, and gives added fire protection.

When Damaged Plaster Cannot be Repaired—Replacement Options

Partial or complete removal may be necessary if plaster is badly damaged, particularly if the damage was caused by long-term moisture problems. Workers undertaking demolition should wear OSHA-approved masks because the plaster dust that flies into the air may contain decades of coal soot. Lead, from lead based paint, is another danger. Long-sleeved clothing and head-and-eye protection should be worn. Asbestos, used in the mid-twentieth century as an insulating and fireproofing additive, may also be present and OSHA-recommended precautions should be taken. If plaster in adjacent rooms is still in good condition, walls should not be pounded—a small trowel or pry bar is worked behind the plaster carefully in order to pry loose pieces off the wall.

When the damaged plaster has been removed, the owner must decide whether to replaster over the existing lath or use a different system. This decision should be based in part on the thickness of the original plaster and the condition of the original lath. Economy and time are also valid considerations. It is important to ensure that the wood trim around the windows and doors will have the same "reveal" as before. (The "reveal" is the projection of the wood trim from the surface of the plastered wall). A lath and plaster system that will give this required depth should be selected.

Replastering—Alternative Lath Systems for New Plaster

Replastering Old Wood Lath

When plasterers work with old lath, each lath strip is re-nailed and the chunks of old plaster are cleaned out. Because the old lath is dry, it must be thoroughly soaked before applying the base coats of plaster, or it will warp and buckle; furthermore, because the water is drawn out, the plaster will fail to set properly. As noted earlier, if new metal lath is installed over old wood lath as the base for new plaster,

many of these problems can be avoided and the historic lath can be retained. The ceiling should still be sprayed unless a vapor barrier is placed behind the metal lath.

Replastering Over New Metal Lath

An alternative to reusing the old wood lath is to install a different lathing system. Galvanized metal lath is the most expensive, but also the most reliable in terms of longevity, stability, and proper keying. When lathing over open joists, the plasterer should cover the joists with kraft paper or a polyethylene vapor barrier. Three coats of wet plaster are applied consecutively to form a solid, monolithic unit with the lath. The scratch coat keys into the metal lath; the second, or brown, coat bonds to the scratch coat and builds the thickness; the third, or finish coat, consists of lime putty and gauging plaster.

Replastering Over New Rock Lath

It is also possible to use rock lath as a plaster base. Plasterers may need to remove the existing wood lath to maintain the woodwork's reveal. Rock lath is a 16x36-inch, 1/2-inch thick, gypsum-core panel covered with absorbent paper with gypsum crystals in the paper. The crystals in the paper bond the wet plaster and anchor it securely. This type of lath requires two coats of new plaster—the brown coat and the finish coat. The gypsum lath itself takes the place of the first, or scratch, coat of plaster.

Painting New Plaster

The key to a successful paint job is proper drying of the plaster. Historically, lime plasters were allowed to cure for at least a year before the walls were painted or papered. With modern ventilation, plaster cures in a shorter time; however, fresh gypsum plaster with a lime finish coat should still be perfectly dry before paint is applied—or the paint may peel. (Plasterers traditionally used the "match test" on new plaster. If a match would light by striking it on the new plaster surface, the plaster was considered dry.) Today it is best to allow new plaster to cure two to three weeks. A good alkaline-resistant primer, specifically formulated for new plaster, should then be used. A compatible latex or oil-based paint can be used for the final coat.

A Modern Replacement System—Veneer Plaster

Using one of the traditional lath and plaster systems provides the highest quality plaster job. However, in some cases, budget and time considerations may lead the owner to consider a less expensive replacement alternative. Designed to reduce the cost of materials, a more recent lath and plaster system is less expensive than a two-or-three coat plaster job, but only slightly more expensive than drywall. This plaster system is called veneer plaster.

The system uses gypsum-core panels that are the same size as drywall (4x8 feet), and specially made for veneer plaster. They can be installed over furring channels to masonry walls or over old wood lath walls and ceilings. Known most commonly as "blue board," the panels are covered with a special paper compatible with veneer plaster. Joints between the 4-foot wide sheets are taped with fiberglass mesh, which is bedded in the veneer plaster. After the tape is bedded, a thin, 1/16-inch coat of high-strength veneer plaster is applied to the entire wall surface. A second veneer layer can be used as the "finish" coat, or the veneer plaster can be covered with a gauged lime finish-coat—the same coat that covers ordinary plaster.

Although extremely thin, a two-coat veneer plaster system has a 1,500 psi rating and is thus able to withstand structural movements in a building or surface abrasion. With either a veneer finish or a gauged lime putty finish coat, the room will be ready for painting almost immediately. When complete, the troweled or textured wall surface looks more like traditional plaster than drywall.

The thin profile of the veneer system has an added benefit, especially for owners of uninsulated masonry buildings. Insulation can be installed between the pieces of furring channel used to attach blue board to masonry walls. This can be done without having to fur out the window and door jambs. The insulation plus the veneer system will result in the same thickness as the original plaster. Occupants in the rooms will be more comfortable because they will not be losing heat to cold wall surfaces.

Patching Materials

Plasterers generally use ready-mix base-coat plaster for patching, especially where large holes need to be filled. The ready-mix plaster contains gypsum and aggregate in proper proportions. The plasterer only needs to add water.

Another mix plasterers use to patch cracks or small holes, or for finish-coat repair, is a "high gauge" lime putty (50 percent lime; 50 percent gauging plaster). This material will produce a white, smooth patch. It is especially suitable for surface repairs.

Although property owners cannot duplicate the years of accumulated knowledge and craft skills of a professional plasterer, there are materials that can be used for do-it-yourself repairs. For example, fine cracks can be filled with an all-purpose drywall joint compound. For bridging larger cracks using fiberglass tape, a homeowner can use a "quicksetting" joint compound. This compound has a fast drying time—60, 90, or 120 minutes. Quick-setting joint compound dries because of a chemical reaction, not because of water evaporation. It shrinks less than all-purpose joint compound and has much the same workability as ready-mix base-coat plaster. However, because quick-set joint compounds are hard to sand, they should only be used to bed tape or to fill large holes. All-purpose point compound should be used as the final coat prior to sanding.
Homeowners may also want to try using a ready-mix perlited base-coat plaster for scratch and brown coat repair. The plaster can be hand-mixed in small quantities, but bagged ready-mix should be protected from ambient moisture. A "millmixed pre-gauged" lime finish coat plaster can also be used by homeowners. A base coat utilizing perlite or other lightweight aggregates should only be used for making small repairs (less than 4 ft. patches). For large-scale repairs and entire room replastering, see the precautions in Table 1 for using perlite.
Homeowners may see a material sold as "patching plaster" or "plaster of Paris" in hardware stores. This dry powder cannot be used by itself for plaster repairs. It must be combined with lime to create a successful patching mixture.
When using a lime finish coat for any repair, wait longer to paint, or use an alkaline-resistant primer.

Summary

The National Park Service recommends retaining historic plaster if at all possible. Plaster is a significant part of the "fabric" of the building. Much of the building's history is documented in the layers of paint and paper found covering old plaster. For buildings with decorative painting, conservation of historic flat plaster is even more important. Consultation with the National Park Service, with State Historic Preservation Officers, local preservation organizations, historic preservation consultants, or with the Association for Preservation Technology is recommended. Where plaster cannot be repaired or conserved using one of the approaches outlined in this Brief, documentation of the layers of wallpaper and paint should be undertaken before removing the historic plaster. This information may be needed to complete a restoration plan.

Plaster Terms

Scratch coat. The first base coat put on wood or metal lath. The wet plaster is "scratched" with a scarifier or comb to provide a rough surface so the next layer of base coat will stick to it.

Brown coat. The brown coat is the second application of wet, base-coat plaster with wood lath or metal systems. With gypsum board lath (rock lath, plasterboard), it is the only base coat needed.

Finish coat. Pure lime, mixed with about 35 percent gauging plaster to help it harden, is used for the very thin surface finish of the plaster wall. Fine sand can be added for a sanded finish coat.

Casing Bead. Early casing bead was made of wood. In the 19th century, metal casing beads were sometimes used around fireplace projections, and door and window openings. Like a wood ground, they indicate the proper thickness for the plaster.
Corner Bead. Wire mesh with a rigid metal spline used on outside corners. Installing the corner bread plumb is important.

Outside corners. Installing the corner bead plumb is important.

Cornerite. Wire mesh used on inside corners of adjoining walls and ceilings. It keeps corners from cracking.

Ground. Plasterers use metal or wood strips around the edges of doors and windows and at the bottom of walls. These grounds help keep the plaster the same thickness and provide a stopping edge for the plaster. Early plaster work, however, did not use grounds. On early buildings, the woodwork was installed and primed before plastering began. Some time in the early 19th century, a transition occurred, and plasterers applied their wall finish before woodwork was installed.

Gypsum. Once mined from large gypsum quarries near Paris (thus the name plaster of Paris), gypsum in its natural form is calcium sulfate. When calcined (or heated), one-and-a-half water molecules are

driven off, leaving a hemi-hydrate of calcium sulfate. When mixed with water, it becomes calcium sulfate again. While gypsum was used in base-coat plaster from the 1890s on, it has always been used in finish coat and decorative plaster. For finish coats, gauging plaster was added to lime putty; it causes the lime to harden. Gypsum is also the ingredient in moulding plaster, a finer plaster used to create decorative moldings in ornamental plaster work.

Lime. Found in limestone formations or shell mounds, naturally occurring lime is calcium carbonate. When heated, it becomes calcium oxide. After water has been added, it becomes calcium hydroxide. This calcium hydroxide reacts with carbon dioxide in the air to recreate the original calcium carbonate.

Screed. Screeds are strips of plaster run vertically or horizontally on walls or ceilings. They are used to plumb and straighten uneven walls and level ceilings. Metal screeds are used to separate different types of plaster finishes or to separate lime and cement plasters.

SECTION 092400

CEMENT PLASTERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior vertical plasterwork.
2. Interior horizontal and nonvertical plasterwork.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

C. Samples: For each type of factory-prepared finish coat and for each color and texture specified.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Where indicated, provide cement plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E 119 by a qualified testing agency.

2.2 METAL LATH

A. Expanded-Metal Lath: ASTM C 847, cold-rolled carbon-steel sheet with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized-zinc coating.

1. Diamond-Mesh Lath: [**Flat**] [**Self-furring**], [**2.5 lb/sq. yd. (1.4 kg/sq. m)**] Flat-Rib Lath: Rib depth of not more than 1/8 inch (3 mm), [**2.75 lb/sq. yd. (1.5 kg/sq. m)**] [3/8-Inch (10-mm) Rib Lath: [**3.4 lb/sq. yd. (1.8 kg/sq. m]**

B. Wire-Fabric Lath:

1. Welded-Wire Lath: ASTM C 933; self-furring, [**1.4 lb/sq. yd. (0.8 kg/sq. m)**]
2. Woven-Wire Lath: ASTM C 1032; self-furring, with stiffener wire backing, 1.4 lb/sq. yd. (0.8 kg/sq. m).

2.3 ACCESSORIES

A. General: Comply with ASTM C 1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:

1. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 (Z180) zinc coating.
2. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized-zinc coating.
3. External- (Outside-) Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized-zinc coating.
4. Cornerbeads: Fabricated from [**zinc**] [**or**] [**zinc-coated (galvanized) steel**].
   a. Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
   b. Smallnose cornerbead with perforated flanges; use on curved corners.
   c. Smallnose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.
   d. Bullnose cornerbead, radius 3/4 inch (19 mm) minimum, with expanded flanges; use at locations indicated on Drawings.

5. Casing Beads: Fabricated from [**zinc**] [**or**] [**zinc-coated (galvanized) steel**]; square-edged style; with expanded flanges.
6. Control Joints: Fabricated from [**zinc**] [**or**] [**zinc-coated (galvanized) steel**]; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
7. Expansion Joints: Fabricated from [**zinc**] [**or**] [**zinc-coated (galvanized) steel**]; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
8. Two-Piece Expansion Joints: Fabricated from [**zinc**] [**or**] [**zinc-coated (galvanized) steel**]; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch (6 to 16 mm) wide; with perforated flanges.

C. Plastic Accessories: Manufactured from high-impact PVC.
1. Cornerbeads: With perforated flanges.
   a. Smallnose cornerbead; use unless otherwise indicated.
   b. Bullnose cornerbead, radius 3/4-inch (19-mm) minimum; use at locations indicated on Drawings.
2. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.
   a. Square-edge style; use unless otherwise indicated.
   b. Bullnose style, radius 3/4-inch (19-mm) minimum; use at locations indicated on Drawings.
3. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
4. Expansion Joints: Two-piece type, formed to produce slip-joint and square-edged [**1/2-inch- (13-mm-)**] [**1-inch- (25-mm-)**] [**1-1/2-inch- (38-mm-)**] <**Insert dimension**> wide reveal; with perforated concealed flanges.

2.4 MISCELLANEOUS MATERIALS

A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in cement plaster.
C. Bonding Compound: ASTM C 932
D. Fasteners for Attaching Metal Lath to Substrates: ASTM C 1063.
E. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter unless otherwise indicated.
F. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

2.5 PLASTER MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I, Type II.
   1. Color for Finish Coats: White or Gray to match existing.
B. Masonry Cement: ASTM C 91, Type N.
   1. Color for Finish Coats: White or Gray to match existing.
C. Plastic Cement: ASTM C 1328.
D. Colorants for Job-Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color **to match Existing**.
E. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
F. Sand Aggregate: ASTM C 897.

G. Perlite Aggregate: ASTM C 35.

H. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
   1. Color: **Match Existing**.

I. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems formulated with colorfast mineral pigments and fine aggregates; for use over cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.
   1. Color: **Match Existing**

2.6 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.
   1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.

B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:
   1. Portland Cement Mixes:
      a. Scratch Coat: For cementitious material, mix 1 part portland cement and [0 to 3/4] [3/4 to 1-1/2] parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
      b. Brown Coat: For cementitious material, mix 1 part portland cement and [**0 to 3/4**] [**3/4 to 1-1/2**] parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
   2. Masonry Cement Mixes:
      a. Scratch Coat: Mix 1 part masonry cement and 2-1/2 to 4 parts aggregate.
      b. Brown Coat: Mix 1 part masonry cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.
   3. Portland and Masonry Cement Mixes:
      a. Scratch Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
      b. Brown Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
   4. Plastic Cement Mixes:
      a. Scratch Coat: Mix 1 part plastic cement and 2-1/2 to 4 parts aggregate.
      b. Brown Coat: Mix 1 part plastic cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.
   5. Portland and Plastic Cement Mixes:
      a. Scratch Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
      b. Brown Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

C. Base-Coat Mixes for Use over [**Unit Masonry**] [**and**] [**Concrete**]: Single base (scratch) coat for two-coat plasterwork on low-absorption plaster bases as follows:
   1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 0 to 3/4 part lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
   2. Portland and Masonry Cement Mix: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
   3. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.

D. Base-Coat Mixes for Use over [**Unit Masonry**] [**and**] [**Concrete**]: Single base (scratch) coat for two-coat plasterwork on high-absorption plaster bases as follows:
   1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
   2. Masonry Cement Mix: Use 1 part masonry cement and 2-1/2 to 4 parts aggregate.
   3. Portland and Masonry Cement Mix: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
   4. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.

E. Job-Mixed Finish-Coat Mixes:
   1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and [3/4 to 1-1/2] [1-1/2 to 2] parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
   2. Masonry Cement Mix: Use 1 part masonry cement and 1-1/2 to 3 parts aggregate.
   3. Portland and Masonry Cement Mix: For cementitious materials, mix 1 part portland cement and 1 part masonry cement. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
   4. Plastic Cement Mix: Use 1 part plastic cement and 1-1/2 to 3 parts aggregate.

F. Factory-Prepared Finish-Coat Mixes: For **ready-mixed finish-coat plasters**, **acrylic-based finish coatings**, comply with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Prepare smooth, solid substrates for plaster according to ASTM C 926.

B. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.

C. Sound-Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.

3.2 INSTALLING METAL LATH

A. Metal Lath: Install according to ASTM C 1063.

3.3 INSTALLING ACCESSORIES

A. Install according to ASTM C 1063 and at locations indicated on Drawings.

B. Reinforcement for External (Outside) Corners:
   1. Install lath-type, external-corner reinforcement at exterior locations.
   2. Install cornerbead at interior locations.

C. Control Joints: Locate as indicated on Drawings.

3.4 PLASTER APPLICATION

A. General: Comply with ASTM C 926.

B. Bonding Compound: Apply on **unit masonry and concrete** substrates for direct application of plaster.

C. Walls; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork with 3/4-inch (19-mm) total thickness, as follows:
   1. Portland cement mixes.
   2. Masonry cement mixes.
   3. Portland and masonry cement mixes.
   4. Plastic cement mixes.
   5. Portland and plastic cement mixes.

D. Ceilings; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork and having [**1/2-inch (13-mm) total thickness**] [**3/4-inch (19-mm) total thickness for metal lath on concrete**], as follows:
   1. Portland cement mixes.
   2. Masonry cement mixes.
   3. Portland and masonry cement mixes.
   4. Plastic cement mixes.
   5. Portland and plastic cement mixes.

E. Walls; Base-Coat Mix: For base (scratch) coat, for two-coat plasterwork and having [**3/8-inch (10-mm) thickness on masonry**] [**1/4-inch (6-mm) thickness on concrete**], as follows:
   1. Portland cement mix.
   2. Masonry cement mix.
   3. Portland and masonry cement mix.
   4. Plastic cement mix.
   5. Portland and plastic cement mix.

F. Ceilings; Base-Coat Mix: For base (scratch) coat, for two-coat plasterwork and having 1/4-inch (6-mm) thickness on concrete, as follows:
   1. Portland cement mix.
   2. Masonry cement mix.
   3. Portland and masonry cement mix.
   4. Plastic cement mix.
   5. Portland and plastic cement mix.

G. Plaster Finish Coats: Apply to provide finish to match Existing.

H. Acrylic-Based Finish Coatings: Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.

I. Concealed Exterior Plasterwork: Where plaster application is used as a base for adhered finishes, omit finish coat.

J. Concealed Interior Plasterwork:
   1. Where plaster application is concealed behind built-in cabinets, similar furnishings, and equipment, apply finish coat.
   2. Where plaster application is concealed above suspended ceilings and in similar locations, omit finish coat.
   3. Where plaster application is used as a base for adhesive application of tile and similar finishes, omit finish coat.

3.4 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

END OF SECTION 092400

SECTION 09241

GYPSUM VENEER PLASTERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Gypsum veneer plaster and gypsum base for interior veneer plaster.
   2. Gypsum veneer plaster over interior cementitious backer units.
   3. Gypsum veneer plaster over interior masonry surfaces.
   4. Gypsum veneer plaster over interior monolithic concrete surfaces.

B. Related Requirements:
   1.
   2. Section 092216 "Non-Structural Metal Framing" for non-load-bearing steel framing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations, fabrication, and installation of control joints, reveals, and trim; include plans, elevations, sections, details of components, and attachments to other work.

C. Samples: For each trim accessory and textured finish on rigid backing.

1.3 QUALITY ASSURANCE

A. Mockups: Provide mockups of **ceilings and partitions** in sizes of at least 100 sq. ft. (9 sq. m).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM VENEER PLASTER

A. One-Component Gypsum Veneer Plaster: ASTM C 587, ready-mixed, smooth, finish-coat veneer plaster formulated for application directly over substrate without use of separate base-coat material.

B. High-Strength, One-Component Gypsum Veneer Plaster: ASTM C 587, ready-mixed, smooth, finish-coat veneer plaster containing mill-mixed, fine silica sand; with a compressive strength of 3000 psi (20 MPa) when tested according to ASTM C 472; and formulated for application directly over substrate without use of separate base-coat material.

C. Two-Component Gypsum Veneer Plaster: ASTM C 587, with separate formulations; one for base-coat application and one for finish-coat application over substrates.
   1. Base Coat:
   2. Smooth Finish Coat:
   3. Textured Finish Coat:

D. High-Strength, Two-Component Gypsum Veneer Plaster: ASTM C 587, ready-mixed, base-coat plaster and smooth finish-coat veneer plaster containing mill-mixed, fine silica sand; with a compressive strength of 3000 psi (20 MPa) when tested according to ASTM C 472.

2.3 PANEL PRODUCTS

A. Gypsum Base for Veneer Plaster: ASTM C 1396/C 1396M.
   1. Thickness: **To match existing** .

B. Gypsum Base for Veneer Plaster, Type X: ASTM C 1396/C 1396M.
   1. Thickness: **To match existing** .

C. Gypsum Base for Veneer Plaster, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.
   1. Thickness: [**1/2 inch (12.7 mm)**] [**As indicated**] <**Insert dimension**>.

D. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With moisture- and mold-resistant core; [**non-rated**] [**fire-resistive rated**]; glass-mat facing on both sides of panel.
   1. Core: [**1/2 inch (12.7 mm), regular type**] [**1/2 inch (12.7 mm), Type X**] [**5/8 inch (15.9 mm), Type X**].
   2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

E. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 and approved by backer unit manufacturer for use as veneer plaster substrate.
   1. Thickness: [**1/2 inch (12.7 mm)**] [**As indicated**] <**Insert dimension**>.
   2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

F. Backing Panels for Multilayer Applications: ASTM C 1396/C 1396M gypsum base or gypsum board, as recommended by gypsum veneer plaster manufacturer, for application method and thicknesses indicated.
   1. Core: Matching face layer unless otherwise indicated.
   2. Thickness: Matching face layer unless otherwise indicated.

2.4 TRIM ACCESSORIES

A. Standard Trim: ASTM C 1047, approved for use in gypsum veneer plaster applications indicated.
   1. Material: [**Galvanized-steel sheet or aluminum-coated steel sheet; rolled zinc, plastic, or paper-faced galvanized-steel sheet**] [**Galvanized-steel sheet, aluminum-coated steel sheet, or rolled zinc**] [**Plastic**] [**Paper-faced, galvanized-steel sheet**].

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

2.5 JOINT-REINFORCING MATERIALS

A. General: Comply with joint strength requirements in ASTM C 587 and with gypsum veneer plaster manufacturer's written recommendations for each application indicated.

B. Joint Tape: [**As recommended by gypsum veneer plaster manufacturer for applications indicated**] [**Paper**] [**Open-mesh, glass fiber**].

C. Embedding Material for Joint Tape: As recommended by gypsum veneer plaster manufacturer for use with joint-tape material and gypsum veneer plaster applications indicated.

2.6 AUXILIARY MATERIALS

A. Bonding Agent: ASTM C 631 polyvinyl acetate.

B. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum-base, face-layer panels to backing-layer panels in multilayer construction.

C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

D. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

E. Sound Attenuation Blankets: ASTM C 665, Type I; Comply with mineral-fiber requirements of assembly.

F. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, complying with ASTM C 834.

G. Patching Mortar: Dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

PART 3 - EXECUTION

3.1 INSTALLING PANELS, GENERAL

A. Gypsum Base for Veneer Plaster: Apply according to ASTM C 844 unless manufacturer's written recommendations are more stringent.
   1. Erection Tolerance: No more than 1/16-inch (1.6-mm) offsets between planes of gypsum base panels, and 1/8 inch in 8 feet (3 mm in 2.4 m) noncumulative, for level, plumb, warp, and bow.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Install sound attenuation blankets before installing gypsum base for veneer plaster.

D. Cementitious Backer Units: Install according to ANSI A108.11.
   1. Where cementitious backer units abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

E. Trim: Install trim with back flanges intended for fasteners, and attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

F. Control Joints: Install as required and recommended by Plaster Stnadards.

G. Gypsum Base: Reinforce interior angles and flat joints with joint tape and embedding material to comply with ASTM C 843 and with gypsum veneer plaster manufacturer's written recommendations.

H. Abuse-Resistant Base: Reinforce joints between abuse-resistant panels with joint tape and embedding material according to panel manufacturer's written recommendations.

I. Glass-Mat Interior Gypsum Board: Reinforce joints between moisture- and mold-resistant panels with joint tape and embedding material according to panel manufacturer's written recommendations.

3.2 GYPSUM VENEER PLASTERING

A. Bonding Agent: Apply bonding agent on dry according to gypsum veneer plaster manufacturer's written recommendations.

B. Gypsum Veneer Plaster Mixing: Mechanically mix gypsum veneer plaster materials to comply with ASTM C 843 and with gypsum veneer plaster manufacturer's written recommendations.

C. Gypsum Veneer Plaster Application: Comply with ASTM C 843 and with veneer plaster manufacturer's written recommendations.
   1. One-Component Gypsum Veneer Plaster: Trowel apply plaster over substrate to uniform thickness. Fill all voids and imperfections. Immediately double back with same mixer batch of plaster to a uniform total thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm).
   2. Two-Component Gypsum Veneer Plaster:
      a. Base Coat: Hand trowel or machine apply base coat over substrate to a uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm). Fill voids and imperfections.
      b. Finish Coat: Trowel apply finish-coat plaster over base-coat plaster to a uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm).
   3. Where gypsum veneer plaster abuts metal, including doorframes, windows and other units, groove finish coat to eliminate spalling.
   4. Do not apply veneer plaster to gypsum base if paper facing has degraded from exposure to sunlight. Before applying veneer plaster, use remedial methods to restore bonding capability to degraded paper facing according to manufacturer's written recommendations.

D. Concealed Surfaces: Do not omit gypsum veneer plaster behind cabinets, furniture, furnishings, and similar removable items. Omit veneer plaster in the following areas where it will be concealed from view in the completed Work unless otherwise indicated or required to maintain fire-resistance and STC ratings:
   1. Above suspended ceilings.
   2. Behind wood paneling.

E. Gypsum Veneer Plaster Finish: To match existing.

END OF SECTION 092613

SECTION 092900

GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior gypsum board.
   2. Exterior gypsum board for ceilings and soffits.
   3. Tile backing panels.
   4. Texture finishes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Sustainable Design Submittals:
C. Samples: For each texture finish indicated on same backing indicated for Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C 1396/C 1396M.
   1. Thickness: 5/8 inch (15.9 mm).
   2. Long Edges: **Tapered**.
B. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
   1. Thickness: 1/4 inch (6.4 mm).
   2. Long Edges: Tapered.
C. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
   1. Core:**5/8 inch (15.9 mm), Type X**.
   2. Long Edges: Tapered.
   3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
   1. Core: **5/8 inch (15.9 mm), Type X**.
   2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

B. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.
   1. Thickness: **1/4 inch (6.4 mm**.
   2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: [**Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet**] [**Galvanized or aluminum-coated steel sheet or rolled zinc**] [**Plastic**] [**Paper-faced galvanized-steel sheet**].
   2. Shapes:
      a. Cornerbead.
      b. Bullnose bead.
      c. LC-Bead: J-shaped; exposed long flange receives joint compound.
      d. L-Bead: L-shaped; exposed long flange receives joint compound.
      e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      f. Expansion (control) joint.
      g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C 1047.
   1. Material: **Hot-dip galvanized-steel sheet, plastic, or rolled zinc**.
   2. Shapes:
      a. Cornerbead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Board: Paper.
   2. Exterior Gypsum Soffit Board: Paper.
   3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
   4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints**, rounded or beveled panel edges,** and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use **setting-type taping** compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use **setting-type, sandable topping** compound.
   4. Finish Coat: For third coat, use **setting-type, sandable topping** compound.
   5. Skim Coat: For final coat of Level 5 finish, use **setting-type, sandable topping compound.**

D. Joint Compound for Exterior Applications:
   1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
   2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
   2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

G. Vapor Retarder: As specified in Section 072600 "Vapor Retarders."

2.8 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Polystyrene Aggregate Ceiling Finish: Water-based, job-mixed, polystyrene aggregate finish with flame-spread and smoke-developed indexes of not more than 25 when tested according to ASTM E 84.

1. Texture: **Light spatter.**
2. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.
3. Texture: **Light spatter**.

C. Non-Aggregate Finish: Premixed, vinyl texture finish for spray application.

1. Texture**: Light Spatter**.

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Comply with ASTM C 840.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

E. Prefill open joints[**, rounded or beveled edges,**] and damaged surface areas.

F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: **Ceiling plenum areas, concealed areas.**
2. Level 2: **Panels that are substrate for tile**.

3. Level 4: **Panels exposed to view specifically & critical at surfaces perpendicular to Windows.**

H. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.2 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.

3.3 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

SECTION 09306

FLOOR AND WALL TILE

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Tile floor finish using the thinset application method.
- B. Tile wall finish using the thinset application method.

1.02 SUBMITTALS
- A. Submit under provisions of the General Requirements.
- B. Product Data: Provide instructions for using adhesives and grouts.
- C. Samples: Submit two samples illustrating pattern, color variations, and grout color.

1.03 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect and handle products to site.
- B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.04 ENVIRONMENTAL REQUIREMENTS
- A. Do not install adhesives in an unventilated environment.
- B. Maintain 50 degrees F during installation of mortar materials.

PART 2 PRODUCTS

2.01 TILE MANUFACTURERS
- A. FLOOR: Ceramic or Porcelain Tile – **See Section 2.02A FLOOR TILE Below**
- B. WALL: Ceramic or Porcelain Tile – **See Section 2.02B WALL TILE Below**
- B. Substitutions: Under provisions of the General Requirements as equal or better.

