



**DULUTH INTERNATIONAL AIRPORT**

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**DULUTH INTERNATIONAL AIRPORT  
NEW PASSENGER TERMINAL  
BID PACKAGE 2C- WAY-FINDING REBID  
& HAZARDOUS MATERIALS ABATEMENT  
ISSUE FOR BID- CONTRACT DOCUMENTS**

FAA AIP No. - 3-27-0024-54-12  
RS&H PROJ. No. – 213.1882.091  
CITY OF DULUTH BID No. 12-4403

**PROJECT MANUAL- VOLUME 2 OF 2**

Date: SEPTEMBER 17, 2012



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## ITEM P-100 MOBILIZATION & GENERAL CONDITIONS

### DESCRIPTION

**100-1.1** The work specified in this item consists of the preparatory work and operations in mobilizing for beginning work on the project, including, but not limited to, those operations necessary for the movement of personnel, equipment, supplies and incidentals to the project site, and for the establishment of temporary offices, buildings, guard houses, utilities, safety equipment and first aid supplies, sanitary and other facilities as required by these specifications and state and local laws and regulations. The cost of bonds and any required insurance and any other preconstruction expenses necessary for the start of the work, excluding the cost of construction materials, shall also be included in this section.

### METHOD OF MEASUREMENT

**100-2.1** Measurement of the item, Mobilization, as specified herein will be on a lump sum basis.

### BASIS OF PAYMENT

**100-3.1** The work and incidental costs covered under this item will be paid for at the Contract lump sum price for the item of mobilization. The Engineer shall make the final determination of the allowable percentage of completion for the payment of mobilization and shall approve the percentage paid based on the percent of contract amount actually earned which will be based upon actual work completed.

PARTIAL PAYMENTS. Partial payments will be made in accordance with the following:

<u>Percent of Contract Amount Earned*</u>	<u>Allowable Percent Of the Lump Sum Price for the Item**</u>
0	0
5	25
10	50
25	75
50	100

\* The Percent of Contract Amount Earned equals the work completed to date (including the total of all previous mobilization) plus or minus work completed associated with executed change orders, if any, divided by the Total Original Contract Amount plus or minus the Total Executed Change Order Amounts, if any.

\*\* In the event the lump sum bid for mobilization exceeds 7.5 percent of the original contract amount for the project, the difference (remainder above 7.5%) will not be paid until the project is complete and the Engineer and Owner has issued a statement of final acceptance as of the date when the Contractor has furnished all of the required reports, certifications and other documentation. The date of final acceptance by the Engineer and Owner will govern, in accordance with statutes and regulations, for payment of retainage or other monies due to the Contractor.

Payment shall be made under:

Item P-100-3.1                      Mobilization and General Conditions -- Per Lump Sum.

### TESTING REQUIREMENTS

**100-4.1** None.

### END OF ITEM P-100

## ITEM P-102 SAFETY AND SECURITY

### GENERAL

**102-1.1** The provisions of this safety and security plan and associated procedures are applicable within the boundaries of the **Duluth International Airport**. A complete understanding of all procedures and requirements contained herein is required to ensure safety during construction. This safety plan is a part of this Contract and deviations from the requirements established herein will be sufficient cause for Contract termination.

Required reference material associated with this safety plan includes:

FAA AC 150/5200-18[C], Airport Safety Self-Inspection  
FAA AC 150/5210-5[D], Painting, Marking and Lighting of Vehicles Used on an Airport  
FAA AC 150/5370-2[F], Operational Safety on Airports During Construction  
FAA AC 150/5370-12[A], Quality Control of Construction for Airport Grant Projects

Copies of these documents are included in the specifications.