2.02 TILE MATERIALS
- A. FLOOR TILE: Ceramic or Porcelain: ANSI A137.1
  1. **Floor Tile 1 (Manufacturer, Style TBD)**
     a) Size & Color – To be selected by architect/owner.
     b) Grout Color- To be selected by architect/owner
     c) Location: Public Restrooms #113, #114
  2. **Floor Tile 2 (Manufacturer, Style TBD)**
     a) Size & Color – To be selected by architect/owner
     b) Grout Color- To be selected by architect/owner
     c) Location: Apartment Bathrooms
     d) **Alternate:** LVT at all Apartment Bathrooms. Reference Section 01030 Alternates, and Section 09650 Resilient Flooring.
- B. WALL TILE: Ceramic or Porcelain
  1. Wall Tile 1 (Manufacturer, Style TBD)
     a. Size: 3x12
     b. Color: To be selected by architect/owner
     c. Grout Color: To be selected by architect/owner
     d. Location: Public Restrooms #113, #114
        1) Installation Pattern: Brick Lay
        2) Reference Elevations for design & wainscot heights.
  2. Wall Tile 2 (Manufacturer, Style TBD)
     a. Size: 1-1/2 x 6 chair rail
     b. Color: To be selected by architect/owner
     c. Grout Color: To be selected by architect/owner
     d. Location: Public Restrooms #113, #114
     e. Reference Elevations for design & wainscot heights
  3. **Wall Tile 3 (Manufacturer, Style TBD)**
     a. Size: 4-1/4" x 12-7/8" Cove Base
     b. Color: to be selected by architect/owner

c. Grout Color: to be selected by architect/owner
d. Location: Public Restrooms #113, #114

2.03 ADHESIVE MATERIALS
A. Adhesives: thinset bond type as recommended and/or manufactured by the tile manufacturer.

2.04 MORTAR MATERIALS
A. Mortar Materials: Portland cement, sand, latex additive, and water as recommended and/or manufactured by the tile manufacturer, color to be selected.

2.05 GROUT MIX
A. Mix and proportion pre-mix grout materials in accordance with manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that surfaces are ready to receive work.

3.02 PREPARATION
A. Protect surrounding work from damage or disfiguration.
B. Vacuum clean surfaces and damp clean.
C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
D. Apply sealer conditioner to substrate surfaces in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - THINSET METHOD
A. Install adhesive tile, thresholds, and grout in accordance with manufacturer's instructions and/or the TCA Handbook.
B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
C. Place edge strips at exposed tile edges.
D. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align floor, base and wall joints.
E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
F. Sound tile after setting. Replace hollow sounding units.
G. Keep expansion, control joints free of adhesive or grout. Apply sealant to joints.
H. Allow tile to set for a minimum of 48 hours prior to grouting.
I. Grout tile joints.
J. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.
K. Install shower pan per manufacturer's instructions.

3.04 CLEANING
A. Clean tile and grout surfaces.

3.05 PROTECTION OF FINISHED WORK
A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION 09306

SECTION 096400
EXISTING WOOD FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Existing wood floors to be repaired, patched, and re-finished.
   2. Sand, patch & refinish at equipment and cabinet removal to match.

1.2 SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: For each type of floor assembly and accessory. Include plans, sections, and attachment details. Include expansion provisions and trim details.
C. Samples: For each exposed product and for each color/stain and texture specified.
   1. Contactor to mock-up small area, or use salvaged original wood flooring pieces to create mock-up for final re-finished and stained appearance for architect's review and approval.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Flooring: Verify existing to match species, grade, and cut.

2.2 FIELD-FINISHED WOOD FLOORING

A. Solid-Wood Flooring: Provide and install to match existing.
   1. Grade and Species: Oak (Verify & Match)
   2. Cut: Verify & Match
   3. Thickness: Verify & Match
   4. Face Width: Verify & Match
B. Urethane Finish System: Complete system of compatible components to match existing.
   1. Floor Sealer: Pliable, penetrating type.
   2. Finish Coats: Formulated for multicoat application on wood flooring.
   3. Stains: Oak Natural or Golden Oak Stain – Architect to select final stain color.
C. Wood Filler: Compatible with finish system components and recommended by filler and finish manufacturers for use indicated. Match existing provide pigmented filler.

2.3 ACCESSORY MATERIALS

A. Wood Sleepers and Subfloor: As required to match existing
B. Wood Underlayment: As required to match existing
C. Asphalt-Saturated Felt: ASTM D 4869/D 4869M, Type II.
D. Wood Flooring Adhesive: Mastic recommended for application indicated.
E. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood flooring manufacturer.
F. Fasteners: As recommended for application.
G. Thresholds and Saddles: To match wood flooring. Tapered on each side.
H. Reducer Strips: To match wood flooring, tapered, and in thickness required to match height of flooring.

PART 3 - EXECUTION

3.1 EXAMINATION

3.2 PREPARATION

A. Existing floor fill, repair & patch including underlayment:

1. Grind high spots and fill low spots to produce a maximum 1/8-inch (3-mm) deviation in any direction when checked with a 10-foot (3-m) straight edge.
2. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
3. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

B. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Comply with wood flooring standards, not less than applicable recommendations in NWFA's "Installation Guidelines."

B. Provide expansion space at walls and other obstructions and terminations of flooring.

C. Vapor Retarder: Comply with the following for vapor retarder installation:
1. Wood Flooring Nailed to Wood Subfloor: Install flooring over a layer of asphalt-saturated felt.

D. Solid-Wood Flooring: Blind nail or staple flooring to substrate.
1. Plank Flooring: For flooring of face width more than 3 inches (76 mm):
   a. Hardwood: Install countersunk screws at each end of each piece in addition to blind nailing. Cover screw heads with wood plugs glued flush with flooring.
   b. Softwood: Install no fewer than two countersunk nails at each end of each piece, spaced not more than 16 inches (406 mm) along length of each piece, in addition to blind nailing. Fill holes with matching wood filler.

3.4 FIELD FINISHING

A. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that are noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.

B. Fill and repair wood flooring defects.

C. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and **three** finish coats.
1. Apply stains to achieve an even color distribution matching approved Samples.
2. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.

D. Cover wood flooring before finishing.

E. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

3.5 PROTECTION

A. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.
1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096400

SECTION 09650

RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Vinyl sheet Flooring and Vinyl Plank Flooring

1.03 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect and handle products to site under provisions of the General Requirements.
- B. Protect roll materials from damage.

1.04 ENVIRONMENTAL REQUIREMENTS
- A. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- B. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

1.05 MAINTENANCE DATA
- A. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.06 EXTRA MATERIALS
- A. Provide 60 sq ft of flooring, 10 lineal feet of base, and stair materials of each material specified.

1.07 WARRANTY
- A. 3 year light commercial warranty

PART 2 PRODUCTS

2.01 MATERIALS – LUXURY VINYL TILE
- A. Luxury Vinyl Tile: **Patcraft, Paint Palette 2.5 mm 1840V**
  1. Color: To be selected from full range of manufacturer color options. Assume (2) colors will be selected.
  2. Tile Size: 12x24
  3. Overall Thickness: 2.5 mm
  4. Wear Layer Thickness: 20 mil
  5. Installation Pattern: Stagger
  6. Transitions: At existing Terrazzo/Marble/Wood flooring: Use Schluter Schiene Edging (Finish to be selected by architect/owner). Ensure that transition will be flush.
  7. Or approved equal - Substitution requests to be submitted to architect prior to bidding.

2.02 MATERIALS – RUBBER BASE
- A. Base: FS SS-W-40. Rubber; coved wall base; pre-molded external corners
  1. Approved Manufacturers: Johnsonite, Roppe, Tarkett
  2. Color: To be selected by architect/owner
  3. Height: 4”
  4. Thickness: 1/8 inch thick
  5. Length: Roll (Strips are not acceptable.)

2.03 ACCESSORIES
- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.
- C. Edge Strips: Flooring material as approved.
- D. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify concrete floors are dry to a maximum moisture content of 7 percent, and exhibit negative alkalinity, carbonization, or dusting.
- B. Verify floor and lower wall surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

3.02 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
B. Prohibit traffic until filler is cured.
C. Vacuum clean substrate.
D. Apply primer as recommended by manufacturer.

3.05 INSTALLATION – RESILIENT TILE FLOORING

A. Install in accordance with manufacturer's instructions.
B. Spread only enough adhesive to permit installation of materials before initial set.
C. Set flooring in place, press with heavy roller to attain full adhesion.
D. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.
G. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.
H. Install resilient edge strips at unprotected or exposed edges, and where flooring terminates.
G. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.06 INSTALLATION - BASE

A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.
B. Miter internal corners. At external corners, use pre-molded units or "V" cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use pre-molded units.
C. Install base on solid backing. Bond tight to wall and floor surfaces.
D. Scribe and fit to door frames and other interruptions.

3.07 CLEANING

A. Clean all work as described in the General Requirements.
B. Remove access adhesive from floor, base, and wall surfaces without damage.
C. Clean, seal, and wax floor and base surfaces in accordance with manufacturer's instructions.

3.08 PROTECTION OF FINISHED WORK

A. Protect finished Work.
B. Prohibit traffic on floor finish for 48 hours after installation.

END OF SECTION 09650

SECTION 09680

CARPET – PAD AND TACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Cut Pile carpet with Pad or Integral backing

1.3 SUBMITTALS

A. Product Data: For the following, including installation recommendations for each type of substrate:
   1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
   2. Carpet Cushion: For each type indicated. Include manufacturer's written data on physical characteristics and durability.

B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet: 12-inch- (300-mm-) square Sample.
   2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- (300-mm-) long Samples.
   3. Carpet Cushion: 6-inch- (150-mm-) square Sample.
   4. Carpet Seam: 6-inch (150-mm) Sample.
   5. Mitered Carpet Border Seam: 12-inch- (300-mm-) square Sample. Show carpet pattern alignment.

C. Product Schedule: For carpet **and carpet cushion.** Use same designations indicated on Drawings.

D. Qualification Data: For Installer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.

F. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet **and carpet cushion**.

G. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Mockups: Before installing carpet, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install carpet **and carpet cushion** until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet **and carpet cushion** over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 WARRANTY

A. Special Warranty for Carpet: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
3. Warranty Period: 5 years from date of Substantial Completion.

B. Special Warranty for Carpet Cushion: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet cushion installation that fail in materials or workmanship within specified warranty period.

1. Warranty includes consequent removal and replacement of carpet and accessories.
2. Warranty does not include deterioration or failure of carpet cushion due to unusual traffic, failure of substrate, vandalism, or abuse.
3. Failure includes, but is not limited to, permanent indentation or compression.
4. Warranty Period: 5 years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet: Full-width rolls equal to **5** percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

PART 2 - PRODUCTS

2.1 CUT PILE CARPET

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:

1. Manufacturer: J&J Flooring, Tempo

a. Color: To be selected from manufacturer’s full range of color selections.
b. Construction: Textured Patterned Loop
c. Backing: Premierbac Plus (A)
d. Face Weight: 16 oz/sy
e. Standard Adhesive: Commercial on Premium Carpet Adhesive
f. Location: **Stair S1 – only between floors 1 & 2 (treads and risers only)**

C. Primary Backing: Manufacturer's standard material.

D. Secondary Backing: Manufacturer's standard material.

E. Applied Soil-Resistance Treatment: Manufacturer's standard material

F. Antimicrobial Treatment: Manufacturer's standard material.

2.2 CARPET CUSHION

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:
   1. Thickness: 3/8 inch. Min.
   2. Density: 6 lbs/cu. ft. Min.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet cushion manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer carpet and carpet cushion manufacturers.
   1. VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D 5116:
      a. Total VOCs: 10.00 mg/sq. m x h.
      b. Formaldehyde: 0.05 mg/sq. m x h.
      c. 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.

C. Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with CRI 104, Section 12.2.

D. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

E. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet cushion manufacturer.
   2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet.
   3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. For wood subfloors, verify the following:
   1. Underlayment over subfloor complies with requirements specified in Division 6 Section "Rough Carpentry."
   2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet cushion manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. Comply with CRI 104 and carpet manufacturer's carpet and carpet cushion manufacturers' written installation instructions for the following:
   1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."
   2. Double-Glue-Down Installation: Comply with CRI 104, Section 10, "Double Glue-Down Installation."
   3. Carpet with Attached-Cushion Installation: Comply with CRI 104, Section 11, "Attached-Cushion Installations."
   4. Stretch-in Installation: Comply with CRI 104, Section 12, "Stretch-in Installation."
   5. Stair Installation: Comply with CRI 104, Section 13, "Carpet on Stairs" for stretch-in glue-down installation.

B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

C. Do not bridge building expansion joints with carpet.

D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

H. Comply with carpet cushion manufacturer's written recommendations. Install carpet cushion seams at 90-degree angle with carpet seams.

3.4 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing carpet:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
   2. Remove yarns that protrude from carpet surface.
   3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 16, "Protection of Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet cushion manufacturer.

END OF SECTION 09680

SECTION 09900

PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Surface preparation and field application of paints and coatings.

1.02 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing the work of this section with minimum years documented experience and approved by manufacturer.

1.03 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect and handle products to site.
- B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- C. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- D. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.04 ENVIRONMENTAL REQUIREMENTS
- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- D. Minimum Application Temperature for Varnish and Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 foot candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS
- A. Manufacturer - Paint, Transparent Finishes, Stain, Primer Sealers, and Block Filler by SHERWIN-WILLIAMS or as approved equal.

2.02 MATERIALS
- A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
- C. Patching Materials: Latex filler.
- D. Fastener Head Cover Materials: Latex filler.
- E. All interior paints and primers shall comply with Green Seal standards for low VOC limits.

2.03 FINISHES
- A. Refer to schedule at end of section for surface finish schedule.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

A. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
B. Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface defects.
C. Seal with shellac and seal marks which may bleed through surface finishes.
D. Impervious Surfaces: Remove mildew by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow surface to dry.
E. **Decorative Pressed Metal, & Aluminum Surfaces Scheduled for Paint Finish:** Use approved abrasive cleaning with media approved for substrate - Remove existing paint, surface contamination, and caulking, by media blasting, steam or other approved methods. Apply etching primer or paint primer immediately following cleaning.
F. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply compatible sealer or primer.
G. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
H. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
I. Copper Surfaces Scheduled for a Paint Finish: Remove contamination by steam, high pressure water, or solvent washing. Apply vinyl etch primer immediately following cleaning.
J. Copper Surfaces Scheduled for a Natural Oxidized Finish: Remove contamination by applying oxidizing solution of copper acetate and ammonium chloride in acetic acid. Rub on repeatedly for required effect. Once attained, rinse surfaces with clear water and allow to dry.
K. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
L. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
M. **Concrete, Brick and Unit Masonry Surfaces Scheduled to Receive Paint or Sealer Finish:** Such as all interior Brick & masonry walls, Use approved abrasive cleaning with media approved for substrate - Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of trisodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
N. **Plaster Surfaces:** Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
O. **Uncoated Steel and Iron Surfaces:** Such as existing exterior trusses, Use approved abrasive cleaning with media approved for substrate - Remove rust, paint, caulk, grease, mill scale, weld splatter, and dirt. Where heavy coatings of scale are evident, remove by hand, power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
P. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
Q. **Interior Wood Items Scheduled to Receive Paint Finish:** Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
R. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.
S. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.
T. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.
U. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
V. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's instructions.
B. Do not apply finishes to surfaces that are not dry.
C. Apply each coat to uniform finish.
D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
E. Sand wood and metal lightly between coats to achieve required finish.
F. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
G. Allow applied coat to dry before next coat is applied.
H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
I. Prime concealed surfaces of interior and exterior woodwork with primer paint.

J. Prime concealed surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
B. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars, and supports except where items are prefinished.
C. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
D. Paint exposed conduit and electrical equipment occurring in finished areas.
E. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 CLEANING

A. Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.06 SCHEDULE

The following are for exterior and interior surfaces, and are all products of Sherwin-Williams.

EXTERIOR SURFACES

1. WOOD (Excluding Plywood)
   A. Satin Finish/Latex Base
      1st Coat: Exterior Oil Based Wood Primer
      2nd Coat: Duration, Satin
      3rd Coat: Duration, Satin

2. PLYWOOD & SIDING
   A. Satin Finish/Latex Base
      1st Coat: Exterior Oil Based Wood Primer
      2nd Coat: Duration, Satin
      3rd Coat: Duration, Satin

3. FERROUS METAL (Handrails, Existing Trusses)
   A. Painted (Gloss Finish/Alkyd Base)
      Primer: B66W1310 Pro-Cryl Acrylic Primer
      1st Coat: B66W01153 Pro Ind, DTM Acrylic
      2nd Coat: B66W01153 Pro Ind, DTM Acrylic

4. GALVANIZED METAL
   A. Painted (Satin Finish/Latex Base)
      1st Coat: Duration, Satin
      2nd Coat: Duration, Satin

5. ALUMINUM
   A. Painted (Satin Finish/Latex Base)
      1st Coat: Duration, Satin
      2nd Coat: Duration, Satin

6. CONCRETE MASONRY UNITS
   A. Painted (Satin Finish/Latex Base)
      1st Coat: Loxon Primer/Sealer
      2nd Coat: Duration, Satin
      3rd Coat: Duration, Satin

7. CONCRETE, STUCCO, BRICK
   A. Painted (Satin Finish/Latex Base)
      1st Coat: Loxon Primer/Sealer
      2nd Coat: Duration, Satin
      3rd Coat: Duration, Satin

8. TRAFFIC AND PARKING LINE MARKING
   A. Painted (ProMar Traffic Marking Paint)
      1st Coat: B29W1-WHITE, or B29Y2-YELLOW

INTERIOR SURFACES
1. WOOD AND PLYWOOD
   A. Existing Wood Structure, (Beams, Columns, Floor Joists & Decking
      Primer: B51W00450 – Int/Ext Latex Primer
      2nd Coat: A75W00051 – Solo Int/Ext Acrylic Eg-Shel
      3rd Coat: A75W00051 – Solo Int/Ext Acrylic Eg-Shel

   B. Other, Painted (Eg-Shel Finish/Alkyd Base)
      1st Coat: ProMar 200 Latex Primer, B49W2
      2nd Coat: ProMar 200 Latex Eg-Shel, B20W200
      3rd Coat: ProMar 200 Eg-Shel, B20W200

   C. Stained and Varnished (Clear Finish) Opened Grained Wood
      1st Coat: Interior Wood Stain, A48
      2nd Coat: Sherwood 100 Fast Dri Semi-Paste Filler D70T1
      3rd Coat: Oil Base Gloss Varnish, A66V91
      4th Coat: Oil Base Gloss Varnish, A66V91 or Oil Base Satin Varnish, A66F90

2. CONCRETE MASONRY UNITS
   A. Painted (Eg-Shel Finish/Latex Base)
      1st Coat: ProMar Block Filler, B25W1
      2nd Coat: ProMar 200 Latex Eg-Shel, B20W200
      3rd Coat: ProMar 200 Latex Eg-Shel, B20W200

3. CONCRETE, MASONRY EPOXY SYSTEM (SOLVENT BASE)
   A. Painted (Semi-Gloss Finish)
      1st Coat: Tile-Clad II Epoxy, B62W100 Series
      2nd Coat: Tile-Clad II Epoxy, B62W100 Series
      Additional Coats to ensure consistent Sheen
      (9 mils wet, 4 mils dry per coat)

3B. BRICK, WALLS, EXISTING TO BE EXPOSED
   A. Painted (Latex)
      Primer: LX03W0100 – LXN Condition Wht
      1st Coat: B20w12651 – PROMAR 200, Interior Eg-Shell
      2nd Coat: B20w12651 – PROMAR 200, Interior Eg-Shell

   B. Clear Seal (UltraPaver - Clear Sealer)
      1st Coat: 50.146054 UltraPaver, Clear
      2nd Coat: 50.146054 UltraPaver, Clear

4. GYPSUM WALLBOARD
   A. Painted (Eg-Shel Finish/Latex Base)
      1st Coat: ProMar 200 Latex Wall Primer, B28W200
      2nd Coat: ProMar 200 Alkyd Eg-Shel Enamel, B33W200
      3rd Coat: ProMar 200 Alkyd Eg-Shel Enamel, B33W200

5. FERROUS METAL (Gloss, Handrails)
   A. Painted (Gloss Finish/Alkyd Base)
      Primer: B66W1310 Pro-Cryl Acrylic Primer
      1st Coat: B66W01153 Pro Ind, DTM Acrylic
      2nd Coat: B66W01153 Pro Ind, DTM Acrylic

6. GALVANIZED METAL
   A. Painted (Flat Finish/Latex Base)
      1st Coat: ProMar 200 Latex Flat Wall Paint, B30W200
      2nd Coat: ProMar 200 Latex Flat Wall Paint, B30W200

7. DECORATIVE PRESSED METAL, EXISTING HISTORICAL
   A. Painted (Flat Finish/Latex Base)
      Primer: B66W1310 Pro-Cryl Acrylic Primer
      1st Coat: B66W01153 Pro Ind, DTM Acrylic
      2nd Coat: B66W01153 Pro Ind, DTM Acrylic

8. ALUMINUM
   A. Painted (Flat Finish/Latex Base)
      1st Coat: ProMar 200 Latex Flat Wall Paint, B30W200
      2nd Coat: ProMar 200 Latex Flat Wall Paint, B30W200

9. CONCRETE FLOORS (SEALED)
   A. Painted (Clear Acrylic Floor Finish)
      1st Coat: Concrete and Terrazzo Sealer B44V22 or W.R. Meadows – TIAH

END OF SECTION 09900

SECTION 10431

SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Exterior ADA Parking Signs
   2. Building Numbering & Addressing
   3. Exterior Site & Amenity Signage
   4. Interior signage
   5. Building Mounted Signage – "Fin-Style" Sign (Reference Section 01019 Special Provisions, 4. Cash Allowances, item f.)

B. Contractor shall install and furnish Interior Signage: Apartments, Mechanical Rooms, Offices, Restrooms, etc. – (Tactile and Braille Signage), All Exterior Signage and ADA Parking Signage. Bid price to also include the purchase and delivery of all signage.

C. Site Signage, and Interior Signage design should reflect the historic nature of the building. Contractor to submit design options to Architect and Owner prior to Final Shop Drawing Submittal.

D. All signs are to comply with ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1. Including, but not limited to installation height and location, size and tactile & braille requirements.

1.3 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for signs.
   1. Show sign design – should reflect the historic nature of the Lee Lofts and Building 1
   2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   3. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.

C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors.

D. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
   1. Plaque Casting: 6 inches (150 mm) square including border.
   2. Dimensional Characters: Full-size Samples of each type of dimensional character letter, number, and graphic element.
   3. Aluminum: For each form, finish, and color, on 6-inch- (150-mm-) long sections of extrusions and squares of sheet at least 4 by 4 inches (100 by 100 mm).

E. Maintenance Date: For signs to include maintenance manuals.

F. Warranty: Special warranty specified in this section.

1.5 SIGN SCHEDULE

1. **Building Mounted Signage** – "Fin-Style" Sign
   a. Contractor to coordinate with Architect and Owner on final design, materials, colors, size, and location.
   b. Reference Section 01019 Special Provisions, 4. Cash Allowances, item f.
2. **Exterior ADA Parking Signs**: Provide and install pole mounted handicap sign(s) with bottom of sign at 60 inches above grade. Reference site plan for type, quantity and location. Submit to Architect for approval.

3. **Other Exterior Site Signage**: Coordinate final numbering and location with architect. To include (but not limited to): Property Address, Leasing office numbers and hours; Tenant Space entry doors & information.
4. **Interior Signage**: Coordinate design, final numbering, and locations with architect. To include (but not limited to): Apartments, Leasing Office, Community Room, Restrooms, Mechanical and Electrical Rooms, Storage Rooms, Stairwells and Required Exits, Laundry, Learning Center, Basement, etc.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
B. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
C. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.
B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Deterioration of metal and polymer finishes beyond normal weathering.
b. Deterioration of embedded graphic image colors and sign lamination.
2. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.
B. Interior Signage - Tactile and Braille Signage: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
1. Panel Material: **Opaque acrylic sheet**.
2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

2.2 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.3 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated.
1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.

2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.4 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ACRYLIC SHEET FINISHES

A. Colored Coatings for Acrylic Sheet: For copy **and background** colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for **three** years for application intended.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
B. Verify that items**, including anchor inserts** are sized and located to accommodate signs.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 10431

SECTION 10522

FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Fire extinguishers; Reference drawings –
  1. Cabinets with Extinguishers, where indicated on the floor plans.
  2. Wall Mounted Extinguishers, where indicated on the floor plans.

1.02 SUBMITTALS
- A. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.
- B. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS
- A. LARSEN'S Architectural Series Fire Extinguisher Cabinets. Fire rated cabinets (FS) where indicated to be installed in fire rated assemblies, Ref. CFP sheet.
- B. Substitutions: Under provisions of the General Requirements.

2.02 EXTINGUISHERS
- A. Dry Chemical Type: Larsen's MP series MP5 (5 lb capacity), Cast steel tank, with pressure gage.

2.03 CABINETS
- A. LARSEN'S - Architectural Series SS 2409-R3 & FS 2409-R3, Vertical Duo Door with Larsen-Loc. Fire rated cabinets (FS) where indicated to be installed in fire rated assemblies, Ref. CFP sheet.
- B. Interior Metal: Formed sheet steel, baked enamel box.
- C. Configuration: Semi-recessed type, exterior nominal dimensions of 27-1/2 inch high x 13 inch wide x 5 inch deep.
- D. Trim Type: Returned to wall surface, with 2-1/2 inch projection.
- E. Exterior Door and Trim: Stainless Steel, reinforced for flatness and rigidity; latch with vertical glass.
- F. Door Glazing: Glass, clear, 1/8 inch thick tempered.
- G. Cabinet Mounting Hardware: Appropriate to cabinet.

2.04 FABRICATION
- A. Form cabinet enclosure with right angle inside corners and seams. Formed trim and door stiles.
- B. Pre-drill for anchors.
- C. Hinge doors for 180 degree opening with continuous piano hinge. Provide roller type catch.
- D. Weld, fill, and grind components smooth.
- E. Glaze doors with resilient channel gasket glazing.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION
- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 24 inches from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.
- E. Verify exact location with Architect.

END OF SECTION 10522

SECTION 10800

TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Toilet and washroom accessories.
- B. Grab bars, Towel bars
- C. Toilet Paper, Paper Towel
- D. Shower Seat & Hardware
- E. Attachment hardware

PART 2 PRODUCTS

2.01 MANUFACTURERS
- A. BOBRICK WASHROOM EQUIPMENT INC., or BRADLEY CORPORATION.
- B. Substitutions: Under provisions of the General Requirements.

2.02 FABRICATION
- A. Weld and grind joints of fabricated components, smooth.
- B. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.
- C. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges. Form bar with 1 1/2 inches clear of wall surface. Knurl grip surfaces.
- D. Shop assemble components and package complete with anchors and fittings.
- E. Provide steel anchor plates, adapters, and anchor components for installation.

2.03 FINISHES
- A. Reference Schedule in section 3.04 for finishes.
- B. Galvanizing: ASTM A123 to 1.25 oz./sq. yd. Galvanize ferrous metal and fastening devices.
- C. Chrome/Nickel Plating: ASTM B456, satin finish.
- D. Stainless Steel: No. 4 satin luster finish.
- E. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 EXECUTION

3.01 EXAMINATION
- A. Verify that site conditions are ready to receive work and dimensions are as indicated on shop drawings and instructed by the manufacturer.
- B. Verify exact location of accessories for installation. Coordinate with ADA requirements.

3.02 PREPARATION
- A. Deliver inserts and rough-in frames to site for timely installation. Provide templates and rough-in measurements as required.

3.03 INSTALLATION
- A. Install accessories in accordance with manufacturer's instructions and Americans with Disabilities Act. Also reference ANSI A117.1.
- B. Install plumb and level, securely and rigidly anchored to substrate.

3.04 SCHEDULE
- A. Reference drawings for all required accessories and submit for approval including but not limited to:
- B. Toilet Tissue Holders: Bobrick. Color: To be selected.
- C. Towel Bar: 2 per Apartment bathroom, 18" & 24" with concealed wall bracket. Color: To be selected.
- D. Grab Bars as indicated on the drawings, Bobrick.
  - a. At Public Restrooms: Bobrick, Color: To be selected, sizes as indicated on drawings.
  - b. At Accessible Apartment Units: Bobrick, Color: To be selected, sizes as indicated on drawings.
- E. Shower Curtain Rod: 1 at each apartment shower, 1 inch dia. tube, concealed attachment. Color: To be selected.
- F. Shower Seat: ADA & FH approved, 1 at each accessible shower, submit for approval

END OF SECTION 10800

SECTION 10850

BUILDING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building specialties shall be furnished and installed as shown and herein specified. Installation shall be in accordance with the respective manufacturer's instructions. Certain manufacturer's products have been selected as a basic standard, and reference to these products has been made. Other manufacturers' products of equal capacities and design characteristics may be used, if approved by the Architect prior to the Bidding. The Contractor shall submit for approval shop drawings or standard cuts and illustrations or a combination thereof showing all items he proposes to use.

1.02 MAILBOXES

A. Manufacturer – **Florence Manufacturing Company**, front loading horizontal mailboxes for recessed mounting with snap-on outer trim kit.

B. Additional Features: Standard 5-pin cylinder tenant can lock with two keys. Engraved identification number for slots with color fill. Color: To be selected by architect.

C. Quantity and Size: (5) sections 4CADD-09 and (1) section of 4CADS-04 (49 Mailboxes and 11 parcel boxes total). Reference details on Sheet A8.1 of bid documents for configuration.