### CONTRACTOR SAFETY AND SECURITY OFFICER

**102-2.1 CONTRACTOR SAFETY AND SECURITY OFFICER (CSSO).** The Contractor shall appoint its on-site Construction Superintendent or other qualified individual(s) as its duly authorized representative to serve as Contractor Safety and Security Officer (CSSO) for the duration of the Contract. The CSSO shall thoroughly understand the safety and security requirements of the Contract, the necessity for them and shall have sufficient authority to implement its provisions without significant deviation. The Contractor shall notify the Engineer in writing of the name of the individual(s) selected for the assignment.

The CSSO shall represent the Contractor on safety and security requirements compliance. The CSSO shall be especially knowledgeable regarding the requirements of FAA AC's 150/5200-18, Airport Self Inspection Guide and 150/5370-2 Operational Safety on Airports During Construction, latest edition.

**102-2.2 RESPONSIBILITIES OF THE CONTRACTOR SAFETY AND SECURITY OFFICER.** Prior to the desired date for commencement of any work on the project, the CSSO shall accomplish the following:

a. Develop and submit in writing a detailed work sequence schedule with dates and times specified for all milestone events. This sequence schedule shall conform, as a minimum, to the events specified in Section 3.1, Construction Sequence, and shall be subject to the approval of the Engineer. To assure adequate time for coordination, this document shall be submitted at least one week prior to the date of the Preconstruction Conference.

b. Develop and submit in writing a detailed outline of the procedures to be followed to maintain safety and security of both Contractor operations and the integrity of airport landside and airside operations during the prosecution of contract work. This plan shall detail, in addition, the procedures to be followed in the event of an accident or fire involving Contractor personnel and the Contractor's efforts to maintain fire protection and security. These procedures shall be subject to the approval of the Engineer and reflect any change as may be deemed necessary.

c. Conduct at least one meeting of all Contractor supervisory personnel prior to the start of contract work. The purpose of this meeting is to review the approved Work sequence schedule and safety and security procedures. Attendance at this meeting by the CSSO, all Contractor supervisory personnel and the Engineer is mandatory. This meeting shall also be open to other employees of the

Contractor and others as the Engineer may deem appropriate. Minutes of this meeting shall be taken by the CSSO, copies provided to each supervisor and kept on file in the Contractor's construction office for periodic review and updating.

d. Develop a safety and security orientation program and provide a briefing for all employees of the Contractor and subcontractors that will be used on the project. A similar briefing will be given to new employees prior to their use on contract work. In addition, the CSSO shall be responsible for briefing, from time to time, all Contractor personnel on any changes to safety and security measures deemed necessary.

## CONSTRUCTION SEQUENCING

**102-3.1 CONSTRUCTION SEQUENCE.** The Contractor shall prepare a construction schedule and submit to the Engineer at least one week prior to the pre-construction conference.

**102-3.2 CLOSING RUNWAYS.** The Contractor shall acquaint his supervisors and employees with the sequence of construction and its relationship to airport activity and aircraft operations that are inherent to this airport. No runway, taxiway, apron or airport roadway shall be closed without the written approval of the Owner, to enable necessary NOTAMS and/or advisories to airport fixed based operators (FBOs), tenants and users.

The Contractor shall contact the Engineer a minimum of ten (10) days prior to any requested closing.

Any construction activity within **[250]** feet of the centerline of an active runway or within **[160]** feet of the centerline of an active taxiway or apron requires the closure of the affected area. These safety areas are shown on the phasing plan.

The Engineer will arrange for an inspection prior to return to service of any facility, that has been closed for work, on or adjacent thereto, or that has been used for a crossing point or haul route by the Contractor.

## MARKING AND LIGHTING

**102-4.1** Proper marking and lighting of areas on the airfield associated with the construction shall be the responsibility of the Contractor. This will include properly marking and lighting closed runways, taxiways, taxilanes, and aprons, the limits of construction, material storage areas, equipment storage areas, haul routes, parking areas and other areas defined as required for the Contractor's exclusive use. The Contractor shall erect and maintain around the perimeter of these areas suitable marking and warning devices visible for day and night use. Temporary barricades, flagging, and flashing warning lights shall be required at critical access points. The type and location of marking and warning devices will be approved by the Engineer.