1.03 SITE AMENITIES

A. Benches – (3) Total – Polywood Traditional Garden 60" Bench. Color TBD

1.04 MIRRORS

A. Public Restrooms: 24"x36" with frame to be selected by owner.

B. Apartment Units: Frameless with beveled edges, plated glass mirror, ref details on dwgs for size and location.

1.05 FIBERGLASS REINFORCED PLASTIC PANELING

A. Product - Class A – Minimum .090 thickness panel. Include Manufacturer's vinyl molding at all corners, transitions, joints, and tops, bottoms, etc.

B. Product shall be applied using manufacturer recommended adhesive and manufacturer recommended mechanical fasteners. Pre-drill rivet holes and silicone caulk prior to riveting.

C. Locations: install behind mop sinks

END OF SECTION 10850

SECTION 11451

RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Cooking equipment including: Electric ranges, Microwave ovens.
   2. Ventilation range hoods.
   3. Refrigerator/freezers; **Energy Star Compliant**.
   4. Dishwashers; **Energy Star Compliant**.
   5. Garbage Disposal; **Energy Star Compliant**

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include operating characteristics, dimensions of individual appliances, and finishes for each appliance. **All appliances must be submitted and approved by the Owner/Developer prior to ordering.**

B. Samples for Verification: factory-applied **color** finishes.

C. Appliance Schedule: For appliances; use same designations indicated on Drawings.

D. Manufacturer Certificates: Signed by manufacturers certifying that products comply with requirements.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for **each product**.

F. Maintenance Data: For **each product** to include in maintenance manuals.

G. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer with a service center capable of providing training, parts, and emergency maintenance repairs.

B. Product Options: Information on Drawings and in Specifications establishes requirements for product's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

C. Regulatory Requirements: Comply with provisions of the following product certifications:
   1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   2. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
   3. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.
   4. NAECA: Provide residential appliances that comply with NAECA standards.

D. Regulatory Requirements, Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." ANSI A117.1. FED-STD-795, "Uniform Federal Accessibility Standards."
   1. Operable Parts: Provide controls with forward reach no higher than 48 inches (1219 mm) above the floor, horizontal front reach no more than 25 inches (635 mm), horizontal side reach no more than 24 inches (610 mm), and that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
   2. Range or Cooktop: Provide knee clearance for forward approach of 27 inches (685 mm) high, 30 inches (760 mm) wide, and 11 inches (280 mm) horizontally; toe space clearance of 9 inches (230 mm) high and 17 inches (430 mm) horizontally; with insulated underside of cooktop to prevent burns, shocks, or abrasions. Provide top surface 34 inches (865 mm) above the floor, with controls that do not require reaching across burners.
   3. Refrigerator/Freezer: Provide 50 percent of freezer space within 54 inches (1370 mm) of the floor.

E. AHAM Standards: Provide appliances that comply with the following AHAM standards:
   1. Dishwashers: AHAM DW-DW1.
   2. Electric Ranges: AHAM ER-1.
   3. Household Refrigerators: AHAM HRF-1.
   4. Household Freezers: AHAM HRF-1.

F. Energy Ratings: Provide residential appliances that carry labels indicating energy-cost analysis (estimated annual operating costs) and efficiency information as required by the FTC Appliance Labeling Rule.
   1. Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.5 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer of each appliance specified agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.
   1. Electric Range: Five-year limited warranty for surface-burner elements.
   2. Microwave Oven: Five-year limited warranty for defects in the magnetron tube.
   3. Refrigerator/Freezer: Five-year limited warranty for in-home service on the sealed refrigeration system.
   4. Freezer: Five-year limited warranty for in-home service on the sealed refrigeration system.
   5. Dishwasher: 5-year warranty for in-home service against deterioration of tub and door liner.
   6. Clothes Washer: 5-year limited warranty for the inner wash basket and outer tub, and five-year limited warranty for the balance suspension system and drive transmission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.
   3. Basis-of-Design Product: The design for each residential appliance is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.
   4. **All appliances & finishes must be submitted and approved by the Owner/Developer prior to ordering.**
   5. **Confirm selected or submitted appliances fit in the designed space with manufacturers listed or recommended clearances.**

2.2 COOKING APPLIANCES, provide one at each unit as indicated on plans.

A. Range (ADA, Accessible Units, front controls), Black
   1. Products: 30” wide x 34” tall (max.) Free-Standing with Front Controls
   2. Acceptable manufacturers, submit equals for approval.
      a. Amana Appliances, General Electric Company; Hotpoint; KitchenAid, Maytag

B. Range (Adaptable Units), Black
   1. Products: 30” wide x 36” tall, Free-Standing Range
   2. Acceptable manufacturers, submit equals for approval.
      a. Amana Appliances, General Electric Company; Hotpoint; KitchenAid, Maytag

C. Microwave Oven Over Range, (Adaptable Units), Black
   1. Products: Over Range Microwave Oven 1.5 cf, 950 watt
   2. Acceptable manufacturers, submit equals for approval.
      a. Amana Appliances; General Electric Company; Hotpoint; KitchenAid; Maytag;

D. Microwave Oven Counter Top, (Accessible Units), Black
   1. Products: Microwave Oven .7 cf, 700 watt
   2. Acceptable manufacturers, submit equals for approval.
      a. Amana Appliances; General Electric Company; Hotpoint; KitchenAid; Maytag;

E. Exhaust Hood (Accessible Units), Black
   1. Products: 30” wide – recirculating type, ventless.
   2. Acceptable manufacturers, submit equals for approval.
      a. General Electric Company; Hotpoint; KitchenAid; Maytag; Whirlpool Corp

2.3 REFRIGERATION APPLIANCES, provide one at each unit as indicated on plans.

A. Refrigerator/Freezer with ice maker (Adaptable Units), Black with Ice maker
   1. Products: Top-Freezer Refrigerator, **Energy Star Rated**, 18 Cu.Ft.
   2. Size: Must fit within the casework design: 30”W x 70”H max.
   3. Acceptable manufacturers, submit equals for approval.
      a. Amana Appliances; General Electric Company; Hotpoint; KitchenAid; Maytag;

B. Refrigerator/Freezer with ice maker, (Accessible Units), Black with Ice maker
   1. Products: Top-Freezer Refrigerator, ADA Compliant, **Energy Star Rated**, 18 Cu.Ft.
   2. Size: Must fit within the casework design: 30”W x 70”H max.
   3. Acceptable manufacturers, submit equals for approval.
      a. Amana Appliances; General Electric Company; Hotpoint; KitchenAid; Maytag;

2.4 CLEANING APPLIANCES, provide one at each unit as indicated on plans.

A. Garbage Disposal – **Energy Star Rated**, Reference Mechanical drawings and schedules

B. Dishwasher (Adaptable Units), Black
   1. Products: Dishwasher, **Energy Star Rated**
   2. Size: Sized to fit below a typical countertop height of 36” a.f.f.
   3. Acceptable manufacturers, submit equals for approval.
      a. Amana Appliances; General Electric Company; Hotpoint; KitchenAid; Maytag;

C. Dishwasher (Accessible Units), Black
   1. Products: Dishwasher, **Energy Star Rated**
   2. Size; Sized to fit below an accessible countertop height of 34” a.f.f.
   3. Acceptable manufacturers, submit equals for approval.
      a. Amana Appliances; General Electric Co; Hotpoint; KitchenAid; Maytag;

D. Clothes Washer (Adaptable, Type-B Units), Stackable, provide one at each unit as indicated.
   1. Products: Clothes Washer, White, 3.3 CF, **Energy Star Rated**
   2. Size; Must fit in Laundry Closets, reference floor plans. **Must be Stackable.**
   3. Acceptable manufacturers, submit equals for approval.
      a. Amana Appliances; General Electric Co; Hotpoint; KitchenAid; Maytag;

E. Clothes Dryer (Adaptable, Type-B Units), Stackable, provide one at each unit as indicated.
   1. Products: Clothes Dryer, White, 6.5 cf, **Energy Star Rated**
   2. Size; Must fit in Laundry Closets, reference floor plans. **Must be stackable.**
   3. Must be **Ventless-type dryer.**
   4. Acceptable manufacturers, submit equals for approval.
      a. Amana Appliances; General Electric Company; Hotpoint; KitchenAid; Maytag;

F. Clothes Washer (ADA, Accessible Units, frontload), provide one at each Accessible unit as indicated.
   1. Products: Clothes Washer, White, 3.3 cf, **Energy Star Rated**
   2. Size; Must fit in Laundry Closets, reference floor plans.
   3. Acceptable manufacturers, submit equals for approval.
      a. Amana Appliances; General Electric Company; Hotpoint; KitchenAid; Maytag;

G. Clothes Dryer (ADA, Accessible Units, Frontload) , provide one at each Accessible unit as indicated.
   1. Products: Clothes Dryer, White, 6.5 cf, **Energy Star Rated**
   2. Size; Must fit in Laundry Closets, reference floor plans.
   3. Must be **Ventless-type dryer.**
   4. Acceptable manufacturers, submit equals for approval.
      a. Amana Appliances; General Electric Company; Hotpoint; KitchenAid; Maytag;

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Color-Coated Finish: Provide appliances with manufacturer's standard finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, color, gloss, and minimum dry film thickness for painted finishes

D. For exact finish, insert names of coating manufacturers and products.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Utilities: Refer to Divisions 15 and 16 for plumbing and electrical requirements.

3.3 CLEANING AND PROTECTION

A. Test each item of residential appliances to verify proper operation. Make necessary adjustments.

B. Verify that accessories required have been furnished and installed.

C. Remove packing material from residential appliances and leave units in clean condition, ready for operation.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 11451

SECTION 12356

RESIDENTIAL KITCHEN & BATH CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Countertops, base and wall cabinets for Apartment Units
      a. For casework relating to Public or Commercial Spaces, reference Section 06410 Custom Casework.
   2. Wood-faced kitchen cabinets.
   3. Wood-faced vanity cabinets.
   4. Plastic-laminate countertops.

B. Related Sections include the following:
   1. Division 11 Section "Residential Appliances" for appliances mounted in kitchen casework.
   2. Division 15 Section "Plumbing Fixtures" for sink units mounted in countertops.

1.3 DEFINIITIONS

A. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.

B. Semi-exposed Surfaces of Casework: Surfaces behind opaque doors or drawer fronts, including interior faces of doors and interiors and sides of drawers. Bottoms of wall cabinets are defined as "semi-exposed."

C. Concealed Surfaces of Casework: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of cabinets installed directly against and completely concealed by walls or other cabinets. Tops of wall cabinets and utility cabinets are defined as "concealed."

1.4 SUBMITTALS

A. Product Data: For the following:

Samples and Submittals must be approved by Owner/Developer prior to ordering or production.
   1. Cabinets.
   2. Plastic-laminate countertops.
   3. Cabinet hardware.

B. Shop Drawings: For cabinets and countertops. Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, cutouts for plumbing fixtures, and methods of joining countertops.

C. Samples for Initial Selection: Manufacturer's color samples consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material exposed to view.

D. Samples for Verification: For the following materials; in sets showing the full range of color, texture, and pattern variations expected:
   1. Wood-veneered panels with transparent finish, 8 by 10 inches (200 by 250 mm), for each species.
   2. Solid wood with transparent finish, 50 sq. in. (300 sq. cm), for each species.
   3. Plastic laminate for countertops, 8 by 10 inches (200 by 250 mm).
   4. One unit of each type of exposed hardware.

E. Product Certificates: Signed by manufacturers of casework certifying that products furnished comply with requirements. **Samples and Submittals must be approved by Owner/Developer prior to ordering or production.**

1.5 QUALITY ASSURANCE

A. Source Limitations for Cabinets: Obtain cabinets through one source from a single manufacturer.

B. Product Designations: Drawings indicate size, configurations, and finish material of casework by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes, similar door and drawer configurations, same finish material, and complying with the Specifications may be considered. Refer to Division 1 Section "Substitutions."

C. Quality Standards: Unless otherwise indicated, comply with the following standards:

1. Cabinets: KCMA A161.1.
   a. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semi exposed location of each unit and showing compliance with the above standard.
2. Plastic-Laminate Countertops: KCMA A161.2.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install kitchen casework until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Established Dimensions: Where kitchen casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.

C. Field Measurements: Where kitchen casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes if necessary.

D. Field Measurements for Countertops: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 COORDINATION

F. Coordinate layout and installation of blocking and reinforcement in partitions for support of kitchen casework.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CABINETS:
   a. Mid-America Cabinets
      1) Finish: **Standard**
      2) Color: **To be selected by owner**
      3) Species: **To be selected by owner**
      4) Door style: **To be selected by owner.**
   b. As submitted and approved equal
2. PLASTIC LAMINATE FOR COUNTERTOPS:
   a. Manufacturers/Color(s) - - to be selected by owner.
      1) Edge Profile: Eased
      2) Finish: Matte
   b. As submitted and approved equal

C. Product: Subject to compliance with requirements, provide **Mid America Cabinets or Equivalent.**

2.2 COLORS, TEXTURES, AND PATTERNS

A. Colors, Textures, and Patterns: As listed, or selected by Architect from manufacturer's full range for these characteristics.

2.3 CABINET MATERIALS

A. Exposed Materials: Comply with the following:

1. Exposed Wood Species: As follows. Do not use two adjacent exposed faces that are noticeably dissimilar in color, grain, figure, or natural character markings.

a. **Oak, or as selected by Owner/Developer**

2. Solid Wood: Clear hardwood lumber of species indicated, free of defects, selected for compatible grain and color, and kiln dried to 7 percent moisture content.
3. Plywood: Hardwood plywood complying with HPVA HP-1 with face veneer of species indicated, selected for compatible color and grain with Grade A faces and Grade C backs of same species as faces.
   a. Edge band exposed edges with minimum 1/8-inch- (3-mm-) thick, solid-wood edging of same species as face veneer.

B. Semi exposed Materials: Unless otherwise indicated, provide the following:
1. Plywood: Hardwood plywood complying with HPVA HP-1 with Grade C faces stained to be compatible with exposed surfaces and Grade 3 backs of same species as faces.
2. Thermoset Decorative Panels: Medium-density particleboard complying with ANSI A208.1, Grade M-2; with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
   b. Provide thermoset decorative overlay on both sides of shelves, dividers, drawer bodies, and other components with two semiexposed surfaces.
   c. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with semiexposed edges.
3. Vinyl-Faced Particleboard: Medium-density particleboard complying with ANSI A208.1, Grade M-2 with an embossed, wood-grain-patterned vinyl film adhesively bonded to particleboard.
   d. Provide vinyl film on both sides of shelves, dividers, drawer bodies, and other components with two semi exposed surfaces and on semi exposed edges.

C. Concealed Materials: Comply with the following:
1. Particleboard: ANSI A208.1, Grade M-2.
3. Medium-Density Fiberboard: ANSI A208.2.
4. Hardboard: AHA A135.4, Class 1 Tempered.

2.4 COUNTERTOP MATERIALS

A. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
1. Grade: HGS.
2. Grade: HGP.
3. Provide through-color plastic laminate.
4. Grade for Backer Sheet: BKL.

B. Particleboard: ANSI A208.1, Grade M-2.
C. Plywood: Exterior softwood plywood complying with PS 1, Grade C-C Plugged, touch sanded.
D. Solid Wood Edges and Trim: Clear hardwood lumber of species indicated, free of defects, selected for compatible grain and color, and kiln dried.

2.5 CASEWORK HARDWARE

A. General: Manufacturer's standard units complying with BHMA A156.9, of type, material, size, and finish as selected from manufacturer's standard choices.
B. Hinges: **Semi-concealed, self-closing hinges.**
D. Drawer Guides: 100 lb. rated epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05091.
E. Cabinet Pulls:
1. Knobs (cabinet doors): To be selected by owner.
2. Pulls (cabinet drawers): To be selected by owner

2.6 CABINET CONSTRUCTION

A. Face Style: Reveal overlay; door and drawer faces partially cover cabinet body or face frames.
B. Face Frames: 3/4-inch solid wood with glued mortise and tenon or doweled joints.
C. Door and Drawer Fronts: 2 inch wide by 3/4 inch thick perimeter assembled around a 1/4 inch veneer panel.
D. Cabinet Ends: 1/2 inch industrial-grade particle board fastened to face frame with tongue-and-groove. Exposed end panels are finished with wood veneer to match face frame finish.
E. Cabinet Tops and Bottoms: Wall cabinets constructed of 1/4 inch hardboard dadoed into end panels and interlocked into hanging rails for strength. Base bottoms constructed similarly of 1/2 inch industrial-grade particle board.
F. Hanging Rails: 3/4 inch by 2-1/2 inch hardwood on upper cabinets. 3/4 inch by 1 inch hardwood on base cabinets.

G. Drawers: 7/16 inch industrial-grade particle board using full box construction with 1/8 inch hardboard bottoms. Drawer fronts constructed to match cabinet door material and style.
H. Shelves: 1/2 inch industrial-grade particle board. Wall shelving adjustable up to 24" wide. Base cabinets feature 11 inch deep half-shelf.
I. Toe Kick: 1/2 inch industrial-grade particle board fastened between end panels.
J. Joinery: Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect tops and bottoms of wall cabinets and bottoms and stretchers of base cabinets to ends and dividers with mechanical fasteners. Rabbet tops, bottoms, and backs into end panels.
K. Factory Finishing: To greatest extent possible, finish casework at factory. Defer only final touchup until after installation.

2.7 PLASTIC-LAMINATE COUNTERTOPS
A. Configuration: Provide countertops with the following front, cove (intersection of top with backsplash), backsplash, and end-splash style:
1. Front: Eased Edge.
2. Cove: Cove molding (one-piece postformed laminate supported at junction of top and backsplash by wood cove molding).
3. Backsplash: Curved or waterfall shape with scribe.
B. Plastic-Laminate Substrate: Particleboard not less than 3/4 inch (19 mm) thick.
1. For countertops at sinks and lavatories, use phenolic-resin particleboard or exterior-grade plywood.
2. Build up countertop thickness to 1-1/2 inches (38 mm) at front, back, and ends with additional layers of particleboard laminated to top.
C. Backer Sheet: Provide plastic-laminate backer sheet on underside of countertop substrate.
D. Paper Backing: Provide paper backing on underside of countertop substrate.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install casework with no variations in flushness of adjoining surfaces; use concealed shims. Where casework abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework face.
B. Install casework without distortion so doors and drawers fit openings and are aligned. Complete installation of hardware and accessories as indicated.
C. Install casework and countertop level and plumb to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).
D. Fasten cabinets to adjacent units and to backing.
1. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches (600 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips.
2. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches (600 mm) o.c., with toggle bolts through metal backing behind gypsum board.
E. Fasten plastic-laminate countertops by screwing through corner blocks of base units into underside of countertop. Form seams using splines to align adjacent surfaces, and secure with glue and concealed clamping devices designed for this purpose.
F. Fasten solid-surfacing-material countertops by screwing through corner blocks of base units into underside of countertop. Align adjacent surfaces, and form seams to comply with manufacturer's written instructions using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

3.2 ADJUSTING AND CLEANING
A. Adjust casework and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
B. Clean casework on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 12356

SECTION 12491

WINDOW TREATMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of window coverings and accessories:
   1. 2” Cordless Faux wood blinds.
   2. Manual Roller Shades

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

B. Shop Drawings: Show location and extent of window coverings. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other Work, operational clearances, and relationship to adjoining work.

C. Samples for Initial Selection: For each colored component of each type of window covering indicated.
   1. Include similar Samples of accessories involving color selection.

D. Window Treatment Schedule: Include window coverings in schedule using same room designations indicated on Drawings.

E. Product Certificates: For each type of window covering product, signed by product manufacturer.

F. Product Test Reports: For each type of window covering product.

G. Maintenance Data: For window coverings to include in maintenance manuals. Include the following:
   1. Methods for maintaining coverings and finishes.
   2. Precautions about cleaning materials and methods that could be detrimental to finishes and performance.
   3. Operating hardware.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each window covering type through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide window coverings with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

   1. Flame-Resistance Ratings: Passes NFPA 701.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Corded Window Covering Product Standard: Provide window coverings complying with WCMA A 100.1.

E. Year 2000 Compliant: Computer hardware and software shall be capable of accurately processing, providing, and receiving date data from, into, and between the twentieth and twenty-first centuries, including leap year calculations.

F. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
   1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver coverings in factory packages, marked with manufacturer and product name, and location of installation using same room designations indicated on Drawings and in a window treatment schedule.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install coverings until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where window coverings are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Comfortex Window Fashions.
   2. Hunter Douglas Window Fashions.
   3. Levolor Contract; a Newell Company; Levolor.
   4. Springs Window Fashions Division, Inc.; Bali.
   5. Springs Window Fashions Division, Inc.; Graber.
   6. Verosol USA, Inc.
   7. US Floor and Window Inc.
   8. SWF Contract

2.2 HORIZONTAL LOUVER BLINDS, 2” FAUXWOOD BLINDS

A. Steel Channel Headrails: Headrail is a “U”-shaped 2-1/4” deep by 2” high channel, extruded steel rail. Headrail is to color coordinate with slats, bottom rail, ladder and cords

B. Head Channel Hardware: All operating hardware shall be securely positioned in accurate alignment. Lift cords and braided ladder shall be guided by low friction thermoplastic grommets in the head channel to prevent wear.

C. Foam PVC Bottomrail: The bottomrail shall measure 1/2” high by 2” wide extruded solid foam PVC material. Thermoplastic bottomrail plugs shall be used to secure ends of braided ladders and cords and to afford sill protection.

D. Slats: Slats shall be 2” x 1/8” wide expanded PVC foam material is lead-free and dimensionally stable and is extruded with UV inhibitors and anti-static material. The slats are extruded in solid colors to match the valance and bottomrail. The end clearance of each slat shall not exceed ¼” from each side of the window opening for jamb installation. For face installation, ,or outside mount, slats shall

overlap jamb by 1-1/2” max. on each end where possible. Slat thickness and ladder support distances hall be such that there is no visible sag.

E. Tilt Rod Support: The tilt rod support shall be low friction thermoplastic and shall support the tilt rod. It shall center the ladder drum over ladder hole.

F. Ladder Drum: Ladder drum shall have a smoothed edge clip under, which braided ladder ends with clips, are placed to be securely anchored.

G. Tilter: The tilter mechanism shall be a wand component. Tilter is made up of a wheel and gear.

H. Tilt Rod: the Tilt rod shall be electro-zinc coated steel measuring ¼” in square shape, and shall provide instant tilting response.

I. Ladders: Blinds shall have braided ladders that will assure proper control with adequate overlap of slats. Distance between end braided ladder and end of slats will not braided exceed 5-inche; distance between braided ladders should not exceed 14 inches.
   1. Braided ladder material: material shall be 100% polyester yarn, which will provide maximum strength and flexibility with minimum stretch. Horizontal rungs shall not be less than two threads. Ladders shall be of sufficient length for bottom of blind to hang with a plus one-half/minus zero inches of specified design. Ladders shall be dyed to coordinate with slats.
   2. Braided Ladder clil: metal clip shall be attached to the end of each braided ladder to lock in ladder drum.

J. End Support Brackets: The installation brackets with hinged locking cover shall have a coat of vinyl primer with a finished coat of polyester baked enamel. Color is to match headrail color. Each blind is supplied with a pair of these brackets to securely support the headrail brackets shall permit easy removal of the blind. Bracket dimensions: 2.5” wide X 2.25” high X 1” depth (on the face when installed).

K. Intermediate Support Brackets: Brackets shall be furnished for blinds over 48 inches wide. Maximum spacing for intermediate brackets shall be 48 inches.

L. Hold Down Brackets: Optional hold down brackets for door installations is available

M. Headrail End Stiffeners: shall be electroplated steel and shall be inserted into each of the headrail to add rigidity to the headrail. Field adjustable tabs eliminate lateral movement.

N. Color: to be selected by architect/owner.

O. Location – All apartment windows, unless noted below to receive Manual Roller shades.

2.3 MANUAL ROLLER SHADE

A. Tube sizes shall be 1.5” or 2” tubes.

B. Roller tube is extruded T5 aluminum, engineered with a channel to accept fabric spline. Shade panel should be easy to remove.

C. Clutch mechanism is glass-reinforced polyester thermopolymer (PBT) for wear resistance, smooth operation, and corrosion resistance.

D. Optional spring assist to reduce pull force, allowing easy lifting of larger shades

E. Brackets are stamped steel and corrosion resistant. Available in powder coated white, vanilla, gray and black.

F. Shades are raised and lowered by means of a #10 stainless steel bead chain.

G. Hem Bar is extruded aluminum and completely enclosed in a heat-sealed hem pocket.

H. Limited lifetime Warranty.

I. Fabric Type & Color: to be selected by architect/owner.

J. Location: All windows at Apartment Units #127, #128, #129, #213, #214, #216, #217

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install window coverings level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior louver edges in any position are not closer than 1 inch to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware, if any.

B. Flush Mounted: Install coverings with louver edges flush with finish face of opening if slats are tilted open.

C. Jamb Mounted: Install headrail flush with face of opening jamb and head.

D. Head Mounted: Install headrail on face of opening head.

E. Recessed: Install headrail concealed within blind pocket.

F. Connections: Connect motorized operators to building electrical system.

3.3 ADJUSTING

A. Adjust horizontal louver blinds to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged window covergins that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12491

SECTION 142400

ELECTRIC TRACTION ELEVATORS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Electric Traction, machine room-less, code-compliant elevator designed for retrofit in an existing shaft. **(Basis of Design: TK EOX 3500 Traction Machine Room less (MRL) Elevator.)** Reference drawings and details including:
   1. Standard pre-engineered passenger elevator.
   2. Elevator car enclosures, hoistway entrances, and signal equipment.
   3. Operation and control systems.
   4. Accessibility provisions for physically disabled persons.
   5. Elevator car shall accommodate ambulance stretcher, IBC 2021, 3002.4.
   6. Equipment, machines, controls, systems, and devices as required for safely operating the specified elevators at their rated speed and capacity.
   7. Materials and accessories as required to complete the elevator installation.

B. Related Sections:
   1. Division 1 General Requirements: Meet or exceed all referenced sustainability requirements.
   2. Division 3 Concrete: Installing inserts, sleeves and anchors in concrete.
   3. Division 4 Masonry: Installing inserts, sleeves and anchors in masonry.
   4. Division 5 Metals:
      a. Providing hoist beams, pit ladders, steel framing, auxiliary support steel, and divider beams for supporting guide-rail brackets.
      b. Providing steel angle sill supports and grouting hoistway entrance sills and frames.
   5. Division 9 Finishes: Providing elevator car finish flooring and field painting unfinished and shop primed ferrous materials.
   6. Division 22 Plumbing:
      a. Sump pit and oil interceptor.
   7. Division 23: Heating, Ventilation, and Air Conditioning
      a. Heating and ventilating hoistways
   8. Division 16 Sections:
      a. Providing electrical service to elevators, including fused disconnect switches.
      b. Emergency power supply, transfer switch, and auxiliary contacts.
      c. Heat and smoke sensing devices.
      d. Convenience outlets and illumination in machine room, hoistway, and pit.

C. Work Not Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to ANSI A17.1, Section 300 for hydraulic elevators. State or local requirements must be used if more stringent.
   1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.
   2. Elevator rail supports and columns as needed to support new elevator rails & cab within and tied into existing shaft.
   3. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing including all setting templates and diagrams for placement.
   4. Any existing openings that require infill shall be a minimum two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.
   5. Elevator hoistways shall have barricades, as required.
   6. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.
   7. Provide rail bracket supports at pit, each floor, and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.
   8. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces

from rails and buffers.

9. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
10. When heat, smoke, or combustion sensing devices are required, connect to elevator machine room terminals. Contacts on the sensors should be sided for 120 volt D.C.
11. Install and furnish finished flooring in elevator cab.
12. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.
13. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.
14. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
15. To maintain legal fire rating (masonry. Steel & Wood construction), door frames are to be anchored to walls and properly grouted in place.
16. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
17. General Contractor shall fill and grout around entrances, as required.
18. Elevator sill supports shall be provided at each opening.
19. All walls and sill supports must be plumb where openings occur.
20. Locate a light fixture and convenience outlet in pit with switch located adjacent to the access door.
21. A light switch and fused disconnect switch for each elevator should be located inside the machine room adjacent to the door, where practical, per the National Electrical Code (NFPA No. 70).
22. As indicated by elevator contractor, provide a light outlet for each elevator, in center of hoistway (or in the machine room).
23. For signal systems and power operated door: provide ground and branch wiring circuits, including main line switch. For car light and fan: provide a feeder and branch wiring circuits, including main line switch.
24. Wall thickness may increase when fixtures are mounted in drywall. These requirements must be coordinated between the general contractor and the elevator contractor.
25. Provide supports, patching and recesses to accommodate hall button boxes, signal fixtures, etc.
26. Locate telephone and convenience outlet on control panel.

D. Industry and government standards
   1. ICC/ANSI A117.1 – Accessible and Usable Buildings and Facilities
   2. ADAAG – Accessibility Guidelines for Buildings and Facilities
   3. ANSI/NFPA 70 – National Electrical Code
   4. ANSI/NFPA 80 – Standard for Fire Doors and Fire Windows
   5. ASME/ANSI A17.1 – Safety Code for Elevators and Escalators

1.02 SUBMITTALS

A. Product data: When requested, the elevator contractor will provide standard cab, entrance and signal fixture data to describe product for approval.