Special emphasis shall be given to open trenches, excavations, heavy equipment marshalling areas, and stockpiled material located in the airport operations area, which shall be predominantly marked by the Contractor with flags and lighted by approved light units during hours of restricted visibility and darkness. All marking shall be in accordance with FAA Advisory Circular (AC) 150/5340-1J or latest edition.

## TRAFFIC CONTROL

**102-5.1 VEHICLE IDENTIFICATION.** The Contractor shall establish and maintain a list of Contractor and subcontractor vehicles authorized to operate on the site. Contractor employee vehicles shall be restricted to the Contractor's staging area and are not allowed in the Airport Operations Area (AOA) at any time. To be authorized to operate on the airport, each Contractor or subcontractor's vehicle shall:



a. be marked/flagged for high daytime visibility and lighted for nighttime operations. Vehicles that are not marked and/or lighted shall be escorted by a vehicle appropriately marked and/or lighted. Vehicles requiring escort shall be identified on the list.

b. be identified with the name and/or logo of the Contractor and be of sufficient size to be identified at a distance. Vehicles needing intermittent identification could be marked with tape or with commercially available magnetically attached markers. Vehicles that are not appropriately identified shall be escorted by a vehicle that conforms to this requirement. Vehicles requiring escort shall be identified on the list.

c. be operated in a manner that does not compromise the safety of either landside or airside airport operations. If, in the opinion of the Engineer, any vehicle is operated in a manner not fully consistent with this requirement, the Engineer has the right to restrict operation of the vehicle or prohibit its use on the airport.

**102-5.2 ACCESS TO THE SITE OF CONSTRUCTION.** The Contractor's access to the site shall be as shown on the Contract Layout Plan. No other access points shall be allowed unless approved by the Engineer. All Contractor traffic authorized to enter the site shall be experienced in the route or guided by Contractor personnel. The Contractor shall be responsible for traffic control to and from the various construction areas on the site, and for the operation and security of the access gate to the site. A Contractor's flagman or traffic control person shall monitor and coordinate all Contractor traffic at the access gate with Airport Security. The Contractor shall not permit any unauthorized construction personnel or traffic on the site. Access gates to the site shall be locked and secured at all times when not attended by the Contractor. If the Contractor chooses to leave any access gate open, it shall be attended by Contractor personnel who are familiar with the requirements of the Airport Security Program. The Contractor is responsible for the immediate cleanup of any debris deposited along the access route as a result of his construction traffic. Directional signing from the access gate along the delivery route to the storage area, plant site or work site shall be as directed by the Engineer. In addition, the following requirements are applicable:

a. All Contractor traffic authorized to travel on the airport shall have been briefed as part of the Contractor's construction safety and security orientation program, be thoroughly familiar with the access procedures and route for travel or be escorted by personnel authorized by the Contractor Safety and Security Officer (CSSO).

b. The Contractor shall install work site identification signs at the authorized access point(s). If, in the opinion of the Engineer, directional signs are needed for clarity, they shall be installed along the route authorized for access to each construction site.

c. Under no circumstance will Contractor personnel be permitted to drive their individually owned vehicles to any construction site on the airport. All vehicles must be parked in the area designated for employee parking and out of secured airport property.

d. In addition to the inspection and cleanup required at the end of each shift, the Contractor is responsible for the immediate cleanup of any debris generated along the construction site access route(s) as a result of construction related traffic or operations whether or not created by Contractor personnel.

**102-5.3 MATERIAL SUPPLIERS.** All material suppliers, subcontractors and visitors to the work site are obligated to follow the same safety and security operating procedures as the Contractor. All material suppliers shall make their deliveries using the same access points and routes as the Contractor and shall be advised of the appropriate delivery procedures at the time the materials order is placed. The Contractor shall not use the Airport address for any delivery but shall use the street address appropriate

to the location of the entrance of the work site. If it is not practical to conform to the vehicle identification requirements of Section 102-5.1 and the safety and security operations program requirements of Section 102-2.2, the Contractor shall be prepared to escort all suppliers, subcontractors and visitors while they are on the airport.

**102-5.4 PERSONNEL IDENTIFICATION.** All employees, agents, vendors, invitees, etc. of the Contractor or subcontractors requiring access to the construction site shall, conform to the Security Program.

## **GENERAL SAFETY REQUIREMENTS**

**102-6.1** All Contractor vehicles that are authorized to operate on the airport outside of the designated construction area limits or haul routes as defined herein shall display in full view above the vehicle a flashing amber (yellow) dome-type light or a three-foot by three-foot, or larger, orange and white checkerboard flag, each checkerboard color being one-foot square. Vehicles must be under control of a Contractor mobile (two-way) radio operator (flagmen) monitoring the Airport frequency. Vehicle operators must be vigilant for conflict with any aircraft and give way to any operating aircraft.

All Contractor vehicles that are required to operate outside of the construction area limits as defined herein and cross active runways, taxiways, aprons, or runway approach clear zones shall do so under the direct control of a flagman who is monitoring the Airport frequency. Flagmen and two-way radios shall be furnished by the Contractor. Flagmen shall be instructed in the use of two-way radios prior to use. All aircraft traffic on runways, taxiways and aprons shall have priority over Contractor's traffic.

Construction vehicles not in use for extended periods during the work day, or during nights and weekends (nonwork periods) shall be parked away from active runways, taxiways, and aprons in designated vehicle marshalling areas.

**102-6.2** In order to protect all aircraft traffic, aviation related businesses, terminal apron areas, etc. from potential damage caused by foreign object debris (FOD) generated by construction activities, the Contractor shall provide a vacuum truck as required at the startup of construction to daily vacuum all pavements affected by construction. The vacuum truck shall remain on-site for the duration of the project and shall be available at the discretion of the Owner to vacuum pavement areas adjacent to the construction areas to ensure no FOD is present on pavements within 500 feet of any construction area. Protecting the aircraft, airport tenants, users, public, etc. against FOD is a critical safety issue therefore the cost of the vacuum truck will be included in the cost established for this specification item.

## **CONSTRUCTION CONTROL**

**102-7.1** A primary and alternate responsible Contractor's representative shall be designated by the Contractor. The Contractor's representatives shall be available locally on a 24-hour basis. Names of the primary and alternate, including phone number, shall be made available to the Engineer by the Contractor. The Contractor shall insure that the names and phone numbers are kept current and made available to the Engineer.

## **CONSTRUCTION TECHNIQUES**

**102-8.1** Construction shall be planned and conducted throughout this project in such a manner as to allow the maintenance of completely safe airport operations. Every effort shall be made to reduce the impact of construction activity on overall airport operations. To this end the Contractor's activities shall be conducted in such a manner so as to preclude, except where absolutely required, open excavations, trenches, ditches and above ground obstacles such as booms on cranes or obstacle markers such as wooden saw horses. The primary responsibility for assuring that the safest possible construction

techniques are followed rests with the Contractor Safety and Security Officer (CSSO).

### METHOD OF MEASUREMENT

**102-9.1** The item of Safety and Security shall be measured as a lump sum item when required and furnished for the life of the Contract.

### BASIS OF PAYMENT

**102-10.1** Payment shall be made for airport safety and security measures for personnel or materials related to this specification item and incidentally required to satisfy the specified objective(s) under item P-102-10.0, Safety and Security. This compensation shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item.