B. Shop drawings:
   1. **Retrofit, Historic Building: Field verify and illustrate existing conditions and dimensions at elevator hoistway, pit, plans, finished floor elevations, etc.**
   2. **Retrofit, Historic Building: Report of recommendations and items of concern based on review of structural and electrical engineer's documents and drawings.**
   3. Show new equipment arrangement, control space, pit, and hoistway. Provide plans,

elevations, sections, and details of assembly, erection, anchorage, and equipment location.

4. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
5. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
6. Indicate electrical power requirements and branch circuit protection device recommendations.

C. Powder Coat Paint selection: Submit manufacturer's standard selection charts for exposed finishes and materials.

D. Plastic laminate selection: Submit manufacturer's standard selection charts for exposed finishes and materials.

E. Metal Finishes: Upon request, standard metal samples provided.

F. Operation and maintenance data. Include the following:
1. Owner's Manual and Wiring Diagrams.
2. Parts list, with recommended parts inventory.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: An approved manufacturer with minimum 15 years' experience in manufacturing, installing, and servicing elevators of the type required for the project.
1. Must be the manufacturer of the power unit, controller, signal fixtures, door operators cab, entrances, and all other major parts of the elevator operating equipment.
a. The major parts of the elevator equipment shall be manufactured in the United States, and not be an assembled system.
2. The manufacturer shall have a documented, on-going quality assurance program.
3. ISO-9001:2000 Manufacturer Certified
4. ISO-14001:2004 Environmental Management System Certified

B. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than 15 years of satisfactory experience installing elevators equal in character and performance to the project elevators.

C. Regulatory Requirements:
1. ASME/ANSI A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
2. Building Code: National.
3. NFPA 70 National Electrical Code.
4. NFPA 80 Fire Doors and Windows.
5. Americans with Disabilities Act Accessibility Guidelines (ADAAG).
6. CAN/CSA B44 Safety Code for Elevators and Escalators.

D. Fire-rated Entrance Assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, CAN4-S104 (ULC-S104), UL10(B), and NFPA 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory (2 hour label in Canada).

E. Inspection and testing: Elevator Installer shall obtain and pay for all required inspections, tests, permits, and fees for elevator installation.
1. Arrange for inspections and make required tests.
2. Deliver to the Owner upon completion and acceptance of elevator work.

F. Product Qualifications:
1. LCA, EPD, and HPD data must be provided for all major components of the elevator system.
2. LCA data must be compatible with GaBI Software.
3. Environmental Product Declaration (EPD): Publicly available, critically reviewed life cycle analysis having at least a cradle-to-gate scope.
4. GreenScreen Chemical Hazard Analysis: All ingredients of 100 parts-per-million or greater evaluated using GreenScreen for Safer Chemicals Method v1.2.
5. Health Product Declarations (HPD v2 or later): Complete, published declaration with full disclosure of known hazards, prepared using the Health Product Declaration Collaborative's "HPD builder" on-line tool; Unknown hazard listed will not be considered acceptable.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Manufacturing will deliver elevator materials, components, and equipment and the contractor is responsible to provide secure and safe storage on job site.

1.05 PROJECT CONDITIONS

A. Prohibited Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

B. **Retrofit: This project is considered a retrofit. Elevator & equipment to be installed within an existing hoistway in a historic building. Elevator manufacturers and installer are required to visit the site prior to bidding for evaluation of existing conditions. Bids should include any special conditions and recommendations found during pre-bid investigations. Elevator manufacturer, contractor, and installer shall alert the architect to any discrepancies or concerns found during site and field verification prior to the bid date.**

1.06 WARRANTY

A. Warranty: Submit elevator manufacturer's standard written warranty agreeing to repair, restore or replace defects in elevator work materials and workmanship not due to ordinary wear and tear or improper use or care for 12 months after completion of installation or acceptance thereof by beneficial use, whichever is earlier.

1.07 MAINTENANCE

A. Furnish maintenance and call back service for a period of 1 year for each elevator after completion of installation or acceptance thereof by beneficial use, whichever is earlier, during normal working hours, excluding callbacks. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies, and parts to keep the elevators in proper operation.

1. Manufacturer shall have a service office and full-time service personnel within a 150 mile radius of the project site.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: **TK EOX 3500 Traction Machine Room less (MRL) Elevator.**

B. Provide AC gearless machine room-less elevator systems subject to compliance with the design and performance requirements of this specification.

C. Substitution Requests must be approved by architect prior to bidding.

1) Approved Manufacturers: KONE, Schindler, TKE, Otis, or other approved by architect.

a. Other acceptable machine room-less products: manufacturer with minimum 15 years' experience in manufacturing, installing and servicing elevators of the type required for this project.

2.2 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.

B. Electric Traction, Machine-room less Passenger Elevator

C. Elevator Description:

1. Elevator Equipment: Machine Room Less (MRL) gearless traction elevator
2. Equipment Control: Verify with manufacturer
3. Drive: Verify with manufacturer
4. Quantity of Elevators: 1
5. Landings: 7
6. Openings: 7 front openings, 0 back openings

7. Travel: 63'-0" approx. (field verify)
8. Rated Capacity: **3,500 lb min.**
9. Rated Speed: **200 FPM min.**
10. Clear inside Cab dimensions: (WxD) 5'-5" x 6'-11"
11. Hoistway Dimensions (Existing, Field Verify): **7'-9" x 11'-8"**
12. Existing Pit – Shaft runs to basement, but elevator will not. Basement portion of shaft will be used as pit. Field verify size and depth. Elevator supplier/contractor to review and make recommendations.
13. Cab Height: 7'-9 7/16"
14. Clear inside ceiling height 7'-4"
15. Entrance width and type: 3'-6" and LH openings
16. Entrance height: 7'-0"
17. Existing building Main Power Supply: **120/208 V Volts-three phase** (Elevator manufacturer to provide inverter for power supply)
18. Operation: MC5 (VVVF)
19. Machine Location: Verify with manufacturer
20. Control Space Location: Verify with manufacturer
21. Elevator equipment shall conform to the requirements of seismic zone: **non-seismic, Zone 0 (Abilene, Texas)**
22. Maintenance Service Period: 12 months
23. Auxiliary Operations:
    a. Battery-powered automatic evacuation.
    b. Earthquake Emergency Operation: Comply with requirements in ASME A17.1/CSA B44.
    c. Automatic dispatching of loaded car.
    d. Nuisance-call cancel.
    e. Loaded-car bypass.
    f. Distributed parking.
    g. Off-peak operation.
    h. Automatic operation of lights and ventilation fans.
    i. **Priority** service at **all** floors.
    j. Independent service for **one car**.

D. Performance Requirements
1. Car Performance
    a. Car Speed ± 5% of contract speed under any loading condition or direction of travel
    b. Car Capacity: safely lower, stop and hold (per code) up to 125% of rated load
2. System Performance
    a. Vertical Vibration (max): 15 mg ISO187338/ISO 8041 system pk – pk
    b. Horizontal Vibration (max): 12 mg ISO187338/ISO 8041 system pk – pk
    c. Jerk Rate (max): 3.3 ft/sec3
    d. Acceleration (max): 1.3 ft/sec2
    e. In Car Noise: 55 dB(A) Maximum
    f. Leveling accuracy: ±0.2 inches
    g. Starts per hour (max): 240
3. Additional Requirements:
    a. Must be able to accommodate a stretcher per IBC 2012 regulations.
    b. Provide inspection certificate in each car, mounted under acrylic cover with frame made from **satin stainless steel.**

2.3 EQUIPMENT: CONTROL COMPONENTS AND CONTROL SPACE

A. Controller: provide microcomputer-based control system to perform all functions

1. All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidently contact in a situation where the controller doors are open.
2. Controller shall be separated into two distinct halves; motor drive side and control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.
3. Provide a serial cardrack and main CPU board containing a non-erasable EPROM and operating system firmware.
4. Variable field parameters and adjustments shall be contained in a non-volatile memory module.

B. Drive: provide variable voltage variable frequency AC drive system to develop high starting torque with low starting current.

C. Controller Location: Locate controller(s) in the front wall integrated with the top landing entrance frame, machine side of the elevator. One non-fused phase permanent power in hoistway at top landing. A separate space should not be required.

2.4 EQUIPMENT: HOISTWAY COMPONENTS

A. Machine: AC gearless machine, with permanent magnet synchronous motor, direct current electromechanical disc brakes, and integral traction drive sheave, mounted to the car guide rail at the top of the hoistway.

B. Governor: friction type over-speed governor rated for the duty of the elevator specified.

C. Buffers, Car and Counterweight: Polyurethane buffer

D. Hoistway Operating Devices:
1. Emergency stop switch in pit
2. Terminal stopping switches
3. Emergency stop switch on the machine

E. Positioning System: system consisting of magnets and proximity switches

F. Guide Rails and attachments: steel rails with brackets and fasteners

2.5 EQUIPMENT: HOISTWAY ENTRANCES

A. Hoistway entrances
1. Sills: extruded Aluminum
2. Doors: hollow metal construction with vertical internal channel reinforcements
3. Fire Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B
   a. Fire Protection Rating: **1-1/2 hours**
4. Entrance Finish: **Satin Stainless Steel, No. 4 finish**
5. Entrance Markings Jamb Plates: Provide standard entrance jamb tactile markings on both jambs, at all floors. Plate Mounting: Refer to manufacturer drawings.

2.6 EQUIPMENT: CAR COMPONENTS

A. Car Frame: Provide car frame with adequate bracing to support the platform and car enclosure

B. Car Safeties: Device will be provided and mounted under the car platform, securely bolted to the car frame. The safety will be actuated by a centrifugal governor mounted at the top of the hoistway. The safety is designed to operate in case the car attains excessive descending speed.

C. Platform: platform shall be all steel construction

D. Car Guides: Provide guide-shoes mounted to top and bottom of both car and counterweight frame. Each guide-show assembly shall be arranged to maintain constant contact on the rail surfaces. Provide retainers in areas with seismic design requirements.

E. Cab Finish: To be selected from manufacturer’s full line of materials/colors.

F. Car Wall Finishes:
1. Side Walls: To be selected from manufacturer’s full line of materials/colors.

2. Rear Wall: To be selected from manufacturer's full line of materials/colors.
3. Car Front, Door and skirting: **Satin Stainless Steel**
4. Ceiling: **Satin Stainless Steel**
5. Handrails: **Satin Stainless Steel**
    a. Rails to be located on side walls of car enclosure.
6. Sills: Aluminum Extruded
7. Flooring: by others, prepared to receive finish as indicated in Specifications and drawings
8. Provide hooks for protective pads in **all cars** and **one** complete set(s) of full-height protective pads.
9. Emergency Car Signals:
    a. Emergency Siren: Siren mounted on top of cab that is activated when the alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.
    b. Emergency Car Lighting: Provide Emergency power unit employing a 12-volt sealed rechargeable battery and totally static circuits shall illuminate the elevator car and provide current to the alarm bell in the event of building power failure.
    c. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.
    d. Ventilation: Manufacturer's standard cab fan.

2.7 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: Provide car operating panel with all push buttons, key switches, and message indicators for elevator operation. Fixture finish to be satin stainless steel.
    1. Main flush mounted car operating panel shall contain a bank of round, mechanical, illuminated buttons, marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. Buttons have Amber Dot Matrix illumination (halo). All buttons to have raised text and Braille marking on the left-hand side. The car operating display panel shall be Amber Dot Matrix. All texts, when illuminated, shall be Amber Dot Matrix. The car operating panel shall have a satin stainless-steel finish.
    2. Additional Feature of car operating panel shall include:
        a. Car position indicator within operating panel satin Stainless Steel
        b. Elevator Data Plate marked with elevator company and car number on car top
        c. Help Buttons with raised markings
        d. In car stop switch per local code.
        e. Call Cancel Button
B. Hall Fixtures: Wall mounted hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Wall mounted hall fixtures shall have a Satin Stainless Steel finish.
    1. Hall fixtures shall feature round, mechanical, buttons in applied mount face frame. Hall fixtures shall correspond to options available from that landing. Buttons shall be in a vertically mounted fixture.
C. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and doors are opening, the lantern shall indicate the direction in which the car is to travel, and a chime will sound. The chime will sound once for up and twice for down. The car riding lantern face plate shall have a Satin Stainless Steel finish.
D. Car-Control Stations: Provide manufacturer's standard **recessed** car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
    1. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

E. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

F. Firefighters' Two-Way Telephone Communication Service: Provide **flush-mounted cabinet telephone jack** in each car and required conductors in traveling cable for firefighters' two-way telephone communication service.

2.8 ELEVATOR OPERATION AND CONTROLLER

A. Elevator Operation
   1. Simplex Collective Operation
   2. Relative System response Dispatching

B. Standard Operating Features to include:
   1. Full Collective Operation
   2. Fan and Light Control
   3. Load Weighing Bypass
   4. Ascending Car Uncontrolled Movement Protection
   5. Top of Car Inspection Station

C. Additional Operating Features to Include:

D. Elevator Control System for Inspections and Emergency:
   1. Provide devices within controller to run the elevator in inspection operation.
   2. Provide devices on car top to run the elevator in inspection operation.
   3. Provide within controller an emergency stop switch to disconnect power from the brake and prevents motor from running
   4. Provide the means from the controller to mechanically lift and control the elevator brake to safely bring car to nearest available landing when power is interrupted
   5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.
   6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.
   7. Provide the means for the control to reset elevator earthquake operation.

2.9 EQUIPMENT: DOOR OPERATOR AND CONTROL

A. Door Operator: A closed loop permanent magnet VVVF high-performance door operator shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.

B. The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by local code.

C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.

D. Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.

E. Electronic Door Safety Device. The elevator car shall be equipped with an electronic protective device extending the full height of the car. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.

PART 3 EXECUTION

3.01 EXAMINATION

A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and machine rooms/control space, as constructed and verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. **Retrofit: This project is considered a retrofit. Elevator & equipment to be installed within a reconstructed hoistway in a historic building. Elevator manufacturer and installer are required to visit the site prior to shop drawing construction for evaluation of existing conditions. Shop drawings should include any special conditions and recommendations found during pre-bid investigations. Elevator manufacturer, contractor, and installer shall immediately alert the architect to any discrepancies or concerns found during site and field verification.**

C. Prior to start of work, verify hoistway is in accordance with shop drawings. Dimensional tolerance of hoistway from shop drawings: -0 inches +2 inches. Do not begin work of this section until dimensions are within tolerances.

D. Prior to start of work, verify projections greater than two inches (four inches if ASME A17.1/CSA B44 2000 applies) must be beveled not less than 75 degrees from horizontal.

E. Prior to start of work, verify landings have been prepared for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.

F. Prior to start of work, verify elevator pit has been constructed in accordance with requirements, is dry and reinforced to sustain vertical forces, as indicated in approved submittal. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.

G. Prior to start of work, verify control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including sleeves and penetrations.

H. Verify installation of GFCI protected 20-amp in pit and adjacent to each signal control cabinet in control space.

3.02 PREPARATION

A. Coordinate installation of anchors, bearing plates, brackets and other related accessories.

3.03 INSTALLATION

A. Install elevator systems components and coordinate installation of hoistway wall construction.
   1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
   2. Comply with the National Electrical Code for electrical work required during installation.

B. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.

C. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.

D. Lubricate operating parts of system where recommended by manufacturer.

3.04 FIELD QUALITY CONTROL

A. Acceptance testing: Upon completion of the elevator installation and before permitting use of elevator, perform acceptance tests as required by A17.1 Code and local authorities having jurisdiction. Perform other tests, if any, as required by governing regulations or agencies.
B. Advise Owner, Contractor, Architect, and governing authorities in advance of dates and times tests are to be performed on the elevator.

3.05 ADJUSTING

A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

3.06 CLEANING

A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless stall shall be cleaned with soap and water and dried with a non-abrasive surface; shall not be cleaned with bleached-based cleansers.
B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.
    a. Use environmentally preferable and low VOC emitting cleaners for each application type. Cleaners that contain solvents, pine and/or citrus oils are not permitted.

3.07 PROTECTION

A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

3.08 TESTING AND INSPECTIONS

A. Perform recommended and required testing in accordance with authority having jurisdiction
B. Obtain required permits and provide originals to Owner/Architect.

3.09 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.
B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

END OF SECTION 142400

SECTION 210500

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, fittings, valves, and connections for combination sprinkler and standpipe systems.

1.2 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 211200 - Fire-Suppression Standpipes: Standpipe design.

C. Section 211300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.3 REFERENCE STANDARDS

A. ASME A112.18.1 - Plumbing Supply Fittings; 2012.

B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.

D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2011.

F. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings; 2012.

G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

H. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.

I. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

J. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2013.

K. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2013.

L. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.

M. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40; 2015.

N. ASTM F439 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2013.

O. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR); 2013.

P. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2014.

Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

R. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.

S. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2012.

T. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2012.

U. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2009.

V. AWWA C606 - Grooved and Shouldered Joints; 2011.

W. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

X. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; 2013.

Y. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

Z. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

AA. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Division 1 Section - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

D. Project Record Documents: Record actual locations of components and tag numbering.

E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Valves: Bear UL label or marking. Provide manufacturer's name and pressure rating marked on valve body.

C. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.1 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Conform work to NFPA 13.

B. Standpipe and Hose Systems: Conform to NFPA 14.

C. Welding Materials and Procedures: Conform to ASME Code.

2.2 BURIED PIPING

A. Steel Pipe: ASTM A53/A53M Schedule 40 or ASTM A795 Standard Weight, black, with AWWA C105 polyethylene jacket, or double layer, half-lapped polyethylene tape.
   1. Steel Fittings: ASME B16.9, wrought steel, buttwelded; with double layer, half-lapped polyethylene tape.
   2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings.
   3. Joints: Welded in accordance with AWS D1.1.

B. Cast Iron Pipe: AWWA C151/A21.51.
   1. Fittings: AWWA C110, standard thickness.
   2. Joints: AWWA C111, rubber gasket.
   3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

2.3 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A795 Schedule 10 or ASTM A53 Schedule 40, black.
   1. Steel Fittings: ASME B16.9, wrought steel, buttwelded.
   2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
   3. Malleable Iron Fittings: ASME B16.3, threaded fittings.

4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
5. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

B. CPVC Pipe: ASTM F442/F442M, SDR 13.5.
1. Fittings: ASTM F438 Schedule 40, or ASTM F439 schedule 80, CPVC.
2. Joints: Solvent welded, using ASTM F493 cement.

2.4 PIPE SLEEVES

A. Vertical Piping:
1. Sleeve Length: 1 inch above finished floor.
2. Provide sealant for watertight joint.

B. Pipe Passing Through Below Grade Exterior Walls:
1. Zinc coated or cast iron pipe.
2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

C. Not required for wall hydrants for fire department connections or in drywall construction.

D. Clearances:
1. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
2. All Rated Openings: Caulked tight with fire stopping material conforming to ASTM E814 in accordance with Firestopping section to prevent the spread of fire, smoke, and gases.

2.5 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Modular/Mechanical Seal:
1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.

2.6 ESCUTCHEONS

A. Material:
1. Fabricate from nonferrous metal.
2. Chrome-plated except when 300 series, ASTM A269/A269M stainless steel is provided.
3. Metals and Finish: Comply with ASME A112.18.

B. Construction:
1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.7 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.8 MECHANICAL COUPLINGS

A. Rigid Mechanical Couplings for Grooved Joints:
   1. Dimensions and Testing: Comply with AWWA C606.
   2. Minimum Working Pressure: 300 psig.
   3. Housing Material: Fabricate of ductile iron conforming to ASTM A536.
   4. Housing Coating: Factory applied orange enamel.
   5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
   6. Bolts and Nuts: Hot dipped galvanized or zinc electroplated steel

2.9 GATE VALVES

A. Up to and including 2 inches:
   1. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.

B. Over 2 inches:
   1. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged ends.

C. Over 4 inches:
   1. Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

2.10 GLOBE OR ANGLE VALVES

A. Up to and including 2 inches:
   1. Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity repackable under pressure.

B. Over 2 inches:
   1. Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.11 BUTTERFLY VALVES

A. Bronze Body:
   1. Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and built-in tamper proof switch rated 10 amp at 115 volt AC.

B. Cast or Ductile Iron Body
   1. Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and internal tamper switch rated 10 amp at 115 volt AC.

2.12 CHECK VALVES

A. Up to and including 2 inches:
   1. Bronze body and swing disc, rubber seat, threaded ends.

B. Over 2 inches:
   1. Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.

C. 4 inches and Over:
   1. Iron body, bronze disc, stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

2.13 DRAIN VALVES

A. Compression Stop:
   1. Bronze with hose thread nipple and cap.

B. Ball Valve:
   1. Brass with cap and chain, 3/4 inch hose thread.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. The entire building shall be provided with a fire protection sprinkler system and Class I manual wet standpipe system.

C. Prepare design documents including shop drawings and hydraulic calculations in accordance with NFPA 13 and 14 and submit to Authority Having Jurisdiction for approval prior to installation. Design shall be performed by a licensed Professional Engineer.

D. Install standpipe piping, hangers, and supports in accordance with NFPA 14.

E. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

F. Install piping to conserve building space, to not interfere with use of space and other work.

G. Piping shall be concealed where routed in finished spaces.

H. Group piping whenever practical at common elevations.

I. Sleeve pipes passing through partitions, walls, and floors.

J. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

K. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

L. Pipe Hangers and Supports:
   1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   2. Place hangers within 12 inches of each horizontal elbow.
   3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   6. Support piping from top chord of bar joists. Support from deck or bottom chord is not acceptable.

M. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

N. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

O. Do not penetrate building structural members unless indicated.

P. Provide sleeves when penetrating footings, floors, and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.

2. Aboveground Piping:
    a. Pack solid using mineral fiber conforming to ASTM C592.
    b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
3. All Rated Openings: Caulk tight with fire stopping material conforming to ASTM E814 in accordance with Firestopping section to prevent the spread of fire, smoke, and gases.
4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

Q. Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

R. Escutcheons:
1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

S. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

T. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.

U. Provide gate valves for shut-off or isolating service.

V. Provide drain valves at main shut-off valves, low points of piping and apparatus.

END OF SECTION 210500

SECTION 210523

GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Two-piece ball valves with indicators.

B. Bronze butterfly valves with indicators.

C. Iron butterfly valves with indicators.

D. Check valves.

E. Bronze OS&Y gate valves.

F. Iron OS&Y gate valves.

G. NRS gate valves.

H. Indicator posts.

I. Trim and drain valves.

1.2 RELATED REQUIREMENTS

A. Section 210500 - Common Work Results for Fire Suppression: Pipe and fittings.

B. Section 210553 - Identification for Fire Suppression Piping and Equipment.

C. Section 211200 - Fire-Suppression Standpipes.

D. Section 211300 - Fire Suppression Sprinklers.

E. Section 283100 - Fire Detection and Alarm.

1.3 ABBREVIATIONS AND ACRONYMS

A. EPDM: Ethylene-propylene diene monomer.

B. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

C. NRS: Non-rising stem.

D. OS&Y: Outside screw and yoke.

E. PTFE: Polytetrafluoroethylene.

F. SBR: Styrene-butadiene rubber.

1.4 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

B. FM 1140 - Approval Standard for Quick Opening Valves 1/4 Inch through 2 Inch Nominal Size; 1998.

C. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

D. UL 258 - Shutoff Valves for Trim and Drain Purposes for Fire Protection Service; Current Edition, Including All Revisions.

1.5 SUBMITTALS

A. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

B. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.6 QUALITY ASSURANCE

A. Manufacturer:

1. Obtain valves for each valve type from single manufacturer.
2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

B. Where listed products are specified, provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), FM Global, or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.

C. Welding Materials and Procedures: Conform to ASME BPVC-IX.

D. Installer and Maintenance Contractor Qualifications:
1. Company specializing in performing the work of this section with minimum five years documented experience.
2. Trained and approved by manufacturer to design, install, test and maintain the equipment specified herein.
3. Complies with manufacturer's certification requirements.
4. Complies with manufacturer's insurance requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
1. Maintain valve end protection and protect flanges and specialties from dirt.
a. Provide temporary inlet and outlet caps.
b. Maintain caps in place until installation.
2. Store valves in shipping containers and maintain in place until installation.
a. Store valves indoors and maintain at higher than ambient dew point temperature.
b. If outdoor storage is unavoidable, store valves off the ground in watertight enclosures.

C. Use the following precautions for handling:
1. Do not use operating handles or stems as lifting or rigging points.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Comply with NFPA 13 and NFPA 14 for valves.

B. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:
1. Worm-gear actuator with handwheel for quarter-turn valves, except trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Hand-lever: For quarter-turn trim and drain valves 2 NPS and smaller.

2.2 TWO-PIECE BALL VALVES WITH INDICATORS

A. Description:
1. Minimum Pressure Rating: 175 psig.
2. Body Design: Two piece.
3. Body Material: Forged brass or bronze.
4. Port Size: Full or standard.
5. Seat: PTFE.
6. Stem: Bronze or stainless steel.
7. Ball: Chrome-plated brass.
8. Actuator: Worm gear or traveling nut.
9. Supervisory Switch: Internal or external.
10. End Connections: Threaded or grooved.

2.3 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. Minimum Pressure Rating: 175 psig.

B. Body Material: Bronze.

C. Seat: EPDM.

D. Stem: Bronze or stainless steel.

E. Disc: Bronze with EPDM coating.

F. Actuator: Worm gear or traveling nut.

G. Supervisory Switch: Internal or external.

2.4 IRON BUTTERFLY VALVES WITH INDICATORS

A. Minimum Pressure Rating: 175 psig.

B. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.

C. Seat: EPDM.

D. Stem: Stainless steel.

E. Disc: Ductile iron, nickel plated.

F. Actuator: Worm gear or traveling nut.

G. Supervisory Switch: Internal or external.

H. Body Design: Grooved-end connections.

2.5 CHECK VALVES

A. Minimum Pressure Rating: 175 psig.

B. Type: Center guided check valve.

C. Body Material: Cast iron, ductile iron.

D. Center guided check with elastomeric seal.

E. Hinge Spring: Stainless steel.

F. End Connections: Flanged, grooved, or threaded.

2.6 BRONZE OS&Y GATE VALVES

A. Minimum Pressure Rating: 175 psig.

B. Body and Bonnet Material: Bronze or brass.

C. Wedge: One-piece bronze or brass.

D. Wedge Seat: Bronze.

E. Stem: Bronze or brass.

F. Packing: Non-asbestos PTFE.

G. Supervisory Switch: External.

H. End Connections: Threaded.

2.7 IRON OS&Y GATE VALVES

A. Minimum Pressure Rating: 175 psig.

B. Body and Bonnet Material: Cast or ductile iron.

C. Wedge: Cast or ductile iron, or bronze with elastomeric coating.

D. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.

E. Stem: Brass or bronze.

F. Packing: Non-asbestos PTFE.

G. Supervisory Switch: External.

H. End Connections: Flanged.

2.8 NRS GATE VALVES

A. Minimum Pressure Rating: 175 psig.

B. Body and Bonnet Material: Cast or ductile iron.

C. Wedge: Cast or ductile iron with elastomeric coating.

D. Stem: Brass or bronze.

E. Packing: Non-asbestos PTFE.

F. Supervisory Switch: External.

G. End Connections: Flanged.

2.9 INDICATOR POSTS

A. Type: Underground.

B. Base Barrel Material: Cast or ductile iron.

C. Cap: Cast or ductile iron.

D. Operation: Wrench.

2.10 TRIM AND DRAIN VALVES

A. Ball Valves:
   1. Description:
      a. UL 258 or FM 1140 listed.
      b. Pressure Rating: 175 psig.
      c. Body Design: Two piece.
      d. Body Material: Forged brass or bronze.
      e. Port Size: Full or standard.
      f. Seat: PTFE.
      g. Stem: Bronze or stainless steel.
      h. Ball: Chrome-plated brass.
      i. Actuator: Hand-lever.
      j. End Connections: Threaded or grooved.

B. Angle Valves:
   1. Description:
      a. UL 258 or FM 1140 listed.
      b. Pressure Rating: 175 psig.
      c. Body Material: Brass or bronze.
      d. Ends: Threaded.
      e. Stem: Bronze.
      f. Disc: Bronze.
      g. Packing: Asbestos free.
      h. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:
   1. Description:
      a. UL 258 or FM 1140 listed.
      b. Pressure Rating: 175 psig.
      c. Body Material: Bronze with integral seat and screw-in bonnet.
      d. Ends: Threaded.
      e. Stem: Bronze.
      f. Disc Holder and Nut: Bronze.

g. Disc Seat: Nitrile.
h. Packing: Asbestos free.
i. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Confirm valve interior to be free of foreign matter and corrosion.

B. Remove packing materials.

C. Examine guides and seats by operating valves from the fully open position to the fully closed position.

D. Examine valve threads and mating pipe for form and cleanliness.

3.2 INSTALLATION

A. Comply with specific valve installation requirements and application in the following Sections:

B. Install listed fire protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections.
   1. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in water supply connections and backflow preventer at potable water supply connections.

D. Valves in horizontal piping installed with stem at or above the pipe center.

E. Position valves to allow full stem movement.

F. Install valve tags. Comply with Section 210553 requirements for valve tags, schedules, and signs on surfaces concealing valves; and the appropriate NFPA standard applying to the piping system in which valves are installed.

END OF SECTION 210523

SECTION 210553

IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

1.2 REFERENCE STANDARDS

1.3 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

2.2 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.3 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
4. Equipment: 2-1/2 inch high letters.

2.4 PIPE MARKERS

A. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

C. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.5 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Use tags on piping 3/4 inch diameter and smaller.

G. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 210553

SECTION 211200

FIRE-SUPPRESSION STANDPIPES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Standpipe system.