PARTIAL PAYMENTS. Partial payments will be made in accordance with the following:

<u>Percentage of Original Contract Earned</u>	<u>Allowable Percent of the Lump Sum Price for the Item</u>
5	15
15	20
25	25
50	50
75	75
100 (or Contract Completion)	100

Payment shall be made under:

Item P-102-10.1	Safety and Security - Per Lump Sum.
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### TESTING REQUIREMENTS

**102-11.1** None.

### END OF ITEM P-102

## ITEM P-104 PROJECT SURVEY AND STAKEOUT

### DESCRIPTION

**104-1.1** Under this item, the Contractor shall do all necessary surveying required to construct all elements of the work as shown on the Contract Drawings and specified in the proposal and specifications. This shall include but not be limited to stakeout, layout and elevations for pavements, structures, forms and appurtenances as shown and required, consistent with the current practices and shall be performed by qualified personnel acceptable to the Engineer. The stakeout survey shall proceed immediately following the award of the Contract or as soon as authorized by the Owner and shall be expeditiously progressed to completion in a manner and at a rate satisfactory to the Engineer. The Contractor shall keep the Engineer fully informed as to the progress of the stakeout survey. All survey work shall be provided under the direction of a licensed land surveyor.

### MATERIALS

**104-2.1** All instruments, equipment, stakes and any other material necessary to perform the work satisfactorily shall be provided by the Contractor.

All stakes used shall be of a type approved by the Engineer. It shall be the Contractor's responsibility to maintain these stakes in their proper position and location at all times.

The Contractor shall supply to the Engineer a rod, level and tripod for his exclusive use during the entire project. The rod shall be 15 feet in length with hundredth-of-a-foot graduation. The level shall be self-leveling and have documentation demonstrating it has been calibrated within one month of the work commencement. All provided equipment shall be in good working order and maintained by the Contractor throughout the course of the project.

### CONSTRUCTION METHODS

**104-3.1** The Contractor shall trim trees, brush and other interfering objects, not inconsistent with the Contract Drawings, from survey lines in advance of all survey work to permit accurate and unimpeded work by his stakeout survey crews.

The exact position of all work shall be established from control points, baseline transit points or other points of similar nature that are shown on the Contract Drawings and/or modified by the Engineer. Any error, apparent discrepancy or absence in or of data shown or required for accurately accomplishing the stakeout survey shall be referred to the Engineer for interpretation or furnishing when such is observed or required.

The Contractor shall place two offset stakes or references at each centerline station and at such intermediate locations as the Engineer may direct. From computations and measurements made by the Contractor, these stakes shall be clearly and legibly marked with the correct centerline station number, offset and cut or fill so as to permit the establishment of the exact centerline location and elevation during construction. If markings become faded or blurred for any reason, the markings shall be restored by the Contractor at the request of the Engineer. He shall locate and place all cut, fill, slope, fine grade or other stakes and points, as the Engineer may direct, for the proper progress of the work. All control points shall be properly guarded and flagged for easy identification.

Drainage structures shall be staked out by the Contractor at the locations and elevations shown on the Contract Drawings or specified by the Engineer.

Reference points, baselines, stakes and benchmarks for borrow pits shall be established by the Contractor.

Permanent survey marker locations shall be established and referenced by the Contractor.

The Contractor shall be responsible for the accuracy of his work and shall maintain all reference points, stakes, etc., throughout the life of the work. Damaged or destroyed points, benchmarks or stakes, or any reference points made inaccessible by the progress of the construction, shall be replaced or transferred by the Contractor. Any of the above points which may be destroyed or damaged shall be transferred by the Contractor before they are damaged or destroyed. All control points shall be referenced by ties to acceptable objects and recorded. Any alterations or revisions in the ties shall be so noted and the information furnished to the Engineer immediately. All stakeout survey work shall be referenced to the centerlines shown on the Contract Drawings. All computations necessary to establish the exact position of the work from control points shall be made and preserved by the Contractor. All computations, survey notes and other records necessary to accomplish the work, shall be neatly made. Such computations, survey notes and other records shall be made available to the Engineer upon request and shall become the property of the Owner and delivered to the Engineer not later than the date of acceptance of the Contract.