B. Fire department connection.

1.2 RELATED REQUIREMENTS

A. Section 210500 - Common Work Results for Fire Suppression: Fire Protection Piping.

B. Section 210523 - General-Duty Valves for Water-Based Fire-Suppression Piping.

C. Section 210553 - Identification for Fire Suppression Piping and Equipment.

D. Section 211300 - Fire Suppression Sprinklers.

E. Section 262717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

B. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; 2013.

C. NFPA 1963 - Standard for Fire Hose Connections; 2014.

D. UL 405 - Fire Department Connection Devices; Current Edition; Including All Revisions.

E. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's catalog sheet for equipment indicating rough-in size, finish, and accessories.

B. Shop Drawings: Indicate supports, components, accessories, and sizes.
   1. Submit shop drawings, product data, and hydraulic calculations to authority having jurisdiction for approval. Drawings and calculations shall be stamped by a licenced professional engineer.
   2. Installation shall be fully coordinated with structure and all other trades. Coordination shall be performed with installed conditions, not just the construction drawings. Rework of piping due to conflicts with field conditions shall be performed without cost to the Owner or Engineer.

C. Project Record Documents: Record actual locations of components.

D. Operation Data: Include manufacturer's data.

E. Certificates: Provide certificate of compliance from authority having jurisdiction indicating approval of field acceptance tests.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 14.

B. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed by the State.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience .

PART 2 PRODUCTS

2.1 VALVES

A. General Duty Valves: Refer to Section 210523.

B. Specialty Valves:
   1. Hose Station Valve:
      a. Angle type, brass finish, 1-1/2 NPS with automatic ball drip.

2. Hose Connection Valve:
    a. Angle type; brass finish; 2-1/2 NPS, thread to match fire department hardware, 300 psi working pressure, with threaded cap and chain of same material and finish.
3. Pressure Reducing Valve:
    a. Angle type; brass finish with inner hydraulic controls; 1-1/2 inch size, thread to match fire department hardware, 400 psi inlet pressure, with threaded cap and chain of same material and finish.

C. Hose Connection Valve Cabinets:
1. Style: Recessed mounted.
2. Tub: 16 gage, 0.0598 inch thick steel, prepared for pipe and accessory rough-in.
3. Door: 12 gage, 0.1046 inch thick steel, flush, glazed with 1/4 inch (6.35 mm) thick wired glass full panel; hinged, positive latch device.
4. Finish: Prime Coated.

2.2 FIRE DEPARTMENT CONNECTION

A. Type: Flush mounted wall type with brass finish.

B. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.

C. Drain: 3/4 inch automatic drip, outside.

D. Label: "Auto. Sprinkler Standpipe"

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 14.

C. Locate hose station valve in cabinet at 60 inches above finished floor.

D. Connect standpipe system to water source ahead of domestic water connection.

E. Where residual pressure exceeds 100 psi at any hose station, provide pressure orifice disc in discharge of hose station valve to prevent pressure on hose exceeding 100 psi.

F. Flush entire system of foreign matter.

3.2 FIELD QUALITY CONTROL

A. Test entire system in accordance with NFPA 14.

B. Test shall be witnessed by Fire Marshal.

END OF SECTION 211200

SECTION 211300

FIRE SUPPRESSION SPRINKLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. System design, installation, and certification.

C. Fire department connections.

1.2 RELATED REQUIREMENTS

A. Section 210500 - Common Work Results for Fire Suppression: Pipe, fittings, and valves.

B. Section 220553 - Identification for Plumbing Piping and Equipment.

1.3 REFERENCE STANDARDS

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

B. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2012.

C. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2012.

D. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2013.

E. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2013.

F. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.4 SUBMITTALS

A. See Division 1 Section - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings:

1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation. Additionally, indicate general routing of piping for review by Architect.
2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
3. Submit shop drawings, product data, and hydraulic calculations to authority having jurisdiction for approval. Drawings and calculations shall be stamped by a licenced professional engineer.
4. Installation shall be fully coordinated with structure and all other trades. Coordination shall be performed with installed conditions, not just the construction drawings. Rework of sprinkler piping due to conflicts with field conditions shall be performed without cost to the Owner or Engineer.

D. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

E. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.5 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Conform to UL requirements.

C. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed by the State.

D. Equipment and Components: Provide products that bear UL label or marking.

E. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.7 EXTRA MATERIALS

A. Provide extra sprinklers of type and size matching those installed, in quantity required by referenced NFPA design and installation standard.

B. Provide suitable wrenches for each sprinkler type.

C. Provide metal storage cabinet located adjacent to alarm valve.

PART 2 PRODUCTS

2.1 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for entire building.

B. Occupancy: Comply with NFPA 13.

C. Water Supply: Determine volume and pressure from water flow test data.

D. Interface system with building fire and smoke alarm system.

E. Provide fire department connections at locations coordinated with Fire Department.

F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

G. Pipe Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
6. Other Types: As required.

2.2 SPRINKLERS

A. Suspended Ceiling Type: Semi-recessed or concealed pendant type with matching push on escutcheon or cover plate.
1. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

B. Exposed Area Type: Standard upright type with guard.
1. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

C. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate .
1. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

D. Guards: Finish to match sprinkler finish.
1. Provide guards at all heads in basement, mechanical rooms, and storage rooms.
2. Provide guards at all heads installed below 8' AFF.

E. Finish:
1. Heads and escutcheons in historic areas, rooms 101, 102, 103, 104, 106, and 107 shall have brass finish.
2. Heads and escutcheons in all other areas shall have black finish.

2.3 PIPING SPECIALTIES

A. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, accelerator, and with the following additional capabilities and features:
1. Activate electric alarm.

2. Test and drain valve.
3. Externally resettable.
4. Replaceable internal components without removing valve from installed position.

B. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with pressure retard chamber and variable pressure trim; with test and drain valve.

C. Backflow Preventer: Double check valve assembly backflow preventer with drain and OS & Y gate valve on each end. Coordinate requirements with Authority Having Jurisdiction.

D. Test Connections:
1. Inspector's Test Connection for Preaction Systems:
a. Provide test connections approximately 6 ft above floor for each or portion of each sprinkler system equipped with an alarm device, located at the most remote part of each system.
b. Route test connection to an open-site drain location, excluding janitor sinks, accepting full flow without negative consequences.
c. Supply discharge orifice with same size as corresponding sprinkler orifice.
2. Backflow Preventer Test Connection:
a. Provide downstream of the backflow prevention assembly, listed hose valves with 2.5 inch National Standard male hose threads with cap and chain.

E. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.

F. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

G. Fire Department Connections:
1. Type: Flush mounted wall type with brass finish.
2. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
3. Drain: 3/4 inch automatic drip, outside.
4. Label: "Auto. Sprinkler Standpipe".

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Install buried shut-off valves in valve box. Provide post indicator.

D. Provide approved backflow preventer assembly at sprinkler system water source connection.

E. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle. Coordinate with Authority Having Jurisdiction.

F. Place pipe runs to minimize obstruction to other work.

G. Place piping in concealed spaces above finished ceilings.

H. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

I. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

J. Flush entire piping system of foreign matter.

K. Install guards on sprinklers where subject to damage..

L. Hydrostatically test entire system.

M. Required tests must be witnessed by authority having jurisdiction.

N. Provide concealed or sidewall heads in lobby. Other public areas must have concealed or recessed heads. Exposed ceiling or sidewall heads may be used in apartments.

O. Piping serving historic lobby shall be concealed as much as possible. Route piping between sleepers at floor above if required to conceal piping. Coordinate final routing with Architect prior to installation.

P. Areas subject to freezing shall be provided with dry type heads.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION 211300

SECTION 213000

FIRE PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire pump package, including electric motor drive, controller, and accessories.

B. Electric jockey pump.

C. System maintenance.

1.2 RELATED REQUIREMENTS

A. Section 210500 - Common Work Results for Fire Suppression: Fire protection piping.

B. Section 283100 - Fire Detection and Alarm.

1.3 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; Factory Mutual Research Corporation; current edition.

B. NEMA MG 1 - Motors and Generators; 2014.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

D. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

E. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection; 2016.

F. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

G. UL 448 - Centrifugal Stationary Pumps for Fire-Protection Service; Current Edition, Including All Revisions.

H. UL 1478 - Fire Pump Relief Valves; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Administrative for submittal procedures.

B. Product Data: Provide manufacturers literature including general assembly, pump curves showing performance characteristics with pump and system, operating point indicated, NPSH curve, controls, wiring diagrams, and service connections.

C. Shop Drawings: Indicate layout, general assembly, components, dimensions, weights, clearances, and methods of assembly.

D. Certificates: Certify that fire pumps meet or exceed requirements at operating conditions and that installation complies with regulatory requirements.

E. Test Reports: Indicate results of hydrostatic test and field acceptance tests.

F. Manufacturer's Instructions: Indicate support details, connection requirements, for fire pump system.

G. Project Record Documents: Record actual locations of components and accessories.

H. Operation Data: Include manufacturers instructions, start-up data, trouble-shooting check lists, for pumps, drivers, and controllers.

I. Maintenance Data: Include manufacturers literature, cleaning procedures, replacement parts lists, and repair data for pumps, drivers and controllers.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Pump Gaskets/Screens/Seals: One set for each different pump model.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 20 and NFPA 13; where requirements differ comply with most stringent.

B. Maintain on site at all times one copy of each design and installation standard referenced.

C. Design fire pump system under direct supervision of a Professional Engineer experienced in design of this Work and licensed at the State in which the Project is located.

D. Equipment and Components: Bearing UL (DIR) label or marking.

E. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

F. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

G. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

H. Provide certificate of compliance from authority have jurisdiction indicating approval of field acceptance tests.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire pumps and components in factory packing. Comply with manufacturer's rigging and installation instructions.

B. Protect fire pumps and components from physical damage including effects of weather, water, and construction debris.

C. Provide temporary inlet and outlet caps, and maintain in place until installation.

PART 2 PRODUCTS

2.1 FIRE PUMPS

A. Fire Pumps: Vertical in-line type; UL 448; single stage, close coupled, radially or horizontally split casing, for in-line mounting, for 250 psi.
   1. Casing: Cast or ductile iron, with suction and discharge gage port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
   2. Impeller: Bronze, fully enclosed, keyed directly to motor shaft.
   3. Shaft: Solid alloy steel with bronze sleeve.
   4. Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 230 degrees F maximum continuous operating temperature.
   5. Performance to be determined by fire sprinkler/standpipe designer.
      a. For bidding purposes, assume motor to be 20 hp, 208 volt, three phase, 60 Hz.

B. Fire Pump Accessories:
   1. Eccentric suction reducer and OS&Y gate valve on suction side of pump.
   2. Concentric increaser and check valve in pump discharge and OS&Y gate or butterfly valve on system side of check valve.
   3. Fire pump bypass fitted with OS&Y gate or butterfly valves and check valve.
   4. Main relief valve, UL 1478, and enclosed type waste cone.
   5. Suction pressure gage, 4-1/2 inch diameter dial with snubber, valve cock and lever handle.
   6. Discharge pressure gage mounted on board attached to pump, with snubber, valve cock and lever handle.
   7. 3/4 inch casing relief valve.
   8. Float operated 3/4 inch automatic air release valve.
   9. Hose valve manifold with 2-1/2 inch hose gate valves with caps and chains.
   10. Flow metering system for closed loop testing.

2.2 ELECTRIC MOTOR DRIVE

A. Motor: Squirrel cage induction type, NEMA MG 1; in open drip proof NEMA 250 enclosure, 3500 rpm.

B. Controller: Full service type with across-the-line starter, in NEMA 250 enclosure, including the following:
   1. Disconnect Switch: Externally operable, quick break type.
   2. Circuit Breaker: Comply with NFPA 20; minimum 10,000 amperes interrupting capacity.

3. Motor Starter: Energized automatically through pressure switch or manually by externally operable handle.
4. Pilot Lamp: Indicates circuit breaker closed and power available.
5. Alarm Relay: Energizes alarm to indicate circuit breaker open or power failure.
6. Switch Relay: For remote start.
7. Manual Selector Station: On enclosure marked "Automatic" and "Non-Automatic."

2.3 PRESSURE BOOSTER (JOCKEY) PUMP

A. Electrically operated, vertical multi-stage pump.

B. Control by automatic jockey pump controller with full voltage starter and minimum run timer to start pump on pressure drop in system and stay in operation for minimum period of time. Fire pump shall start automatically on further pressure drop or on jockey pump failure.

2.4 REMOTE PUMP ALARM PANEL

A. Provide a remote annunciator panel in accordance with NFPA 20, Paragraph 10.4.7.

B. Panel shall indicate the following information:
1. Pump or Motor Running: Signal shall actuate whenever the controller has operated into a motor-running condition. This signal circuit shall be energized by a separate, reliable supervised power source, or from the pump motor power, reduced to not more than 125V.
2. Loss of Phase: The fire pump alarm shall actuate whenever any phase at the line terminals of the motor contactor is lost. All phases shall be monitored. Such monitoring shall detect loss of phase whether the motor is running or at rest.
3. Phase Reversal: This fire pump alarm circuit shall be energized by a separate reliable supervised power source or from the pump motor power, reduced to not more than 125V. The fire pump alarm shall actuate whenever the three-phase power at the line terminals of the motor contactor is reversed.

C. Provide all required power and signal wiring. Coordinate requirements with electrical contractor.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide system analysis to determine if fire pump is required. For bidding purposes, it is anticipated that the facility will require a fire pump. Submit hydraulic calculations supporting design.

B. Install in accordance with NFPA 20.

C. Provide access space around pumps for service; no less than minimum as recommended by manufacturer.

D. Install piping in accordance with Section 210500. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For base mounted pumps, provide supports under elbows on pump suction and discharge.

E. Provide drains for bases and seals, piped to and discharging into floor drains.

F. Provide for connection to electrical service. Refer to Division 26.

G. Lubricate pumps before start-up.

H. Provide supervisory alarm notifications using auxiliary dry contacts interconnected into fire alarm system for monitoring by Owner-designated central or off-site point of constant attendance; see Section 283100.

3.2 FIELD QUALITY CONTROL

A. Perform field acceptance tests as specified in NFPA 20.

B. Perform field acceptance tests in the presence of Fire Marshal.

3.3 CLOSEOUT ACTIVITIES

A. Demonstrate automatic operation of system including verification of pressure switch set points.

3.4 MAINTENANCE

A. Provide service and maintenance of equipment installed under this section for one year from Date of Substantial Completion.

END OF SECTION 213000

SECTION 220501

PLUMBING DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Plumbing demolition.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements, pipe, and equipment arrangements for new work as shown on Drawings.

B. Prior to submitting bid, visit site and become familiar with scope of demolition work required to accommodate new work.

C. Refer to Architectural Drawings for additional clarification of scope of demolition and new work.

D. Report discrepancies to Architect before disturbing existing installation.

3.2 PREPARATION

A. Remove all piping, fixtures, and other plumbing installation from entire building.

3.3 DEMOLITION AND EXTENSION OF EXISTING PLUMBING WORK

A. Remove all equipment, controls, piping, fixtures, and other plumbing installation from the entire building. Piping to be removed to source of supply.

B. Repair adjacent construction and finishes damaged during demolition and extension work.

END OF SECTION 220501

SECTION 220553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.3 SUBMITTALS

A. See Division 1 Section - Administrative Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Pipe Markers: 3/4 inch diameter and higher.

2.2 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.

2.3 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Chart: Typewritten letter size list in anodized aluminum frame.

2.4 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Identify equipment with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

F. Identify control panels and major control components outside panels with plastic nameplates.

G. Identify valves in main and branch piping with tags.

H. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 220553

SECTION 220719

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

C. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2013).

D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

F. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service

B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER

A. Manufacturers:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com.
   3. Owens Corning Corp: www.owenscorning.com.
   4. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum service temperature: 250 degrees F.
   3. Maximum moisture absorption: 0.2 percent by volume.

C. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum service temperature: 250 degrees F.
   3. Maximum moisture absorption: 0.2 percent by volume.

D. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

E. Vapor Barrier Lap Adhesive:
   1. Compatible with insulation.

F. Insulating Cement/Mastic:
   1. ASTM C195; hydraulic setting on mineral wool.

G. Fibrous Glass Fabric:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Blanket: 1.0 lb/cu ft density.
   3. Weave: 5x5.

H. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Vinyl emulsion type acrylic, compatible with insulation, black color.

I. Insulating Cement:
   1. ASTM C449/C449M.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Armacell International: www.armacell.com/#sle.
   2. K-Flex USA: www.kflexusa.com.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534 Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: -40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 JACKETS

A. PVC Plastic.
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive.

2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

E. Glass fiber insulated pipes conveying fluids above ambient temperature:
1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

F. Inserts and Shields:
1. Application: Piping 2-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.

G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Firestopping Section.

H. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Provide PVC jacket.

3.3 SCHEDULES

A. Domestic Hot and Recirculated Hot Water:
1. Glass Fiber Insulation:
a. Pipe Size Range: 1/2 through 1-1/4 inch.
b. Thickness: 1 inch.
2. Glass Fiber Insulation:
a. Pipe Size Range: Above 1-1/4 inch
b. Thickness: 1-1/2 inch

B. Domestic Cold Water:
1. Glass Fiber Insulation:
a. Pipe Size Range: 1/2 through 1-1/4 inch.
b. Thickness: 1/2 inch.
2. Glass Fiber Insulation:
a. Pipe Size Range: Above 1-1/4 inch
b. Thickness: 1 inch

C. Other Systems:
1. Drains from water coolers: 1/2" elastomeric

END OF SECTION 220719

SECTION 221005

PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Flanges, unions, and couplings.
   4. Pipe hangers and supports.
   5. Valves.
   6. Flow controls.
   7. Check valves.
   8. Water pressure reducing valves.
   9. Relief valves.
   10. Sleeves
   11. Sleeve seals
   12. Grout
   13. Escutcheons

1.2 RELATED REQUIREMENTS

A. Section - Firestopping.

B. Section 220553 - Identification for Plumbing Piping and Equipment.

C. Section 220719 - Plumbing Piping Insulation.

1.3 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 1999, and addenda A&B (R2004).

B. ANSI Z223.1 - National Fuel Gas Code; 2015.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

E. ASME B31.9 - Building Services Piping; 2014.

F. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems; 2009.

G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

H. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2015.

I. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

J. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.

K. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

L. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2010.

M. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2002 (Reapproved 2010).

N. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.

O. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

P. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

Q. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).

R. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

S. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2013a.

T. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems; 2011.

U. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).

V. ASTM F 2389-06 - Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems

W. CSA B137.11 - Polypropylene (PP-R) Pipe and Fittings for Pressure Applications

X. NSF/ANSI 14 - Plastic Piping System Components and Related Materials

Y. NSF/ANSI 61 - Drinking Water Systems Components - Health Effects

Z. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2013.

AA. AWWA C651 - Disinfecting Water Mains; 2005.

AB. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009.

AC. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011.

AD. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2012.

AE. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

AF. MSS SP-67 - Butterfly Valves; 2011.

AG. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends; 2011.

AH. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends; 2011.

AI. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 2011.

AJ. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.

AK. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

AL. NSF 372 - Drinking Water System Components - Lead Content; 2011.

AM. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe; 2013.

AN. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Project Record Documents: Record actual routing of piping. Record actual locations of valves.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with adopted standards of local municipality.

B. Where joining systems specific to a piping manufacturer are used, personnel shall receive factory authorized training prior to installation, and submit evidence of such training for review.

C. Valves: Manufacturer's name and pressure rating marked on valve body.

D. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

E. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

F. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 REGULATORY REQUIREMENTS

A. Perform work in accordance with adopted standards of local municipality.

B. Conform to applicable code for installation of backflow prevention devices.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

C. Reference PART 3 EXECUTION for product applications. Listing of products herein does not imply acceptance of use in all sizes or locations.

2.2 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.3 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

B. PVC Pipe: ASTM D2729.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.4 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints: ASTM B 32, alloy Sn95 solder.

B. PE Pipe: ASTM D2239, or ASTM D2447 Schedule 40.
   1. Fittings: ASTM D2609, PE.
   2. Joints: Mechanical with stainless steel clamp.

2.5 WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.

B. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
   1. Manufacturers:
      a. Zurn Industries, LLC
      b. Viega
   2. PPI TR-4 Pressure Design Basis:

C. Polypropylene Pipe (PP-R): Pipe shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. The pipe shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipe shall be made in a three layer extrusion process. Domestic hot water shall contain a fiber layer (faser) to restrict thermal expansion. All pipe shall comply with the rated pressure requirements of ASTM F 2389. All pipe shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11.
   1. Pipe shall be aquatherm® Greenpipe®, Faser®, or available from Aquatherm, Inc.. Piping specifications and ordering information are available at www.aquathermpipe.com.
   2. Fittings shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. The fittings shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All fittings shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11.
   3. Valves with PP-R bodies shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. The valves shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material.
   4. Manufacturer shall warrantee pipe and fittings for 10 years to be free of defects in materials or workmanship. Warrantee shall cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system do to defects in materials or workmanship.
   5. Where up to 1 inch of standard insulation is indicated on the drawings or in these specifications, a field installed, thermal (radiant, conductive, and convective) and vapor barrier insulation shall be provided for all straight lengths of pipe. The thick wall, self insulating fittings do not require an additional vapor barrier for the piping system to meet this performance level. Where up to 1.5 inches of standard inches of insulation is indicated on the drawings or in these specifications, a field installed, thermal (radiant, conductive, and convective) and vapor barrier insulation shall be provided for all straight lengths of pipe and all fittings. The thermal barrier is UV resistant, CFC-free, non-porous, non-fibrous, and resist mold growth. The pipe with the integral thermal barrier with standard unprotected fittings shall meet the ASTM E84 and the CSA/ULc S102 requirements for a Flame Spread Rating of 25 and Smoke Development rating of 50.

D. Mechanical joint system: Manufacturer's fittings and joining methods, for pipe materials and sizes.
   1. Viega

2.6 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.7 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.

B. Plumbing Piping - Drain, Waste, and Vent:
   1. Conform to ASME B31.9.
   2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
   7. Vertical Support: Steel riser clamp.

C. Plumbing Piping - Water:
   1. Conform to ASME B31.9.
   2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
   5. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
   6. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
   7. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   8. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
   9. Vertical Support: Steel riser clamp.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
   2. Other Types: As required.

2.8 GATE VALVES

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. Conbraco Industries: www.conbraco.com.
   3. Nibco, Inc: www.nibco.com.
   4. Milwaukee Valve Company: www.milwaukeevalve.com.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Up To and Including 3 Inches:
   1. 1, Class 125, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, solder ends.

C. 2 Inches and Larger:
   1. 1, Class 125, iron body, bronze trim, outside screw and yoke, handwheel, solid wedge disc, flanged ends. Provide chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.9 BALL VALVES

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. Conbraco Industries: www.conbraco.com.
   3. Nibco, Inc: www.nibco.com.
   4. Milwaukee Valve Company: www.milwaukeevalve.com.

5. Substitutions: See Section 016000 - Product Requirements.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

2.10 PLUG VALVES

A. Construction 2-1/2 Inches and Larger: 1, 175 psi CWP, cast iron body and plug, pressure lubricated, teflon or Buna N packing, flanged or grooved ends. Provide lever operator with set screw.

2.11 BUTTERFLY VALVES

A. Manufacturers:
1. Tyco Flow Control: www.tycoflowcontrol.com.
2. Hammond Valve: www.hammondvalve.com.
3. Crane Co.: www.cranevalve.com.
4. Milwaukee Valve Company: www.milwaukeevalve.com.
5. Substitutions: See Section 016000 - Product Requirements.

B. Construction 1-1/2 Inches and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.

C. Provide gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.12 FLOW CONTROLS

A. Manufacturers:
1. Tyco Flow Control: www.tycoflowcontrol.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Griswold Controls: www.griswoldcontrols.com.
4. Taco, Inc: www.taco-hvac.com.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

2.13 SWING CHECK VALVES

A. Manufacturers:
1. Tyco Flow Control: www.tycoflowcontrol.com.
2. Hammond Valve: www.hammondvalve.com.
3. Nibco, Inc: www.nibco.com.
4. Milwaukee Valve Company: www.milwaukeevalve.com.
5. Substitutions: See Section 016000 - Product Requirements.

B. Up to 2 Inches:
1. 1, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder ends.

C. Over 2 Inches:
1. 1, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged or grooved ends.

2.14 SPRING LOADED CHECK VALVES

A. Manufacturers:
1. Tyco Flow Control: www.tycoflowcontrol.com.
2. Hammond Valve: www.hammondvalve.com.
3. Crane Co.: www.cranevalve.com.
4. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Class 125, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

2.15 WATER PRESSURE REDUCING VALVES

A. Manufacturers:
   1. Amtrol Inc: www.amtrol.com.
   2. Cla-Val Co: www.cla-val.com.
   3. Watts Regulator Company: www.wattsregulator.com.

B. Up to 2 Inches:
   1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.

C. Over 2 Inches:
   1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.16 RELIEF VALVES

A. Temperature and Pressure Relief:
   1. Manufacturers:
      a. Cla-Val Co: www.cla-val.com.
      b. Henry Technologies: www.henrytech.com.
      c. Watts Regulator Company: www.wattsregulator.com.
   2. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME (BPV IV) certified and labelled.

2.17 SLEEVES

A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.18 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: Carbon steel.
   3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.19 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.20 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, exposed-rivet hinge, and spring-clip fasteners.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

B. Coordinate locatios of slab penetrations with Structural Engineer prior to core drilling.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220719.

H. Provide access where valves and fittings are not exposed.

I. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Provide support for utility meters in accordance with requirements of utility companies.

L. TRENCHING

1. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
2. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
3. Do not interfere with 45 degree bearing splay of foundations.
4. Cut trenches wide enough to allow inspection of installed utilities.
5. Hand trim excavations. Remove loose matter.
6. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
7. Remove excavated material from site.

M. BACKFILLING

1. Fill up to subgrade elevations unless otherwise indicated.
2. Employ a placement method that does not disturb or damage other work.
3. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
4. Maintain optimum moisture content of fill materials to attain required compaction density.
5. Utilize sand for fill. Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

N. Install bell and spigot pipe with bell end upstream.

O. Install valves with stems upright or horizontal, not inverted.

P. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

Q. Install water piping to ASME B31.9.

R. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

S. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

T. Do not use PVC piping in return air plenums.

U. Do not use PVC piping exposed in dwelling units.

V. Do not use PEX piping exposed in dwelling units.

W. PP Piping: Install fittings and joints using socket-fusion, elecrofusion, or butt-fusion as applicable for the fitting type. All fusion-well joints shall be made in accordance with the pipe and fitting manufacturer's specifications and product standards.

X. The use of PEX piping shall be limited to 1" and smaller unless noted otherwise.

Y. SLEEVE INSTALLATION
   1. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
   2. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
      a. Sleeves are not required for core-drilled holes.
   3. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
      a. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
      b. Cut sleeves to length for mounting flush with both surfaces.
         1) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
      c. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
   4. Install sleeves for pipes passing through interior partitions.
      a. Cut sleeves to length for mounting flush with both surfaces.
      b. Install sleeves that are large enough to provide 1/4-inchannular clear space between sleeve and pipe or pipe insulation.
      c. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in other sections.
   5. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in other sections.

Z. SLEEVE-SEAL-SYSTEM INSTALLATION
   1. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
   2. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

AA. ESCUTCHEONS
   1. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
   2. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
      a. Escutcheons Schedule:
         1) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

2) Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with exposed-rivet hinge.
3) Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
4) Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
5) Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with exposed-rivet hinge.
6) Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with exposed-rivet hinge.

AB. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

AC. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
7. Provide copper plated hangers and supports for copper piping.
8. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 220548.
9. Support cast iron drainage piping at every joint.

3.4 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Provide spring loaded check valves on discharge of water pumps.

E. Provide flow controls in water recirculating systems where indicated.

3.5 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.7 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new domestic water service.

3.8 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe size: 1/2 inches to 1-1/4 inches:
         1) Maximum hanger spacing: 6.5 ft.
         2) Hanger rod diameter: 3/8 inches.
      b. Pipe size: 1-1/2 inches to 2 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 3/8 inch.
      c. Pipe size: 2-1/2 inches to 3 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 1/2 inch.
      d. Pipe size: 4 inches to 6 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 5/8 inch.
   2. Plastic Piping:
      a. All Sizes:
         1) Maximum hanger spacing: 6 ft.
         2) Hanger rod diameter: 3/8 inch.

B. Pipe Materials:
   1. Domestic Water:
      a. Basis of design is copper. If PEX is used, sizes shall be adjusted to provide equivalent hydraulic diameter.
      b. Stubouts to fixtures shall be copper.
      c. Pipe sizes 1/2" to 1": Any material listed for use in Part 2.
      d. Pipe sizes 1-1/4" and larger: Any material listed for use in Part 2, except PEX is not acceptable.
      e. PEX shall not be used where exposed in dwelling units.
   2. Sanitary Drain and Vent: Any material listed for use in Part 2.
      a. PVC shall not be used in return air plenums.
      b. PVC shall not be used where exposed in dwelling units.

END OF SECTION 221005

SECTION 221006

PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cleanouts.

B. Water hammer arrestors.

C. Mixing valves.

D. Interceptors.

E. Thermostatic mixing valves.

1.2 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; 2009.

C. PDI-WH 201 - Water Hammer Arresters; 2010.

1.3 SUBMITTALS

A. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

B. Certificates: Certify that grease interceptors meet or exceed specified requirements.

PART 2 PRODUCTS

2.1 CLEANOUTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
   2. Josam Company: www.josam.com/#sle.
   3. Zurn Industries, Inc: www.zurn.com/#sle.
   4. Sioux Chief Manufacturing.

B. Cleanouts at Exterior Surfaced Areas:
   1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas:
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas (FFCO):
   1. Lacquered cast iron body with anchor flange, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

E. Cleanouts at Interior Finished Wall Areas (FWCO):
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

F. Cleanouts at Interior Unfinished Accessible Areas: Caulked or threaded type.

2.2 BACKFLOW PREVENTERS

A. Manufacturers:
   1. Conbraco Industries: www.conbraco.com/#sle.
   2. Watts Regulator Company: www.wattsregulator.com/#sle.
   3. Zurn Industries, Inc: www.zurn.com.

B. Reduced Pressure Backflow Preventers:
   1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.3 DOUBLE CHECK VALVE ASSEMBLIES

A. Manufacturers:
   1. Conbraco Industries: www.conbraco.com/#sle.
   2. Watts Regulator Company: www.wattsregulator.com/#sle.
   3. Zurn Industries, Inc: www.zurn.com/#sle.

B. Double Check Valve Assemblies:
   1. ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

2.4 WATER HAMMER ARRESTORS

A. Manufacturers:
   1. Sioux Chief Manufacturing

B. Water Hammer Arrestors:
   1. Stainless steel or Copper construction, piston type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range 34 to 250 degrees F and maximum 150 psi working pressure.

2.5 MIXING VALVES

A. Thermostatic Mixing Valves:
   1. Accessories:
      a. Check valve on inlets.
      b. Volume control shut-off valve on outlet.
      c. Stem thermometer on outlet.
      d. Strainer stop checks on inlets.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Install approved portable water protection devices on plumbing lines where contamination of domestic water may occur.

F. Pipe relief from backflow preventer to nearest drain.

G. Install water hammer arrestors on cold water supply piping to flush valve or solenoid operated fixtures.
.

H. Install cleanouts at locations required by the International Plumbing Code (IPC), whether or not specifically indicated on the drawings. Such locations include, but are not limited to the following:
   1. Base of waste or soil stacks.
   2. Junction of building drain and building sewer (utilize 2-way cleanout at this location).

END OF SECTION 221006

SECTION 223000

PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diaphragm-type compression tanks.

B. Sump pumps.

C. Sanitary Sewage Pumps:
   1. Centrifugal solids handling.

D. Water heaters.

E. Pumps.
   1. Circulators.

F. Water pressure booster system.

1.2 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.

B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; 2014.

1.3 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2013.

B. ICC (IPC) - International Plumbing Code; 2012.

C. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

D. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

E. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data:
   1. Product Data: Provide manufacturer's literature and data sheets for each product. Include information on materials of fabrication, assembly of components, dimensions, weights, capabilities, performance, electrical characteristics, location and sizes of connections, service and access locations, and manufacturer-provided and field-installed accessories.
   2. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   3. Indicate pump type, capacity, power requirements.
   4. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   5. Provide electrical characteristics and connection requirements.

B. Shop Drawings:
   1. Provide plans and elevations showing equipment assembly, including fabrication and installation details. Show location and sizes of connections.
   2. Indicate clearances required for service, access, maintenance, and replacement of internal components.
   3. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

C. Project Record Documents: Record actual locations of components.

D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

C. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.6 CERTIFICATIONS

A. Water Heaters: NSF approved.

B. Electric Water Heaters: UL listed and labeled to UL 174 or UL 1453.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 WARRANTY

A. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.1 WATER HEATER MANUFACTURERS

A. A.O. Smith Water Products Co: www.hotwater.com.

B. Rheem Manufacturing Company: www.rheem.com.

2.2 ELECTRIC WATER HEATERS

A. Type: Automatic, electric, vertical storage.

B. Electrical Characteristics:
1. 208 volts, single phase.

C. Tank: Glass lined welded steel, thermally insulated with one inch thick glass fiber; encased in corrosion-resistant steel jacket; baked-on enamel finish.

D. Controls: Automatic water thermostat with externally adjustable temperature range from 120 to 170 degrees F, flanged or screw-in nichrome elements, enclosed controls and electrical junction box .

E. Accessories: Provide:
1. Water Connections: Brass.
2. Dip tube: Brass.
3. Drain Valve.
4. Anode: Magnesium

2.3 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers:
1. Amtrol Inc: www.amtrol.com/#sle.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Taco, Inc: www.taco-hvac.com.

B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 12 psig.

2.4 IN-LINE CIRCULATOR PUMPS

A. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.

B. Impeller: Bronze.

C. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

D. Seal: Carbon rotating against a stationary ceramic seat.

E. Drive: Flexible coupling.

2.5 PRESSURE BOOSTER SYSTEMS

A. System: Packaged with two pumps, factory assembled, tested, and adjusted; shipped to site as integral unit; consisting of pumps, variable frequency drives, valves, and piping, with control panel assembled on fabricated steel base with structural steel framework.

B. Controls and Instruments: Locate in NEMA 250 Type 1 general purpose enclosure with main disconnect interlocked with door, fused circuit for each motor, variable frequency drives, control circuit transformer with fuse protection, selector switch for each pump, low limit pressure switch, low pressure alarm light, running lights, current sensing devices, minimum run timers, manual alternation, and suction and discharge pressure gages.

C. Lead Pump: Operate continuously with lag pump operating on system demand. Should lead pump fail to operate, next pump in sequence shall start automatically.

D. Time Delay Relay: Prevent lag pump short cycling on fluctuating demands.

E. Thermal Bleed Circuit with Solenoid Valve: Prevent overheating during low demand.

F. Low Pressure Control: Stop pump operation if incoming water pressure drops to atmospheric.

G. Pump Switch: Permit manual or automatic operation.

H. Valving: Each pump outlet combination pressure reducing and check valve to maintain constant system pressure. Provide gate or butterfly valves on suction and discharge of each pump. Provide check valve on each pump discharge.

I. Performance: On drawings

2.6 SUBMERSIBLE SUMP PUMPS

A. Type: Completely submersible, vertical, centrifugal.

B. Casing: Cast iron pump body and oil filled motor chamber.

C. Impeller: Cast iron; open non-clog, stainless steel shaft.

D. Bearings: Ball bearings.

E. Sump: Fiberglass basin with steel cover plate, dimensions as indicated on drawings.

F. Accessories: Oil resistant 6 foot cord and plug with three-prong connector for connection to electric wiring system including grounding connector.

2.7 SANITARY SEWAGE PUMPS

A. Centrifugal Solids Handling:
   1. General: Non-clogging centrifugal type suitable for pumping solids up to 3 inches in diameter without internal interstices that can collect stringy materials and solids resulting in clogging.
   2. Casing:
      a. Capable of withstanding operating pressures 50 percent greater than the maximum operating pressure.
      b. Plugged and tapped holes for draining and venting pump.
      c. Volute to consist of smooth passages.
      d. Configuration to permit removal of impeller without disturbing discharge and suction connections.

e. Handhole to allow cleaning and inspection of pump interior.
f. Lifting eyes to facilitate handling of pump.

3. Impeller:
   a. Design to consist of smooth passages to prevent clogging and pass fibrous or stringy material.
   b. Securely keyed to shaft with locking arrangement preventing loosening by torque from either forward or reverse direction.
   c. Balance statically, dynamically, and hydraulically within the operating range and to the first critical speed at 150 percent of the maximum operating speed.
4. Wearing Rings:
   a. Provide renewable wearing rings on the casing and impeller with wearing surfaces normal to the axis of rotation.
   b. Construction: Cast iron.
   c. Factory designed for simple maintenance and secured to prevent rotation.
   d. In lieu of wearing rings on impeller and casing, replaceable steel wear plates fastened to casing may be used.
5. Pump Shaft:
   a. Provide with adequate size and strength to transmit full driver horsepower with liberal safety factor.
   b. Fabricate from stainless steel.
6. Pump Shaft Sleeve:
   a. Fabricate from stainless steel.
   b. Seal joint between shaft and sleeve to prevent leakage.
   c. Stuffing Box:
      1) Factory designed for minimum 5 rings of packing with removable split type glands.
      2) Fabricate from same material as casing and water sealed.
7. Mechanical Seal System:
   a. Furnish single seals to seal pump shaft against leakage.
   b. Each seal to be held in place by its own spring system, supplemented by external liquid pressures.
   c. System to be readily removable from the shaft.
8. Bearings:
   a. Provide ball type designed to handle all thrust loads in either direction.
   b. Furnish with a L-10 life of minimum 50,000 hours as required by ABMA 9 or ABMA 11.
   c. Pumps depending only on hydraulic balance and thrust are not acceptable.
9. Lubrication:
   a. Bearing:
10. Pump Support:
11. Coupling:
   a. Provide heavy duty, flexible type, locked to the shaft.
   b. Disconnection of the coupling possible without removing the driver half or the pump half of the coupling from the shaft.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C. Pumps:
   1. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.

2. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
3. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION 223000

SECTION 224000

PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fixtures

1.2 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping.

B. Section 221006 - Plumbing Piping Specialties.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008.

B. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2002).

C. ASME A112.18.1 - Plumbing Supply Fittings; 2012.

D. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2013.

E. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use); 2008 (R2013).

F. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2011.

1.4 SUBMITTALS

A. See Division 1 Section - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Faucet Washers: Two sets of each type and size.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.6 WARRANTY

A. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.1 FIXTURES

A. Scheduled on drawings

B. Substitutions permitted, provided products are functionally and materially equivalent to those scheduled. Substitutions must be approvded by Engineer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

E. Seal fixtures to wall and floor surfaces with sealant, color to match fixture.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

3.8 SCHEDULES

A. On Drawings

END OF SECTION 224000

SECTION 230001

MECHANICAL DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mechanical demolition.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to submitting bid, visit site and become familiar with scope of demolition work required to accommodate new work.

B. Refer to Architectural Drawings for additional clarification of scope of demolition and new work.

C. Verify that abandoned equipment and associated mechanical installation serve only abandoned facilities.

D. Should the contractor encounter any existing conditions related to the project area that prevent the work from being performed as indicated or described, contact the Architect immediately.

E. Report discrepancies to Architect before disturbing existing installation.

F. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Remove ductwork, piping, controls, and all other mechanical installation from entire building.

3.3 DEMOLITION OF EXISTING MECHANICAL WORK

A. Remove existing installations in their entirety.

B. Remove abandoned equipment, controls, air devices, ductwork, piping, fixtures, and other mechanical installation. Piping and ductwork to be removed to source of supply.

C. Repair adjacent construction and finishes damaged during demolition and extension work.

END OF SECTION 230001

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

1.2 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

B. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; 2005, Seventh Edition.

1.3 SUBMITTALS

A. See Division 1 Section - Administrative Requirements, for submittal procedures.

B. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Submit to the Construction Manager within two weeks after completion of testing, adjusting, and balancing.
2. Revise TAB plan to reflect actual procedures and submit as part of final report.
3. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
6. Units of Measure: Report data in I-P (inch-pound) units only.
7. Include the following on the title page of each report:
    a. Name of Testing, Adjusting, and Balancing Agency.
    b. Address of Testing, Adjusting, and Balancing Agency.
    c. Telephone number of Testing, Adjusting, and Balancing Agency.
    d. Project name.
    e. Project location.
    f. Report date.

D. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. AABC MN-1, AABC National Standards for Total System Balance.
2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.

E. TAB Supervisor Qualifications: Professional Engineer licensed in Oklahoma.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.4 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 10 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.5 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.6 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities .

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions.

3.7 SCOPE

A. Test, adjust, and balance the following:
   1. Air Handling Units
   2. Fans
   3. Air Inlets and Outlets
   4. Energy Recovery Ventilators

3.8 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer
   2. Model/Frame
   3. HP/BHP
   4. Phase, voltage, amperage; nameplate, actual, no load
   5. RPM
   6. Service factor
   7. Starter size, rating, heater elements
   8. Sheave Make/Size/Bore

B. V-Belt Drives:
   1. Identification/location
   2. Required driven RPM
   3. Driven sheave, diameter and RPM
   4. Belt, size and quantity
   5. Motor sheave diameter and RPM
   6. Center to center distance, maximum, minimum, and actual

C. Air Cooled Condensers:
   1. Location
   2. Manufacturer
   3. Model number

D. Electric Duct Heaters:
   1. Manufacturer
   2. Identification/number
   3. Location
   4. Design kW
   5. Number of stages
   6. Phase, voltage, amperage
   7. Test voltage (each phase)
   8. Test amperage (each phase)
   9. Air flow, specified and actual
   10. Temperature rise, specified and actual

E. Air Moving Equipment:
   1. Location
   2. Manufacturer
   3. Model number
   4. Air flow, specified and actual
   5. Total static pressure (total external), specified and actual

F. Exhaust Fans:
   1. Location
   2. Manufacturer
   3. Model number
   4. Air flow, specified and actual
   5. Total static pressure (total external), specified and actual

G. Air Distribution Tests:
   1. Room number/location
   2. Terminal type
   3. Design air flow
   4. Test (final) air flow
   5. Percent of design air flow

END OF SECTION 230593

SECTION 230713

DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Duct Liner.

1.2 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

D. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2014.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

H. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Division 1 Section - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experienceand approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Owens Corning Corp: www.owenscorning.com/#sle.
   4. CertainTeed Corporation; : www.certainteed.com/#sle.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. 'K' value: 0.25 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Water Vapor Sorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.3 DUCT LINER

A. Manufacturers:
   1. Armacell LLC; AP Coilflex: www.armacell.us/#sle.

B. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 180 degrees F.
   3. Fungal Resistance: No growth when tested according to ASTM G21.
   4. Apparent Thermal Conductivity: Maximum of 0.28 at 75 degrees F.
   5. Minimum Noise Reduction Coefficients:
      a. 1/2 inch Thickness: 0.30.
      b. 1 inch Thickness: 0.40.
   6. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation. Comply with ASTM C916.

D. Liner Fasteners: Galvanized steel, self-adhesive pad, impact applied, or welded with integral or press-on head.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Insulated ducts:
   1. Provide insulation with vapor barrier jackets.

2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. External Duct Insulation Application:
1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Secure insulation without vapor barrier with staples, tape, or wires.
3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

D. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 90 percent coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA HVAC Duct Construction Standards for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.3 SCHEDULES

A. Ductwork located in basement: Flexible glass fiber duct insulation, 1-1/2" thick.

B. Outside Air Intake Ducts: Flexible glass fiber duct insulation, 1-1/2" thick.

C. Supply ducts from space heating and cooling equipment: Flexible glass fiber duct insulation, 1-1/2" thick.
1. Omit duct wrap on fresh air and exhaust ducts connected to ERV.
2. Omit duct wrap on exposed spiral ductwork.

D. Supply and return ducts within 5`of energy recovery ventilators and blower coil equipment: Elastomeric Duct Liner, 1/2" thick.

END OF SECTION 230713

SECTION 230719

HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 REFERENCE STANDARDS

A. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

C. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

D. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.2 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Armacell LLC: www.armacell.us/#sle.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534 Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: -40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.3 JACKETS

A. PVC Plastic.
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

D. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to "Firestopping" Section.

E. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

F. Exterior Applications: Provide PVC jacket.

3.3 SCHEDULE

A. Cooling Systems:
   1. Condensate Drains from Cooling Coils: 1/2" Flexible Elastomeric
   2. Refrigerant Suction: 1" Flexible Elastomeric
   3. Refrigerant Liquid/hot gas: Per system manufacturer's recommendations

END OF SECTION 230719

SECTION 232100

GENERAL REQUIREMENTS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Sleeves.
   2. Sleeve-seal systems.
   3. Grout.
   4. Escutcheons.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inchminimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: Stainless steel.
   3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.4 ESCUTCHEONS

A. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

B. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed or exposed-rivet hinge, and spring-clip fasteners.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
   1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
   2. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
   3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inchannular clear space between sleeve and pipe or pipe insulation.
   3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in other sections.

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in other sections.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 ESCUTCHEON INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
   1. Escutcheon Schedule:
      a. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with exposed-rivet hinge.
      b. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with exposed-rivet hinge.

END OF SECTION 232100

SECTION 232300

REFRIGERANT PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping.

B. Refrigerant.

1.2 RELATED REQUIREMENTS

A. Section 230719 - HVAC Piping Insulation.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.

B. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; 2013.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

D. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2013.

E. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2013.

F. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.

1.4 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.1 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn .
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy.

B. Pipe Supports and Anchors:
   1. Conform to ASME B31.5.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.2 REFRIGERANT

A. Refrigerant: R-454B as defined in ASHRAE Std 34.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install refrigerant piping and accessories in accordance with split system manufacturer's recommendations.

B. Install refrigeration specialties in accordance with manufacturer's instructions.

C. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

D. Where piping must be exposed, obtain approval of routing from Architect prior to installation.

E. Install piping to conserve building space and avoid interference with use of space.

F. Group piping whenever practical at common elevations and locations. Slope piping per manufacturer's recommendations.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.5.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   7. Provide copper plated hangers and supports for copper piping.

I. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

J. Provide clearance for installation of insulation and access to valves and fittings.

K. Provide access to concealed valves and fittings. Coordinate with General Contractor.

L. Flood piping system with nitrogen when brazing.

M. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

N. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

O. Fully charge completed system with refrigerant after testing.

P. Penetrations of roofs shall be made using manufactured roof penetration systems with curbs and pipe fittings. The use of "pitch pan" or similar installations is not acceptable.

3.3 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5, and in accordance with VRFZ system manufacturer's recommendations.

3.4 SCHEDULES

A. Hanger Spacing for Copper Tubing.

1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.

END OF SECTION 232300

SECTION 233100

HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.

B. Duct cleaning.

1.2 RELATED REQUIREMENTS

A. Section 230713 - Duct Insulation: External insulation and duct liner.

B. Section 233300 - Air Duct Accessories.

C. Section 230593 - Testing, Adjusting, and Balancing for HVAC.

1.3 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2013.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

1.4 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.5 SUBMITTALS

A. See Division 1 Section - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.6 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.1 DUCT ASSEMBLIES

2.2 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
2. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E84.

C. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

2.3 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. No variation of duct configuration or size permitted except by written permission.

C. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

D. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

E. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.

F. Provide air foil turning vanes when rectangular elbows must be used.

G. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

H. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards.

I. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

J. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.4 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages,reinforcing, and sealing for operating pressures indicated.

B. Spiral Ducts: Machine made from round spiral lockseam duct, steel with mill phosphatized finish.
   1. Manufacturers:
      a. Wesco
      b. Wichita Sheet Metal.

C. Double Wall Insulated Spiral Ducts: Machine made from round spiral lockseam duct, steel outer wall with mill phosphatized finish or PVC coating, 1 inch thick fiberglass insulation, perforated galvanized steel inner wall; fittings manufactured with solid inner wall.
   1. Manufacturers:
      a. Wesco
      b. Wichita Sheet Metal.

D. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.
   1. Manufacturers:

PART 3 EXECUTION

3.1 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards.

B. Spiral ductwork in exposed locations shall be installed with aircraft cable and manufactured cam type hangers.

C. Install in accordance with manufacturer's instructions.

D. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

F. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

G. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or

screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

I. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

J. Use double nuts and lock washers on threaded rod supports.

K. Connect flexible ducts to metal ducts with draw bands plus sheet metal screws and adhesive. Use a maximum of 5' of flexible duct, at final connection to diffusers only, free of kinks. Do not install above inaccessible ceilings. Do not use flexible ductwork in exposed areas.

L. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

M. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

3.2 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.3 SCHEDULES

A. Ductwork Material:
   1. Low Pressure Supply (Heating Systems): Steel.
   2. Low Pressure Supply (System with Cooling Coils): Steel.
   3. Return and Relief: Steel.
   4. General Exhaust: Steel.
   5. Outside Air Intake: Steel.

B. Ductwork Pressure Class:
   1. Supply (System with Cooling Coils): 1 inch.
   2. Return and Relief: 1 inch.
   3. General Exhaust: 1/2 inch.

C. Round ductwork shall be spiral where exposed. Concealed round ductwork may be spiral, double or single wall, or fabricated.
   1. Base bid: Exposed ductwork shall be single wall spiral.
   2. Alternate bid: Exposed ductwork shall be double wall spiral.

END OF SECTION 233100

SECTION 233300

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers.

C. Combination fire and smoke dampers.

D. Duct access doors.

E. Duct test holes.

F. Fire dampers.

G. Flexible duct connections.

H. Smoke dampers.

I. Volume control dampers.

1.2 RELATED REQUIREMENTS

A. Section 233100 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

B. NFPA 92 - Standard for Smoke Control Systems; 2015.

C. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2014.

D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

E. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.

F. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

G. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Division 1 Section - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.

D. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

E. Project Record Drawings: Record actual locations of access doors and test holes.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.2 BACKDRAFT DAMPERS

A. Gravity Backdraft Dampers, Size 24 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.3 COMBINATION FIRE AND SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

B. Provide factory sleeve and collar for each damper.

C. Multiple Blade Dampers: Fabricate with 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

D. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Locate damper operator on exterior of duct and link to damper operating shaft.

2.4 DUCT ACCESS DOORS

A. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
   1. Less Than 12 inches Square: Secure with sash locks.
   2. Up to 18 inches Square: Provide two hinges and two sash locks.
   3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
   4. Larger Sizes: Provide an additional hinge.

2.5 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.6 FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B. Ceiling Dampers: Galvanized steel, 22 gage frame and 16 gage flap, two layers 0.125 inch ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.

C. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

D. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.

E. Multiple Blade Dampers: 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

F. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.7 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
      a. Net Fabric Width: Approximately 2 inches wide.
   2. Metal: 3 inches wide, 24 gage thick galvanized steel.

C. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.8 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

B. Dampers: UL Class 1 multiple blade type fire damper, normally closed automatically operated by 120 VAC electric actuator.

C. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.9 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. Splitter Dampers:
   1. Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
   2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw .

C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.

D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

F. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards. Refer to Section 233100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96. Provide minimum 8 x 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

D. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

E. Provide duct test holes where indicated and required for testing and balancing purposes.

F. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

G. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

H. Install smoke damper motors in locations to allow service/replacement without removal of permenant building components.

I. Demonstrate re-setting of fire dampers to Owner's representative.

J. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

K. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

L. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly. Omit dampers only where noted on drawings.

M. Where dampers or other accessories that require adjustment or maintenance are located above hard ceilings, provide access panel in ceiling. Coordinate with G.C.

END OF SECTION 233300

SECTION 233700

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

C. Louvers.

1.2 REFERENCE STANDARDS

A. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (R2011).

1.3 SUBMITTALS

A. See Division 1 Section - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.4 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Hart & Cooley, Inc: www.hartandcooley.com.

B. Krueger: www.krueger-hvac.com/#sle.

C. Price Industries: www.price-hvac.com/#sle.

D. Titus: www.titus-hvac.com/#sle.

2.2 DIFFUSERS, REGISTERS, AND GRILLES

A. Type and performance are scheduled on the drawings.

B. Coordinate finish of all devices with Architect.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly. Omit dampers where drawings specifically indicate devices are to be provided without dampers.

E. Paint ductwork visible behind air outlets and inlets matte black. Coordinate with G.C.

END OF SECTION 233700

SECTION 234000

HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Disposable, extended area panel filters.

B. Disposable panel filters.

1.2 REFERENCE STANDARDS

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012, with 2015 amendments.

B. UL 900 - Standard for Air Filter Units; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Division 1 Section - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.

1.4 EXTRA MATERIALS

A. Provide one set of disposable panel filters. Filters shall be delivered to Owner.

PART 2 PRODUCTS

2.1 FILTER MANUFACTURERS

A. American Filtration Inc: www.americanfiltration.com/#sle.

B. AAF International/American Air Filter: www.aafintl.com/#sle.

C. Camfil Farr Company: www.camfilfarr.com/#sle.

2.2 DISPOSABLE, EXTENDED AREA PANEL FILTERS

A. Media: UL 900 Class 1, pleated, lofted, non-woven, reinforced cotton fabric; supported and bonded to welded wire grid by corrugated aluminum separators.
   1. Frame: Non-flammable.
   2. Nominal thickness: 2 inches.

B. Minimum Efficiency Reporting Value (MERV): 8, when tested in accordance with ASHRAE 52.2.

2.3 DISPOSABLE PANEL FILTERS

A. Media: UL 900 Class 2, fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive.
   1. Thickness: 1 inch.

B. Performance Rating:
   1. Face Velocity: 500 FPM.
   2. Initial Resistance: 0.15 inch WG.
   3. Recommended Final Resistance: 0.50 inches WG.

C. Casing: Cardboard frame.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

D. Ensure that filters are easily removable from equipment, and that access is not blocked by other installations.

END OF SECTION 234000

SECTION 237210

AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes static plate rooftop air to air energy recovery ventilators.

PART 2 - PRODUCTS

2.1 AIR TO AIR ENERGY RECOVERY VENTILATORS

A. Manufacturers:
   1. Renewaire
   2. Lossnay
   3. Approved substitute

B. Quality Assurance
   1. The energy recovery cores used in these products shall be certified by ARI under its Standard 1060 for Energy Recovery Ventilators. ARI published certifications shall confirm manufacture's published performance for airflow, static pressure, temperature and total effectiveness, purge air (OACF) and exhaust air leakage (EATR). Products that are not currently ARI Certified will not be accepted.
   2. Manufacturer shall be able to provide evidence of independent testing of the core by Underwriters Laboratory (UL), verifying a maximum flame spread index (FSI) of 25 and a maximum smoke developed index (SDI) of 50 thereby meeting NFPA 90A and NFPA 90B requirements for materials in a compartment handling air intended for circulation through a duct system. The method of test shall be UL Standard 723.
   3. Unit shall be listed under UL 1812 Standard for Ducted Air to Air Heat Exchangers.
   4. The cores shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of ten years from the date of purchase. Balance of Unit shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of two years from the date of purchase.

C. Energy Transfer
   1. Shall be capable of transferring both sensible and latent energy between air streams. Latent energy transfer shall be accomplished by direct water vapor transfer from one airstream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air.

D. Passive Frost Control
   1. Energy-transfer element shall perform without condensing or frosting under normal operating conditions (defined as outside temperatures above -10°F and inside relative humidity below 40%). Occasional extreme conditions shall not affect the usual function or performance of the element. No condensate drains will be allowed.

E. Continuous Ventilation
   1. Unit shall have the capacity to operate continuously without the need for bypass, recirculation, preheaters, or defrost cycles under normal operating conditions.

F. Positive Airstream Separation
   1. Water vapor transfer shall be through molecular transport by hydroscopic resin and shall not be accomplished by “porous plate” mechanisms. Exhaust and fresh airstreams shall at all times travel in separate passages, and airstreams shall not mix.

G. Laminar Flow
   1. Airflow through the energy exchange element shall be laminar, avoiding deposition of particulates on the interior of the energy exchange plate material.

H. Construction

1. Fixed-plate energy-exchange element. Energy-exchange module shall be of fixed-plate cross-flow construction, with no moving parts.
2. No condensate drain pans or drains shall be allowed and unit shall be capable of operating in winter and summer conditions without generating condensate.
3. Housing shall be constructed of galvanized, 20-gauge steel, with lapped corners, and gasketed, zinc plated screw fasteners.
4. Unit shall have single-point power connection.
5. Flange components shall be provided suitable for connection of ductwork.
6. Access door shall provide easy access to blowers, energy transfer elements, and filters. Panel shall be gasketed to provide air-tight seal.
7. Case walls and doors shall be insulated with 1" FSK high-density board insulation, eliminating the possibility of exposing the fresh air to glass fibers.
8. Energy-exchange element shall be protected by 30% efficient 2" nominal pleated, disposable filters.
9. Blowers shall be direct drive.
10. Units shall be provided for single point wiring connection.

PART 3 - EXECUTION

3.1 MANUFACTURER'S DIRECTIONS:

A. Delivery, Storage and Handling - Equipment shall be stored and handled according to the manufacturer's recommendation.

B. Install equipment in strict accordance with manufacturer's recommendations and requirements of other Sections.

3.2 CONNECTIONS

A. Connect ductwork at fresh air and exhaust connections on unit.

B. Provide flexible duct connector at each connection.

C. Provide power wiring and connect controls.

END OF SECTION 237210

SECTION 238127

MINI-SPLIT HEAT PUMP SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air-source heat pumps.

B. Indoor ductless fan & coil units.

C. Controls.

1.2 RELATED REQUIREMENTS

A. Section 233100 - HVAC Ducts and Casings.

B. Section 262717 - Equipment Wiring: Electrical characteristics and wiring connections and installation and wiring of thermostats and other controls components.

1.3 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008.

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

C. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.

D. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

B. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

C. Design Data: Indicate refrigerant pipe sizing.

D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

F. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.5 WARRANTY

A. Provide five year manufacturers warranty for heat exchangers.

B. Provide five year manufacturers warranty for compressors.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Mitsubishi

B. Approved substitute.

2.2 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.

1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator.
2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

2.3 INDOOR UNITS FOR DUCTLESS SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
   1. Location: High-wall.
   2. Cabinet: Plastic.
      a. Finish: White.
   3. Fan: Line-flow fan direct driven by a single motor.
   4. Filter return air with washable, antioxidant pre-filter and a pleated anti-allergy enzyme filter.

B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturer: System manufacturer.

C. Remote Actuators:

2.4 OUTDOOR UNITS

A. The outdoor unit shall be equipped with an electronic control board that interfaces with the indoor unit to perform all necessary operation functions.

B. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.

C. Cabinet
   1. The casing shall be constructed from galvanized steel plate, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection and have a Munsell 3Y 7.8/1.1 finish.
   2. Mounting feet shall be provided and shall be welded to the base of the cabinet and be of sufficient size to afford reliable equipment mount and stability.
   3. Easy access shall be afforded to all serviceable parts by means of removable panel sections.
   4. The fan grill shall be of ABS plastic.

D. Fan
   1. The fan blades shall be of high performance, aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated.
   2. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fans shall be provided with a raised guard to prevent external contact with moving parts.

E. Coil
   1. The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up and allow maximum airflow. The coil shall be protected with an integral metal guard.
   2. Refrigerant flow from the condenser shall be controlled by means of an electronic linear expansion valve (LEV) metering device. The LEV shall be controlled by a microprocessor controlled step motor.
   3. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU-inch/hour per Sq Ft / °F, a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that insulation will not contribute significantly to fire and up to 1” thick insulation shall have a - Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102. All refrigerant line connections shall be flare type sized as required and tightened to manufacturers specified torque value.

F. Compressor
   1. The compressor for shall be a Mitsubishi Electric, injection port equipped, Frame Compliant Scroll compressor with Variable Speed Inverter Drive Technology.
   2. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room loads, increasing the efficiency of the system which shall result in significant energy savings.
   3. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. No crankcase heater is to be used.
   4. The outdoor unit shall have an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.

G. Electrical
   1. The electrical power of the unit shall be 208volts or 230 volts, single phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts.
   2. Power for the indoor unit shall be supplied from the outdoor unit via Mitsubishi Electric A-Control using three (3) fourteen (14) gauge AWG conductors plus ground wire connecting the units.
   3. The outdoor unit shall be controlled by the microprocessor located in the indoor unit.
   4. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC.
   5. The unit shall have Pulse Amplitude Modulation circuit to utilize 98% of input power supply.

2.5 ACCESSORY EQUIPMENT

A. Room Thermostat: Wall-mounted, wired, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
   1. Automatic switching from heating to cooling.
   2. Preferential rate control to minimize overshoot and deviation from setpoint.
   3. Set-up for four separate temperatures per day.
   4. Programming based on weekdays, Saturday and Sunday.
   5. Thermostat display:
      a. Actual room temperature.
      b. Programmed temperature.
      c. System mode indication: heating, cooling, fan auto, off, and on, auto or on, off.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

B. Install in accordance with NFPA 90A and NFPA 90B.

END OF SECTION 238127

SECTION 238128

SMALL SPLIT-SYSTEM HEATING AND COOLING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air cooled condensing units.

B. Indoor air handler (fan & coil) units for duct connection.

C. Controls.

1.2 RELATED REQUIREMENTS

A. Section 233100 - HVAC Ducts and Casings.

B. Section 262717 - Equipment Wiring: Electrical characteristics and wiring connections and installation and wiring of thermostats and other controls components.

1.3 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.

D. ASHRAE Std 23.1 - Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units; 2010.

E. NEMA MG 1 - Motors and Generators; 2014.

F. NFPA 54 - National Fuel Gas Code; 2015.

G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

H. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.

I. NFPA 211 - Guide for Smoke and Heat Venting; 2013, Including All Amendments.

J. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

B. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

C. Design Data: Indicate refrigerant pipe sizing.

D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

F. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Filters: One for each unit.

1.5 WARRANTY

A. Provide five year manufacturers warranty for heat exchangers.

B. Provide five year manufacturers warranty for compressors.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Carrier Corporation: www.carrier.com.

B. Approved substitute.

2.2 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
   1. Heating: Electric resistance heating.
   2. Cooling: Outdoor electric condensing unit with evaporator coil in central ducted indoor unit.
   3. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.
      a. Pipe sizes for each unit shall be sized per the manufacturer's recommendations and account for line length and suction lift requirements. Provide manufacturer's confirmation for each unit that proposed installation and line sizes will provide proper system operation.

B. Performance Requirements: See Drawings for additional requirements.

2.3 INDOOR UNITS FOR DUCTED SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
   1. Air Flow Configuration: As indicated on drawings.
   2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.

B. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.
   1. Motor: NEMA MG 1; 1750 rpm single speed, permanently lubricated, hinge mounted.
   2. Motor Electrical Characteristics:

C. Air Filters: 1 inch thick urethane, washable type arranged for easy replacement.

D. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturers: System manufacturer.

2.4 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Refrigerant: R-454B.
   2. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23 and UL listed.

B. Compressor: Scroll, 3600 rpm, AHRI 520 resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling.

C. Air Cooled Condenser: ARI 520; Aluminum fin and copper tube coil, with direct drive axial propeller fan resiliently mounted, galvanized fan guard.

D. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gage ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.

E. Operating Controls:

1. Control by programmable room thermostat to maintain room temperature setting.

2.5 ELECTRIC FURNACE COMPONENTS

A. Electric Heater: Helix wound bare nichrome wire heating elements arranged in incremental stages of 5 kW each, with porcelain insulators.

B. Operating Controls:
   1. Heater stages energized in sequence with pre-determined delay between heating stages.
   2. High limit temperature control to de-energize heating elements, with automatic reset.

2.6 ACCESSORY EQUIPMENT

A. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with sensor to maintain temperature setting; low-voltage; with following features:
   1. Automatic switching from heating to cooling.
   2. Preferential rate control to minimize overshoot and deviation from setpoint.
   3. Set-up for four separate temperatures per day.
   4. Programming based on weekdays, Saturday and Sunday.
   5. Thermostat display:
      a. Actual room temperature.
      b. Programmed temperature.
      c. System mode indication: heating, cooling, fan auto, off, and on, auto or on, off.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 90A and NFPA 90B.

B. Install gas fired furnaces in accordance with NFPA 54.

C. Provide combustion air and vent connections in accordance with manufacturer's recommendations.

D. Install refrigeration systems in accordance with ASHRAE Std 15.

END OF SECTION 238128

SECTION 260501

ELECTRICAL DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition.

PART 3 EXECUTION

2.1 EXAMINATION

A. Verify that abandoned wiring and equipment serve only abandoned facilities.

B. Report discrepancies to Architect before disturbing existing installation.

C. Beginning of demolition means installer accepts existing conditions.

2.2 PREPARATION

A. Disconnect and remove electrical systems throughout entire building.

2.3 DEMOLITION OF ELECTRICAL WORK

A. Remove existing installations in their entirety.

B. Remove abandoned wiring.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed.

E. Disconnect and remove abandoned panelboards and distribution equipment.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

H. Repair adjacent construction and finishes damaged during demolition.

I. Remove all abandoned knob insulators and other appurtances from the building.

END OF SECTION 260501

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Power and control tray cable.

D. Wiring connectors.

E. Electrical tape.

F. Oxide inhibiting compound.

G. Wire pulling lubricant.

H. Cable ties.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

C. Section 283100 - Fire Detection and Alarm: Fire alarm system conductors and cables.

1.3 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).

E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2011).

F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy Wire for Subsequent Covering of Insulation; 2007 (Reapproved 2012).

G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.

H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

I. NECA 104 - Recommended Practice for Installing Aluminum Building Wire and Cable; 2012.

J. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.

K. NEMA WC 70 - Nonshielded Power Cable 2000 V or Less for the Distribution of Electrical Energy; 2009.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

N. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

O. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

P. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

R. UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members; Current Edition, Including All Revisions.

S. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.

D. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.8 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Metal-clad cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:

a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
1) Maximum Length: 6 feet.
b. Where concealed in hollow stud walls, under raised floors, and above ceilings for branch circuits and feeders to dwelling units.

2. In addition to other applicable restrictions, may not be used:
a. Unless approved by Owner.
b. Where not approved for use by the authority having jurisdiction.
c. Where exposed to view.
d. Where exposed to damage.
e. For damp, wet, or corrosive locations.

2.2 CONDUCTOR AND CABLE MANUFACTURERS

A. AFC Cable Systems: www.afcweb.com

B. Alan Wire Company: www.alanwire.com.

C. Cerro Wire LLC: www.cerrowire.com.

D. Encore Wire Corporation: www.encorewire.com.

E. Southwire Company: www.southwire.com.

F. Substitutions: See Section 016000 - Product Requirements.

2.3 ALL CONDUCTORS AND CABLES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose indicated.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductor Material:
1. Provide copper conductors except where aluminum conductors are specifically indicated. Substitution of aluminum conductors for copper is not permitted. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B 787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.
4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.

H. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
a. Exceptions:
1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
2. Control Circuits: 14 AWG.

I. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
    a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
    a. 208Y/120 V, 3 Phase, 4 Wire System:
        1) Phase A: Black.
        2) Phase B: Red.
        3) Phase C: Blue.
        4) Neutral/Grounded: White.
    b. Equipment Ground, All Systems: Green.
    c. Travelers for 3-Way and 4-Way Switching: Pink.
    d. For control circuits, comply with manufacturer's recommended color code.

2.4 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:
1. Feeders and Branch Circuits:
    a. Size 10 AWG and Smaller: Solid.
    b. Size 8 AWG and Larger: Stranded.
2. Control Circuits: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.
2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.

2.5 METAL-CLAD CABLE

A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

B. Conductor Stranding:
1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

E. Grounding: Full-size integral equipment grounding conductor.

F. Armor: Aluminum or steel, interlocked tape.

G. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.6 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Wiring Connectors for Splices and Taps:
1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

C. Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
5. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
6. Conductors for Control Circuits: Use crimped terminals for all connections.

D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

G. Mechanical Connectors: Provide bolted type or set-screw type.

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.7 WIRING ACCESSORIES

A. Electrical Tape:
1. Manufacturers:
a. 3M: www.3m.com/#sle.
b. Plymouth Rubber Europa: www.plymouthrubber.com/#sle.
2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.

B. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

D. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as shown on the drawings.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated and routing is not shown, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Include circuit lengths required to install connected devices within 10 ft of location shown.
   5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is permitted, under the following conditions:
      a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
   7. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.

D. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
   1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.

H. Terminate cables using suitable fittings.
   1. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
      c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.

I. Install conductors with a minimum of 12 inches of slack at each outlet.

J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

K. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.

4. Clean contact surfaces on conductors and connectors to suitably remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

L. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
3. Wet Locations: Use heat shrink tubing.

M. Insulate ends of spare conductors using vinyl insulating electrical tape.

N. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

O. Identify conductors and cables in accordance with Section 260553.

P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.4 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 014000.

B. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 260519

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

F. Grounding and bonding components.

G. Provide all components necessary to complete the grounding system(s) consisting of:
   1. Metal underground water pipe.
   2. Metal underground gas piping system.
   3. Rod electrodes.

1.2 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2007.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 25 ohms.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Test Reports: Indicate overall resistance to ground .

D. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Grounding Electrode System: Not greater than 25 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

E. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
      b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
      c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
   3. Metal Building or Structure Frame:
      a. Provide connection to metal building or structure frame effectively grounded in accordance with NFPA 70 at nearest accessible location.
   4. Concrete-Encased Electrode:
      a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
   5. Ground Rod Electrode(s):
      a. Provide single electrode unless otherwise indicated or required.
      b. Space electrodes not less than 10 feet from each other and any other ground electrode.
      c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.

6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.

F. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

G. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
b. Metal gas piping.

H. Communications Systems Grounding and Bonding:
1. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
a. Bonding Jumper Size: As indicated.
b. Raceway Size: 3/4 inch unless otherwise indicated or required.
c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

I. Pole-Mounted Luminaires: Also comply with Section 265600.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in addition to requirements of Section 260519:
1. Use insulated copper conductors unless otherwise indicated.
a. Exceptions:
1) Use bare copper conductors where installed underground in direct contact with earth.

2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
a. Exceptions:
1) Use exothermic welded connections for connections to metal building frame.
4. Manufacturers - Mechanical and Compression Connectors:
a. Burndy: www.burndy.com.
b. Thomas & Betts Corporation: www.tnb.com/#sle.
5. Manufacturers - Exothermic Welded Connections:
a. Burndy: www.burndy.com.
b. Cadweld, a brand of Erico International Corporation: www.erico.com/#sle.
c. ThermOweld, a brand of Continental Industries, Inc: www.thermoweld.com/#sle.

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as shown on the drawings.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify existing conditions prior to beginning work.

E. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.

D. Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.

3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

C. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION 260526

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.2 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

B. MFMA-4 - Metal Framing Standards Publication; 2004.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer’s catalog data for fastening systems.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. NFPA 70.
      b. Requirements of authorities having jurisdiction.
   2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   3. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

1. Comply with MFMA-4.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
   a. Comply with MFMA-4.
   b. Channel Material: Use galvanized steel.
   c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

I. Secure fasteners according to manufacturer's recommended torque settings.

J. Remove temporary supports.

3.2 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 260529

SECTION 260534

CONDUIT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Intermediate metal conduit (IMC).

C. Flexible metal conduit (FMC).

D. Liquidtight flexible metal conduit (LFMC).

E. Electrical metallic tubing (EMT).

F. Rigid polyvinyl chloride (PVC) conduit.

G. Conduit fittings.

H. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260537 - Boxes.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 271005 - Structured Cabling for Voice and Data - Inside-Plant: Additional requirements for communications systems conduits.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.

B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.

F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.

G. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.

H. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

K. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

L. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

M. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

N. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

O. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

P. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

B. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or rigid PVC conduit.
   2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), or rigid PVC conduit.
   3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or rigid PVC conduit.
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
   5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
   6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection.
   7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges.

D. Embedded Within Concrete:
   1. Within Slab on Grade: Not permitted.
   2. Within Slab Above Ground: Not permitted.
   3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or rigid PVC conduit.
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
   1. Locations subject to physical damage include, but are not limited to:
      a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
      b. Where exposed below 20 feet in warehouse areas.

K. Exposed, Exterior: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

M. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
   1. Maximum Length: 6 feet.

N. Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit.
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
   3. Maximum Length: 6 feet unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.

2.2 CONDUIT REQUIREMENTS

A. Electrical Service Conduits: Also comply with Section 262701.

B. Communications Systems Conduits: Also comply with Section 271005.

C. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

D. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.

E. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 1/2 inch (16 mm) trade size.
   2. Control Circuits: 1/2 inch (16 mm) trade size.
   3. Flexible Connections to Luminaires: 1/2 inch (16 mm) trade size.
   4. Underground, Interior: 3/4 inch (21 mm) trade size.
   5. Underground, Exterior: 1 inch (27 mm) trade size.

F. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com/#sle.
   2. Republic Conduit: www.republic-conduit.com/#sle.
   3. Wheatland Tube Company: www.wheatland.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.4 INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com/#sle.
   2. Republic Conduit: www.republic-conduit.com/#sle.
   3. Wheatland Tube Company: www.wheatland.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:
   1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.5 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
   2. Electri-Flex Company: www.electriflex.com/#sle.
   3. International Metal Hose: www.metalhose.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type FMC standard wall steel or standard wall aluminum flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.

2.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:

1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
2. Electri-Flex Company: www.electriflex.com/#sle.
3. International Metal Hose: www.metalhose.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel or aluminum flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
a. Do not use die cast zinc fittings.

2.7 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com/#sle.
2. Republic Conduit: www.republic-conduit.com/#sle.
3. Wheatland Tube Company: www.wheatland.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
a. Do not use die cast zinc fittings.
3. Connectors and Couplings: Use compression (gland) or set-screw type.
a. Do not use indenter type connectors and couplings.

2.8 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
1. Cantex Inc: www.cantexinc.com/#sle.
2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com/#sle.
3. JM Eagle: www.jmeagle.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.9 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

E. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install intermediate metal conduit (IMC) in accordance with NECA 101.

E. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

F. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated and routing is not shown, determine exact routing required.
   3. Conceal all conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   5. Unless otherwise approved, do not route conduits exposed:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
   6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   7. Arrange conduit to maintain adequate headroom, clearances, and access.
   8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
   9. Route conduits above water and drain piping where possible.
   10. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   11. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
   12. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
      a. Heaters.
      b. Hot water piping.
      c. Flues.
   13. Group parallel conduits in the same area together on a common rack.

G. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
   4. Use conduit strap to support single surface-mounted conduit.

a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.

5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.

H. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

I. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

J. Underground Installation:
1. Provide trenching and backfilling in accordance with specifications.
2. Minimum Cover, Unless Otherwise Indicated or Required:
a. Underground, Exterior: 24 inches.
b. Under Slab on Grade: 12 inches to bottom of slab.
3. Provide underground warning tape in accordance with Section 260553 along entire conduit length for service entrance where not concrete-encased.

K. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 033000 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where conduits are subject to earth movement by settlement or frost.

M. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
   a. Where conduits enter building from outside.
   b. Where service conduits enter building from underground distribution system.
   c. Where conduits enter building from underground.
   d. Where conduits may transport moisture to contact live parts.
2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
   a. Where conduits pass from outdoors into conditioned interior spaces.
   b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

N. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

O. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

P. Provide grounding and bonding in accordance with Section 260526.

Q. Identify conduits in accordance with Section 260553.

R. Conduit in exposed areas will be painted. Coordinate with G.C. Entire conduit system, including boxes and coverplates shall be installed prior to painting.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective conduits.

3.4 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.5 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 260534

SECTION 260537

BOXES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Pull and junction boxes.

1.2 RELATED REQUIREMENTS

A. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262726 - Wiring Devices:
   1. Wall plates.

F. Section 262716 - Electrical Cabinets and Enclosures.

G. Section 262726 - Wiring Devices: Wall plates in finished areas.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

K. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.

5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.1 BOXES

A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
10. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C. Use of nometallic boxes shall be limited to new framed walls.
11. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
12. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
13. Wall Plates: Comply with Section 262726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:

3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
4. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify locations of outlets in offices and work areas prior to rough-in.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

E. Box Locations:
1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes as required for devices installed under other sections or by others.
4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.

F. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

G. Install boxes plumb and level.

H. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

I. Install boxes as required to preserve insulation integrity.

J. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

K. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

L. Close unused box openings.

M. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

N. Provide grounding and bonding in accordance with Section 260526.

O. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.

P. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

Q. Coordinate installation of outlet boxes for equipment connected under Section 262717.

R. Set wall mounted boxes at elevations to accommodate mounting heights indicated.

S. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
   1. Adjust box locations up to 10 feet if required to accommodate intended purpose.

T. Orient boxes to accommodate wiring devices oriented as specified in Section 262726.

U. Maintain headroom and present neat mechanical appearance.

V. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

W. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

X. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

Y. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

Z. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

AA. Use flush mounting outlet box in finished areas.

AB. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

AC. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

AD. Locate outlet boxes so that wall plates do not span different building finishes.

AE. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation.

AF. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

AG. Use stamped steel bridges to fasten flush mounting outlet box between studs.

AH. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

AI. Use adjustable steel channel fasteners for hung ceiling outlet box.

AJ. Do not fasten boxes to ceiling support wires.

AK. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

AL. Use gang box where more than one device is mounted together. Do not use sectional box.

AM. Use gang box with plaster ring for single device outlets.

AN. Use cast outlet box in exterior locations exposed to the weather and wet locations.

AO. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

AP. Identify boxes in accordance with Section 260553.

3.3 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused box openings.

3.4 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

END OF SECTION 260537

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Underground warning tape.

E. Warning signs and labels.

1.2 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 262726 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.6 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Switchboards:
         1) Identify voltage and phase.
         2) Use identification nameplate to identify main overcurrent protective device.
         3) Use identification nameplate to identify load(s) served for each branch device.
      b. Panelboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Use typewritten circuit directory to identify load(s) served for panelboards with a door.
         4) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

c. Enclosed switches:
1) Identify voltage and phase.
2) Identify load(s) served. Include location when not within sight of equipment.
d. Enclosed Contactors:
1) Identify coil voltage.
2) Identify load(s) and associated circuits controlled. Include location.

2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.

3. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.

4. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.

5. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for switchboards and panelboards.
a. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
2. Identification for Communications Conductors and Cables: Comply with Section 271005.
3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment.

C. Identification for Raceways:
1. Use identification labels or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
2. Use underground warning tape to identify underground raceways.

D. Identification for Boxes:
1. Use color coded boxes to identify systems other than normal power system.
a. Color-Coded Boxes: Field-painted in accordance with Section 099000 per the following color code:.
1) Fire Alarm System: Red.

E. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 271005.
2. Wiring Device and Wallplate Finishes: Comply with Section 262726.
3. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
4. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Materials:
a. Indoor Clean, Dry Locations: Use plastic nameplates.
b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.

2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.

a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.

3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Manufacturers:
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
a. Use only for indoor locations.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
a. Equipment designation or other approved description.
b. Other information as indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
a. Equipment Designation: 1/2 inch.
b. Other Information: 1/4 inch.
5. Color:
a. Normal Power System: White text on black background.
b. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.
a. Exceptions:
1) Provide white text on red background for general information or operational instructions for fire alarm systems.

E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

2.3 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
   1. Do not use handwritten text.

E. Minimum Text Height: 1/8 inch.

F. Color: Black text on white background unless otherwise indicated.

2.4 UNDERGROUND WARNING TAPE

A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
   1. Exception: Use foil-backed detectable type tape where required by serving utility.

B. Non-detectable Type Tape: 3 inches wide, with minimum thickness of 4 mil.

C. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

D. Legend: Type of service, continuously repeated over full length of tape.

E. Color:
   1. Tape for Buried Power Lines: Black text on red background.
   2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.5 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
      a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
      b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
   3. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.

2. Flush-Mounted Equipment: Enclosure front.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conduits: Legible from the floor.
8. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
   1. Do not use adhesives on exterior surfaces except where substrate can not be penetrated.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 12 inch(es) below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 260553

SECTION 260919

ENCLOSED CONTACTORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Lighting contactors.

1.2 RELATED REQUIREMENTS

A. Section 260529 - Hangers and Supports for Electrical Systems.

B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000 (R2005), with errata, 2008.

B. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (R2011).

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide dimensions, size, voltage ratings and current ratings.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. General Electric Company: www.geindustrial.com

B. Eaton Corporation; Cutler-Hammer Products: www.eaton.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Siemens Industry Inc.: www.sea.siemens.com

E. Substitutions: See Section 016000 - Product Requirements.

2.2 LIGHTING CONTACTORS

A. Description: NEMA ICS 2, magnetic lighting contactor.

B. Configuration: Electrically held.

C. Coil operating voltage: 120 volts, 60 Hertz.

D. Poles: As required to match circuit configuration and control function.

E. Contact Rating: Match branch circuit overcurrent protection, considering derating for continuous loads.

F. Enclosure: NEMA ICS 6, Type 1.

G. Accessories:

1. Selector Switch: ON/OFF/AUTOMATIC.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install enclosed contactors where indicated, in accordance with manufacturer's instructions.

B. Install enclosed contactors plumb. Provide supports in accordance with Section 260529.

C. Identify enclosed contactors in accordance with Section 260553.

END OF SECTION 260919

SECTION 260923

LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Occupancy sensors.

B. Time switches.

C. Outdoor photo controls.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260537 - Boxes.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 260919 - Enclosed Contactors: Lighting contactors.

F. Section 265100 - Interior Lighting.

G. Section 265600 - Exterior Lighting.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2011.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
2. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
3. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install lighting control devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

B. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C. Operation and Maintenance Data: Include detailed information on device programming and setup.

D. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. Provide five year manufacturer warranty for all occupancy sensors.

PART 2 PRODUCTS

2.1 ALL LIGHTING CONTROL DEVICES

A. Provide products listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

C. Products for Switching of Electronic Fluorescent Ballasts: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.2 OCCUPANCY SENSORS

A. Manufacturers:
   1. Hubbell Building Automation, Inc; : www.hubbellautomation.com
   2. Sensor Switch Inc; : www.sensorswitch.com/#sle.
   3. WattStopper; : www.wattstopper.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. All Occupancy Sensors:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
      b. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
   3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
   4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
   5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
   6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
   7. Turn-Off Delay: Field adjustable, up to a maximum time delay setting of not less than 5 minutes and not more than 30 minutes.
   8. Sensitivity: Field adjustable.
   9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.

10. Compatibility: Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
11. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.

C. Wall Switch Occupancy Sensors:
1. All Wall Switch Occupancy Sensors:
a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
e. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
f. Finish: Match finishes specified for wiring devices in Section 262726, unless otherwise indicated.
2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 300 square feet for minor motion and 1050 square feet for major motion.
a. Products:
1) Wattstopper #DW-100-G.
2) Substitutions: See Section 016000 - Product Requirements.

D. Ceiling Mounted Occupancy Sensors:
1. All Ceiling Mounted Occupancy Sensors:
a. Description: Low profile occupancy sensors designed for ceiling installation.
b. Unless otherwise indicated or required to control the load indicated on the drawings, provide line voltage units with self-contained relay.
c. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
d. Finish: White unless otherwise indicated.
2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
a. Standard Range Sensors: Capable of detecting motion within an area of 1000 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
1) Products:
(a) Wattstopper #DT-355.
(b) Substitutions: See Section 016000 - Product Requirements.

2.3 TIME SWITCHES

A. Manufacturers:
1. Intermatic, Inc; _____: www.intermatic.com/#sle.
2. Paragon, a brand of Invensys Controls; _____: www.invensyscontrols.com.
3. Tork, a division of NSI Industries LLC; _____: www.tork.com/#sle.

B. Digital Electronic Time Switches:
1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
2. Program Capability:

a. 7-Day Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days.

3. Schedule Capacity: Not less than 16 programmable on/off operations.
4. Provide automatic daylight savings time and leap year compensation.
5. Provide power outage backup to retain programming and maintain clock.
6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
7. Input Supply Voltage: As indicated on the drawings.
8. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:
   a. Indoor clean, dry locations: Type 1.

2.4 OUTDOOR PHOTO CONTROLS

A. Manufacturers:
   1. Intermatic, Inc; : www.intermatic.com/#sle.
   2. Kele; www.kele.com
   3. Paragon, a brand of Invensys Controls; : www.invensyscontrols.com.
   4. Tork, a division of NSI Industries LLC; : www.tork.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.
   6. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. Stem-Mounted Outdoor Photo Controls:
   1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
   2. Housing: Weatherproof, impact resistant polycarbonate.
   3. Photo Sensor: Cadmium sulfide.
   4. Provide external sliding shield for field adjustment of light level activation.
   5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
   6. Voltage: 120 V unless otherwise indicated.
   7. Failure Mode: Fails to the on position.
   8. Load Rating: 1,800 W for tungsten load or 1,000 VA for ballast load.
   9. Products:
      a. Intermatic #K4221C
      b. Substitutions: See Section 01600 - Product Requirements

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130.

B. Coordinate locations of outlet boxes provided under Section 260537 as required for installation of lighting control devices provided under this section.
   1. Mounting Heights: As indicated on the drawings.
   2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 262726.

G. Provide required supports in accordance with Section 260529.

H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

I. Occupancy Sensor Locations:
   1. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.
   2. Locate dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

J. Outdoor Photo Control Locations:
   1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
   2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.

K. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

L. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

M. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area.

D. Test outdoor photo controls to verify proper operation, including time delays where applicable.

E. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on dual technology occupancy sensor lenses to block undesired motion detection.

D. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. Training: Train owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
   4. Location: At project site.

END OF SECTION 260923

SECTION 262100

LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical service requirements.

1.2 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260534 - Conduit.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 262413 - Switchboards: Service entrance equipment.

G. Section 262818 - Enclosed Switches: Service entrance equipment.

1.3 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify the following with Utility Company representative:
      a. Utility Company requirements, including division of responsibility.
      b. Exact location and details of utility point of connection.
      c. Utility easement requirements.
      d. Utility Company charges associated with providing service.
   2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
   3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

C. Utility Company charges associated with providing permanent service to be paid by Owner.

D. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

E. Scheduling:
   1. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.5 QUALITY ASSURANCE

A. Comply with the following:
   1. IEEE C2 (National Electrical Safety Code).
   2. NFPA 70 (National Electrical Code).
   3. The requirements of the Utility Company.

PART 2 PRODUCTS

2.1 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Electrical Service Characteristics:
   1. Service Type: Underground.
   2. Service Voltage: 208Y/120 V, 3 phase, 60 Hz.

C. Utility Company: As indicated on drawings.

D. Division of Responsibility: As indicated on drawings.

E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions and Utility Company requirements.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required support and attachment components in accordance with Section 260529.

E. Provide grounding and bonding for service entrance equipment in accordance with Section 260526.

F. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 260553.

END OF SECTION 262100

SECTION 262413

SWITCHBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Switchboards.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete for supporting foundations and pads.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NECA 400 - Standard for Installing and Maintaining Switchboards; 2007.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

E. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.

F. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; 2013.

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

J. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

K. UL 891 - Switchboards; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.

B. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

C. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

1.8 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Switchboards:
1. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
2. Siemens Industry, Inc: www.usa.siemens.com/#sle.

B. Source Limitations: Furnish switchboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 SWITCHBOARDS

A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.

D. Front-Connected Switchboards:
1. Main Device(s): Individually-mounted.
2. Feeder Devices: Panel/group-mounted.
3. Arrangement: Front accessible only (not rear accessible), rear aligned.

E. Service Entrance Switchboards:
1. Listed and labeled as suitable for use as service equipment according to UL 869A.
2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
3. Comply with Utility Company requirements for electrical service.
4. Provide switchboard with phase loss protection.
5. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.

F. Service Conditions:
1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
a. Altitude: Less than 6,600 feet.
b. Ambient Temperature:
1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.

G. Short Circuit Current Rating:

1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

H. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

I. Bussing: Sized in accordance with UL 891 temperature rise requirements.
1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
4. Phase and Neutral Bus Material: Aluminum.
5. Ground Bus Material: Aluminum.

J. Conductor Terminations: Suitable for use with the conductors to be installed.
1. Line Conductor Terminations:
a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
b. Main and Neutral Lug Type: Mechanical.
2. Load Conductor Terminations:
a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
b. Lug Type:

K. Enclosures:
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
2. Finish: Manufacturer's standard unless otherwise indicated.

L. Future Provisions:
1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.

M. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list switchboards as a complete assembly including surge protective device.

N. Description: NEMA PB 2 switchboard with electrical ratings and configurations as indicated and specified.

O. Bus Connections: Bolted, accessible from front for maintenance.

P. Ground Bus: Extend length of switchboard.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers:
1. Interrupting Capacity:
a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
2. Molded Case Circuit Breakers:

a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
    1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
    1) Provide the following field-adjustable trip response settings:
        (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
        (b) Long time delay.
        (c) Short time pickup and delay.
        (d) Instantaneous pickup.

2.4 SURGE PROTECTIVE DEVICES

A. See Section 264300 for factory-installed, internally mounted surge protective devices. List and label switchboards containing surge protective devices as a complete assembly including surge protective device.

2.5 SOURCE QUALITY CONTROL

A. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
    1. Dielectric tests.
    2. Mechanical operation tests.
    3. Grounding of instrument transformer cases test.
    4. Electrical operation and control wiring tests, including polarity and sequence tests.
    5. Ground-fault sensing equipment test.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive switchboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.

C. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.

D. Provide required support and attachment components in accordance with Section 260529.

E. Install switchboards plumb and level.

F. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Section 033000.

G. Provide grounding and bonding in accordance with Section 260526.

H. Install all field-installed devices, components, and accessories.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

K. Provide filler plates to cover unused spaces in switchboards.

L. Identify switchboards in accordance with Section 260553.

M. Install switchboard in locations shown on drawings, according to NEMA PB 2.1.

N. Install in a neat and workmanlike manner, as specified in NECA 400.

O. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

3.3 FIELD QUALITY CONTROL

A. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

B. Perform field inspection and testing in accordance with Section 014000.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Perform inspections and tests listed in NETA ATS, Section 7.1.

E. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers. Tests listed as optional are not required.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchboard covers and doors.

C. Adjust all operating mechanisms for free mechanical movement.

D. Tighten bolted bus connections in accordance with manufacturer's instructions.

3.5 CLEANING

A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.

B. Touch up scratched or marred surfaces to match original finish.

3.6 PROTECTION

A. Protect installed switchboards from subsequent construction operations.

END OF SECTION 262413

SECTION 262416

PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Lighting and appliance panelboards.

B. Load centers.

C. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 264300 - Surge Protective Devices.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NECA 407 - Standard for Installing and Maintaining Panelboards; 2009.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

D. NEMA PB 1 - Panelboards; 2011.

E. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.

F. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

J. UL 67 - Panelboards; Current Edition, Including All Revisions.

K. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

L. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

M. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

N. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   2. Include documentation of listed series ratings upon request.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Panelboard Keys: Two of each different key.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Siemens Industry, Inc: www.usa.siemens.com.

B. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

C. Substitutions: See Section 016000 - Product Requirements.

D. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 ALL PANELBOARDS

A. Provide products listed and labeled by testing firm acceptable to the authority having jurisdiction as suitable for the purpose indicated.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
   2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
   3. Label equipment utilizing series ratings as required by NFPA 70.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
      b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
   3. Fronts:
      a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
      b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
      c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
   4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list and label panelboards as a complete assembly including surge protective device.

K. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs and feeders as indicated or as required to interconnect sections.

L. Load centers are not acceptable.

M. Provide the following features and accessories where indicated or where required to complete installation:
   1. Feed-through lugs.
   2. Sub-feed lugs.

2.3 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Aluminum or copper.
   3. Ground Bus Material: Aluminum or copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. Provide clear plastic circuit directory holder mounted on inside of door.

2.4 LOAD CENTERS

A. Description: Circuit breaker type load centers listed and labeled as complying with UL 67; ratings, configurations, and features as indicated on the drawings.

B. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Bus Material: Aluminum or copper.

C. Circuit Breakers: Thermal magnetic plug-in type.

D. Enclosures:
   1. Provide flush-mounted enclosures unless otherwise indicated.
   2. Provide circuit directory label on inside of door or individual circuit labels adjacent to circuit breakers.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
   1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
   2. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
      c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
   3. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
   6. Provide the following circuit breaker types where indicated:
      a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
      b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.

c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.

7. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
8. Do not use tandem circuit breakers.
9. Do not use handle ties in lieu of multi-pole circuit breakers.
10. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
11. Provide the following features and accessories where indicated or where required to complete installation:
    a. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

2.6 SOURCE QUALITY CONTROL

A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install panelboards securely, in a neat and workmanlike manner in accordance with NECA 1 (general workmanship), NECA 407 (panelboards), and NEMA PB 1.1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 260529.

E. Install panelboards plumb.

F. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

H. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling.

I. Provide grounding and bonding in accordance with Section 260526.

J. Install all field-installed branch devices, components, and accessories.

K. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

L. Provide filler plates to cover unused spaces in panelboards.

M. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
1. Fire detection and alarm circuits.
2. Communications equipment circuits.

N. Identify panelboards in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 014000.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA STD ATS, Section 7.6.1.1 for all main circuit breakers. Tests listed as optional are not required.

D. Test GFCI circuit breakers to verify proper operation.

E. Test AFCI circuit breakers to verify proper operation.

F. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

3.5 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262416

SECTION 262717

EQUIPMENT WIRING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical connections to equipment.

1.2 RELATED REQUIREMENTS

A. Section 260534 - Conduit.

B. Section 260519 - Low-Voltage Electrical Power Conductors and Cables (600 V and Less).

C. Section 260537 - Boxes.

D. Section 262726 - Wiring Devices.

E. Section 262818 - Enclosed Switches.

1.3 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
2. Determine connection locations and requirements.

B. Sequencing:

1. Install rough-in of electrical connections before installation of equipment is required.
2. Make electrical connections before required start-up of equipment.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

1. Colors: Conform to NEMA WD 1.
2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 16412 .

C. Wiring Devices: As specified in Section 262726.

D. Flexible Conduit: As specified in Section 260534.

E. Wire and Cable: As specified in Section 260519.

F. Boxes: As specified in Section 260537.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible metal conduit. Use liquidtight flexible metal conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION 262717

SECTION 262726

WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260537 - Boxes.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 260923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors.

E. Section 262717 - Equipment Wiring: Cords and plugs for equipment.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).

D. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

G. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

H. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

I. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Operation and Maintenance Data:

1. GFI Receptacles: Include information on status indicators and testing procedures and intervals.

D. Project Record Documents: Record actual installed locations of wiring devices.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Arrow Hart, a brand of Cooper Industries; www.cooperindustries.com

B. Hubbell Incorporated; : www.hubbell-wiring.com.

C. Leviton Manufacturing Company, Inc; : www.leviton.com.

D. Pass & Seymour, a brand of Legrand North America, Inc; : www.legrand.us

E. Substitutions: See Section 016000 - Product Requirements.

F. Source Limitations: Where possible, for each type of wiring device furnish products produced by a single manufacturer and obtained from a single supplier.

2.2 APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFI receptacles with specified weatherproof covers for all receptacles installed outdoors or in damp or wet locations.

D. Provide GFI protection for all receptacles installed within 6 feet of sinks.

E. Provide GFCI protection for receptacles installed in kitchens.

F. Provide GFCI protection for receptacles serving electric drinking fountains.

G. Unless noted otherwise, do not use combination switch/receptacle devices.

2.3 ALL WIRING DEVICES

A. Provide products listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

B. Finishes:
1. Wiring Devices Installed in Finished Spaces: Color as selected by Architect with nylon wall plate unless otherwise indicated.
2. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate unless otherwise indicated.
3. Wiring Devices Installed in Wet or Damp Locations: Gray with specified weatherproof cover unless otherwise indicated.

2.4 WALL SWITCHES

A. All Wall Switches: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

B. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.5 WALL DIMMERS

A. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

B. Control: Slide control type with separate on/off switch.

C. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:
   1. Incandescent: 2000 W.
   2. 0-10V LED: 1500 VA

2.6 RECEPTACLES

A. All Receptacles: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

B. Convenience Receptacles:
   1. Standard Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
   3. Tamper Resistant Convenience Receptacles (All receptacles in dwelling units): Residential grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.

C. GFI Receptacles:
   1. All GFI Receptacles: Provide with feed-through protection, light to indicate ground fault tripped condition and loss of protection, and list as complying with UL 943, class A.
      a. Provide test and reset buttons of same color as device.
   2. Standard GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
   3. Weather Resistant GFI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
   4. Tamper Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.

2.7 WALL PLATES

A. All Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Size: Standard; .
   3. Screws: Metal with slotted heads finished to match wall plate finish.

B. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

C. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

D. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

E. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130.

B. Coordinate locations of outlet boxes provided under Section 260537 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: As indicated on the drawings.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   3. Where multiple receptacles or wall switches are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
   4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
   5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFI receptacles with integral GFI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall switches with OFF position down.

L. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

M. Do not share neutral conductor on branch circuits utilizing wall dimmers.

N. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on left.

O. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

P. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

Q. Identify wiring devices in accordance with Section 260553.

3.4 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting in accordance with Section 014000.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 262726

SECTION 262813

FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

1.2 RELATED REQUIREMENTS

A. Section 262818 - Enclosed Switches: Fusible switches.

1.3 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.

E. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
      a. Fusible Enclosed Switches: See Section 262818.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Fuses: One set(s) of three for each type and size installed.
   3. Fuse Pullers: One set(s) compatible with each type and size installed.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Cooper Bussmann, a division of Cooper Industries: www.cooperindustries.com/#sle.

B. Mersen (formerly Ferraz Shawmut): ferrazshawmut.mersen.com.

C. Littelfuse, Inc: www.littelfuse.com/#sle.

D. Substitutions: See Section 016000 - Product Requirements.

2.2 APPLICATIONS

A. Feeders:
   1. Fusible Switches up to 600 Amperes: Class J, time-delay.

B. General Purpose Branch Circuits: Class RK1, time-delay.

2.3 FUSES

A. Provide products listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose indicated.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

H. Class J Fuses: Comply with UL 248-8.

I. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

J. Provide the following accessories where indicated or where required to complete installation:
   1. Fuseholders: Compatible with indicated fuses.
   2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION 262813

SECTION 262818

ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed safety switches.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 262813 - Fuses.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

G. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Project Record Documents: Record actual locations of enclosed switches.

F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Siemens Industry, Inc: www.usa.siemens.com.

B. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

C. Substitutions: See Section 016000 - Product Requirements.

D. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break, enclosed safety switches complying with NEMA KS 1, type HD (heavy duty), and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed and labeled by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Provide with switch blade contact position that is visible when the cover is open.

G. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
   1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

K. Enclosures: Comply with NEMA KS 1 and NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.

2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

M. Heavy Duty Switches:
1. Conductor Terminations:
a. Provide mechanical lugs unless otherwise indicated.
b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install enclosed switches in accordance with manufacturer's instructions.

B. Install enclosed switches securely, in a neat and workmanlike manner in accordance with NECA 1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 260529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 260526.

H. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Identify enclosed switches in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting in accordance with Section 014000.

B. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262818

SECTION 264300

SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surge protective devices for service entrance locations.

B. Surge protective devices for branch panelboard locations.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding.

B. Section 262413 - Switchboards.

C. Section 262416 - Panelboards.

1.3 ABBREVIATIONS AND ACRONYMS

A. SPD: Surge Protective Device.

1.4 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.

E. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to ordering equipment.

1.6 SUBMITTALS

A. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

B. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

C. Certificates: Manufacturer's documentation of listing for compliance with the following standards:
   1. UL 1449.
   2. UL 1283 (for Type 2 SPDs).

D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

F. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

G. Project Record Documents: Record actual connections and locations of surge protective devices.

1.7 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.9 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

A. Manufacturer's Warranty: Provide minimum ten year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Field-installed, Externally Mounted Surge Protective Devices:
   1. Advanced Protection Technologies, Inc (APT); : www.aptspd.com.
   2. Current Technology; a brand of Thomas & Betts Power Solutions; : www.tnbpowersolutions.com.
   3. General Electric Company; : www.geindustrial.com.
   4. Square D; Schneider Electric; www.schneider-electric.com
   5. Eaton Corporaton; www.eaton.com/electrical
   6. Siemens Industry, Inc.; www.sea.siemens.com
   7. Substitutions: See Section 016000 - Product Requirements.

B. Factory-installed, Internally Mounted Surge Protective Devices:
   1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.

C. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.2 ALL SURGE PROTECTIVE DEVICES

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service, listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated; system voltage as indicated on the drawings.

B. Protected Modes:
   1. Wye Systems: L-N, L-G, N-G, L-L.

C. UL 1449 Voltage Protection Ratings (VPRs):
   1. 208Y/120V System Voltage: Not more than 700 V for L-N, L-G, and N-G modes and 1000 V for L-L mode.

D. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

E. Response Time: Less than one nanosecond

F. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   1. Indoor clean, dry locations: Type 1 or Type 4x.

G. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
   1. Switchboards: See Section 262413.
   2. Panelboards: See Section 262416.

2.3 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

B. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

C. List and label as complying with UL 1283 and UL 1449, Type 1.

D. Surge Current Rating: Not less than 240 kA.

E. Repetitive Surge Current Capacity: Not less than 5,000 impulses.

F. UL 1449 Nominal Discharge Current (I-n): 20 kA.

G. UL 1449 Short Circuit Current Rating (SCCR): Not less than 100 kA.

H. Diagnostics:
   1. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
   2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
   3. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.

I. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

2.4 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

B. List and label as complying with UL 1449, Type 1 or Type 2.

C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

D. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.

E. Repetitive Surge Current Capacity: Not less than 5,000 impulses.

F. UL 1449 Nominal Discharge Current (I-n): 20 kA.

G. UL 1449 Short Circuit Current Rating (SCCR): Not less than 100 kA.

H. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).

I. Diagnostics:
   1. Protection Status Monitoring: Provide indicator lights to report the protection status.
   2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
   3. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify system grounding and bonding is in accordance with Section 260526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1.

B. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

C. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

D. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

E. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 260526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

3.3 FIELD QUALITY CONTROL

A. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

3.4 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 264300

SECTION 265100

INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts.

E. Fluorescent emergency power supply units.

F. Lamps.

G. Luminaire accessories.

1.2 RELATED REQUIREMENTS

A. Section 260537 - Boxes.

B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

C. Section 260919 - Enclosed Contactors: Lighting contactors.

D. Section 260923 - Lighting Control Devices: Automatic controls for lighting including occupancy sensors.

E. Section 262726 - Wiring Devices: Manual wall switches.

F. Section 265600 - Exterior Lighting.

1.3 REFERENCE STANDARDS

A. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.

B. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).

C. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society; 2008.

D. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

F. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

G. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

H. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 101 - Life Safety Code; 2015.

K. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

L. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.

M. UL 1598 - Luminaires; Current Edition, Including All Revisions.

N. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. Shop Drawings:
1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
1. LED Luminaires:
a. Include estimated useful life, calculated based on IES LM-80 test data.
2. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
3. Fluorescent Emergency Power Supply Unit: Include list of compatible lamp configurations and associated lumen output.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.
3. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.

F. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide two year manufacturer warranty for all linear fluorescent ballasts.

C. Provide five year pro-rata warranty for batteries for emergency lighting units.

D. Provide ten year pro-rata warranty for batteries for self-powered exit signs.

E. Provide five year full warranty for fluorescent emergency power supply units.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 016000 - Product Requirements.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.

H. Fluorescent Luminaires:
   1. Provide ballast disconnecting means complying with NFPA 70 where required.
   2. Fluorescent Luminaires Controlled by Occupancy Sensors: Provide programmed start ballasts.
   3. Fluorescent Luminaires Controlled by Dual-Level Switching: Provide with two ballasts.

I. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

J. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.3 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
   1. Sealed maintenance-free lead calcium unless otherwise indicated.
   2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

2.4 EXIT SIGNS

A. All Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.
   2. Directional Arrows: As indicated or as required for the installed location.

B. Self-Powered Exit Signs:
   1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
   2. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
   3. Provide low-voltage disconnect to prevent battery damage from deep discharge.
   4. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

2.5 BALLASTS

A. Manufacturers:
   1. General Electric Company/GE Lighting; : www.gelighting.com/#sle.
   2. Osram Sylvania; : www.sylvania.com/#sle.
   3. Philips Lighting Electronics/Advance; : www.advance.philips.com.
   4. Substitutions: See Section 016000 - Product Requirements.
   5. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.

B. All Ballasts:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

C. Fluorescent Ballasts:
   1. All Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.
      a. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
      b. Total Harmonic Distortion: Not greater than 10 percent.
      c. Power Factor: Not less than 0.95.
      d. Ballast Factor: Normal ballast factor between 0.85 and 1.15, unless otherwise indicated.
      e. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
      f. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
      g. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.
      h. Lamp Operating Frequency: Greater than 20 kHz, except as specified below.
      i. Lamp Current Crest Factor: Not greater than 1.7.
      j. Lamp Wiring Method:

1) Programmed Start Ballasts: Provide parallel or series/parallel wired where available; otherwise series wired is acceptable.

k. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.

l. Provide end of lamp life automatic shut down circuitry for T5 and smaller diameter lamp ballasts.

m. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.

n. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer application.

o. Ballast Marking: Include wiring diagrams with lamp connections.

2. Non-Dimming Fluorescent Ballasts:

a. Lamp Starting Method:

1) T8 Lamp Ballasts: Programmed start unless otherwise indicated.

2) T5 Lamp Ballasts: Programmed start unless otherwise indicated.

3) Compact Fluorescent Lamp Ballasts: Programmed start unless otherwise indicated.

b. Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of 0 degrees F, and energy saving lamp(s) at a minimum of 60 degrees F unless otherwise indicated.

D. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.

2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.6 FLUORESCENT EMERGENCY POWER SUPPLY UNITS

A. Manufacturers:

1. Iota Engineering, LLC; _____: www.iotaengineering.com/#sle.

2. Philips Emergency Lighting/Bodine; _____: www.bodine.com/#sle.

3. Substitutions: See Section 016000 - Product Requirements.

4. Manufacturer Limitations: Where possible, for each type of luminaire provide fluorescent emergency power supply units produced by a single manufacturer.

B. Description: Self-contained fluorescent emergency power supply units suitable for use with indicated luminaires, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

C. Compatibility:

1. Ballasts: Compatible with electronic, standard magnetic, energy saving, and dimming AC ballasts, including those with end of lamp life shutdown circuits.

2. Lamps: Compatible with low-mercury lamps.

D. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the fluorescent emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

E. Battery: Sealed maintenance-free high-temperature nickel cadmium unless otherwise indicated.

F. Emergency Illumination Output:

1. As indicated in Light Fixture Schedule

G. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.

H. Operating Temperature: From 32 degrees F to 122 degrees F unless otherwise indicated or required for the installed location.

2.7 LAMPS

A. Manufacturers:

1. General Electric Company/GE Lighting; _____: www.gelighting.com/#sle.
2. Osram Sylvania; _____: www.sylvania.com/#sle.
3. Philips Lighting Company; _____: www.lighting.philips.com.
4. Substitutions: See Section 016000 - Product Requirements.
5. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.

B. All Lamps:
1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

C. Incandescent Lamps: Wattage and bulb type as indicated, with base type as required for lighting fixture; 130 V rated.
1. Non-Reflector Type Incandescent Lamps: Inside frosted lamp finish unless otherwise indicated.

D. Compact Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
2. Correlated Color Temperature (CCT): 3,000 K unless otherwise indicated.
3. Color Rendering Index (CRI): Not less than 80.
4. Average Rated Life: Not less than 10,000 hours for an operating cycle of three hours per start.

E. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
2. T8 Linear Fluorescent Lamps:
a. Correlated Color Temperature (CCT): 3,000 K unless otherwise indicated.
b. Color Rendering Index (CRI): Not less than 80.
c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.
3. T5 Linear Fluorescent Lamps:
a. Correlated Color Temperature (CCT): 3,000 K unless otherwise indicated.
b. Color Rendering Index (CRI): Not less than 80.
c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.

2.8 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260537 as required for installation of luminaires provided under this section.

B. Install products according to manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).

D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

E. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
   4. Secure pendant-mounted luminaires to building structure.
   5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
   7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

F. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.

G. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
   4. Install canopies tight to mounting surface.
   5. Unless otherwise indicated, support pendants from swivel hangers.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

I. Install accessories furnished with each luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. Fluorescent Luminaires Controlled by Dual-Level Switching: Connect such that each switch controls the same corresponding lamps in each luminaire.

L. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

M. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

N. Fluorescent Emergency Power Supply Units:
   1. For field-installed units, install inside luminaire unless otherwise indicated. Where installation inside luminaire is not possible, install on top of luminaire.
   2. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal ballast(s) in luminaire. Bypass local switches, contactors, or other lighting controls.

O. Install lamps in each luminaire.

P. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.6 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. Just prior to Substantial Completion, replace all lamps that have failed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 265100

SECTION 265600

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior luminaires.

B. Poles and accessories.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260537 - Boxes.

D. Section 260919 - Enclosed Contactors: Lighting contactors.

E. Section 260923 - Lighting Control Devices: Automatic controls for lighting including outdoor photo controls.

1.3 REFERENCE STANDARDS

A. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type); 2002.

B. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society; 2008.

C. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

E. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2006.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 1598 - Luminaires; Current Edition, Including All Revisions.

H. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
2. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
   a. Include estimated useful life, calculated based on IES LM-80 test data.
2. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

C. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Touch-Up Paint: 2 gallons, to match color of pole finish.

G. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the Drawings.

B. Substitutions: See Section 016000 - Product Requirements.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.3 POLES

A. All Poles:
   1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
   2. Structural Design Criteria:
      a. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
         1) Design Wind Speed: 100 miles per hour, with gust factor of 1.3.
      b. Dead Load: Include weight of proposed luminaire(s) and associated supports and accessories.
   3. Material: Steel, unless otherwise indicated.
   4. Shape: Round straight, unless otherwise indicated.
   5. Finish: Match luminaire finish, unless otherwise indicated.
   6. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
   7. Unless otherwise indicated, provide with the following features/accessories:
      a. Top cap.
      b. Handhole.
      c. Anchor bolts with leveling nuts or leveling shims.
      d. Anchor base cover.

B. Metal Poles: Provide ground lug, accessible from handhole.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260537 as required for installation of luminaires provided under this section.

B. Install products according to manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA/IESNA 501 (exterior lighting).

D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

E. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.

F. Pole-Mounted Luminaires:
   1. Foundation-Mounted Poles:
      a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 033000.

1) Install anchor bolts plumb per template furnished by pole manufacturer.
2) Position conduits to enter pole shaft.

b. Install foundations plumb.
c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
d. Tighten anchor bolt nuts to manufacturer's recommended torque.
e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
f. Install anchor base covers as indicated.

2. Grounding:
   a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
   b. Provide supplementary ground rod electrode as specified in Section 260526 at each pole bonded to grounding system as indicated.
3. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.

G. Install accessories furnished with each luminaire.

H. Bond products and metal accessories to branch circuit equipment grounding conductor.

I. Install lamps in each luminaire.

3.4 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.

3.6 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 265600

SECTION 283100

FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

C. Maintenance of fire alarm system under contract for specified warranty period.

1.2 RELATED REQUIREMENTS

A. Section 213000 - Fire Pumps: Supervisory devices.

B. Section 211300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

C. Section 142010 - Passenger Elevators: Elevator systems monitored and controlled by fire alarm system.

1.3 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).

C. IEEE C62.41 - IEEE Recommended Practice on Surge Voltages in Low-Voltage Power Circuits; 1991 (R1995).

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 72 - National Fire Alarm and Signaling Code; 2016.

F. NFPA 101 - Life Safety Code; 2015.

1.4 SUBMITTALS

A. Proposal Documents: Submit the following with cost/time proposal:
   1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
   3. Certification by Contractor that the system design will comply with the contract documents.
   4. Proposed maintenance contract.

B. Evidence of designer qualifications.

C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
   4. System zone boundaries and interfaces to fire safety systems.
   5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
   6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
   7. List of all devices on each signaling line circuit, with spare capacity indicated.
   8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.

9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
11. Certification by the manufacturer of the control unit that the system design complies with the contract documents.
12. Certification by Contractor that the system design complies with the contract documents.

D. Evidence of installer qualifications.

E. Evidence of maintenance contractor qualifications, if different from installer.

F. Inspection and Test Reports:
1. Submit inspection and test plan prior to closeout demonstration.
2. Submit documentation of satisfactory inspections and tests.
3. Submit NFPA 72 "Inspection and Test Form," filled out.

G. Operating and Maintenance Data: Revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
4. List of recommended spare parts, tools, and instruments for testing.
5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

H. Project Record Documents: Have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

I. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with his installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
3. Certificate of Occupancy.
4. Maintenance contract.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Registered engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.

2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.

C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 WARRANTY

A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fire Alarm Control Units: Provided their products meet or exceed the performance of the basis of design product, products of the following are acceptable:
1. Honeywell Security & Fire Solutions/Notifier: www.notifier.com/#sle.
2. Siemens Building Technologies, Inc: www.usa.siemens.com/#sle.
3. Provide all control units made by the same manufacturer.

B. Initiating Devices, and Notification Appliances:
1. Same manufacturer as control units.
2. Provide all initiating devices and notification appliances made by the same manufacturer.

C. Substitutions: Not permitted.

2.2 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
1. Provide all components necessary, regardless of whether shown in the contract documents or not.
2. Protected Premises: Entire building.
3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
a. ADA Standards for Accessible Design.
b. The requirements of the State Fire Marshal.
c. The requirements of the local authority having jurisdiction .
d. Applicable local codes.
e. The contract documents (drawings and specifications).
f. NFPA 101.
g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
4. Evacuation Alarm: general evacuation of entire premises.
5. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
6. Master Control Unit (Panel): New, location shown on plans .
7. Combined Systems: Do not combine fire alarm system with other non-fire systems.

B. Supervising Stations and Fire Department Connections:
1. Public Fire Department Notification: By on-premises supervising station.
2. Remote Supervising Station: UL-listed central station under contract to facility.
3. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.

C. Circuits:
   1. Initiating Device Circuits (IDC): Class A, Style D.
   2. Signaling Line Circuits (SLC) : Class A, Style 6.
   3. Notification Appliance Circuits (NAC): Class B, Style Y.

D. Spare Capacity:
   1. Initiating Device Addresses: Minimum 25 percent spare capacity.
   2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
   3. Master Control Unit: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
   1. Primary: Dedicated branch circuits of the facility power distribution system.
   2. Secondary: Storage batteries.
   3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.

2.3 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
   1. Sprinkler/standpipe water control valves.
   2. Fire pump(s).
   3. Elevator shut-down control circuits.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
   1. Sprinkler water flow.
   2. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
   3. Smoke and heat detectors.
   4. Manual Pull Stations.

C. Elevators:
   1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
   2. Elevator Machine Room and hoistway Heat Detectors: Shut down elevator power prior to hoistway sprinkler activation.

D. Doors:
   1. Door Magnetic Holders: Release upon activation of general alarm.

2.4 COMPONENTS

A. General:
   1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
   2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Analog, addressable type; listed by Underwriters Laboratories as suitable for the purpose intended.

C. Master Control Unit: As specified above.

D. Remote Annunciators: LCD display; .

E. Initiating Devices:
   1. Manual Pull Stations: Dual Action, non-coded, RED with white "FIRE" lettering.
   2. Smoke Detectors: Photoelectric, Addressable.
   3. Heat Detectors: Fixed temperature and Rate-of-Rise.
   4. Addressable Interface Devices.
      a. Provide 1 extra.

F. Notification Appliances:
   1. Bells.

2. Horns: Wall mounted, RED with white "FIRE" lettering, Temporal pattern.
3. Strobes: Wall mounted, RED with white "FIRE" lettering, Multi-candela selectable.
4. Horn/Strobes: Wall mounted, RED with white "FIRE" lettering.

G. Miscellaneous:
1. Door Holders: 24V Electromagnetic, Flush wall-mount FM998

H. Circuit Conductors: Copper; provide 200 feet extra; color code and label.

I. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.

J. Locks and Keys: Deliver keys to Owner.

K. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.
3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Install instruction cards and labels.

D. Provide one year monitoring service.

E. Verify location of all devices with Architect prior to installation.

3.2 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.3 PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
1. Hands-On Instruction: On-site, using operational system.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
1. Initial Training: 1 session pre-closeout.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:

1. Initial Training: 1 session pre-closeout.

D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.4 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

B. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
   1. Approved operating and maintenance data has been delivered.
   2. All aspects of operation have been demonstrated to Owner.
   3. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
   4. Occupancy permit has been granted.
   5. Specified pre-closeout instruction is complete.

3.5 MAINTENANCE

A. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.

B. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
   1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
   2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
   3. Record keeping required by NFPA 72 and authorities having jurisdiction.

C. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 2 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

D. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

E. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

F. Comply with Owner's requirements for access to facility and security.

END OF SECTION 283100