The Contractor shall furnish, at his expense, all horizontal and vertical control, all staking and layout of construction work called for on the plans and the Engineer and Owner shall not be responsible for such work. However, the Owner and Engineer reserve the right to check all said lines, grades, and measurements with their appointed surveyor. Should the Owner's surveyor detect errors in said lines, grades, and measurements, the Contractor shall pay for all said surveying costs and subsequent surveying costs performed to verify correction of errors found in said lines, grades and measurements. Included in this are all blue top staking for subgrade and base course installation. Definition of an error shall be a discrepancy of 1/4" or more. In the case of a discrepancy between the technical specifications and this defined tolerance, this tolerance shall govern.

Prior to the final cross-section survey of the work by the Contractor, the Contractor shall reestablish centerline or baseline points and stationing as required by the Engineer.

Prior to the final cross-section survey of any borrow pits, the Contractor shall reestablish the baseline points and stationing, as well as any necessary benchmarks as required by the Engineer.

During the progress of the construction work, the Contractor will be required to furnish all of the surveying and stakeout incidental to the proper location by line and grade for each phase of the work. For paving and any other operation requiring extreme accuracy, the Contractor will restake with pins or other acceptable hubs located directly adjacent to the work at a spacing directed by the Engineer.

Any existing stakes, iron pins, survey monuments or other markers defining property lines which may be disturbed during construction shall be properly tied into fixed reference points before being disturbed and accurately reset in their proper position upon completion of the work.

Just prior to completion of the work, the Contractor shall reestablish, if necessary, and retie all control points as permanently as possible and to the satisfaction of the Engineer.

**104-3.2** The Contractor shall be required to submit cross sectional data to the Engineer at monthly intervals prior to the Contractor submittal of the monthly application for payment so that the Engineer can verify the quantities of various earthwork and materials volumes for payment. All cross sectional data provided at any time will be in AutoCad 2000 or higher format only. No other formats will be accepted. If the data is submitted in another format other than AutoCad, no earthwork or other materials volumes will be calculated and approved for payment. The earthwork shall include, but not be limited to, unclassified

excavation, embankment, new or existing subbase courses, new or existing base courses, sand/asphalt subgrade, topsoil, etc.

#### **METHOD OF MEASUREMENT**

**104-4.1** Payment will be made at the lump sum price bid for this item.

#### **BASIS OF PAYMENT**

**104-5.1** The lump sum price bid shall include the cost of furnishing all labor, equipment, instruments and all other material necessary to satisfactorily complete the work's surveying and stakeout. Partial payments will be made at the discretion of the Engineer as the work progresses based generally on the percentage of actual work completed compared to the total construction cost.

Payment will be made under:

Item P-104-5.1

Project Survey and Stakeout - Per Lump Sum.

#### **TESTING REQUIREMENTS**

**104-6.1** None.

#### **END OF ITEM P-104**



**NEW PASSENGER TERMINAL  
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**SECTION 01010 - SUMMARY OF WORK**

**1. GENERAL**

- A. All work furnished under this Project Manual shall be installed at the following location in accordance with the Contract Documents:
  - 1. At: Duluth International Airport  
New Passenger Terminal  
Bid Package 2C-Wayfinding Signage Rebid & Hazardous Materials Abatement  
Duluth, Minnesota
  - 2. For: Duluth Airport Authority  
4701 Grinden Drive  
Duluth, MN 55811
- B. The provisions of Part 2 through 6, Part 9 and 10 of the specifications, and Division 1, General Requirements, shall apply to all work of the Contract.
- C. The Scope of Work for the Duluth International Airport, New Passenger Terminal, Bid Package 2C-Wayfinding Signage Rebid & Hazardous Materials Abatement includes all work required for complete construction in accordance with the Contract Documents.
- D. Construction Contract: Construction will be accomplished under Multiple Prime Contracts as described in Section 01014 – Work Scope Descriptions.
- E. Coordination: Project will require close cooperation and coordination with Owner, Owner's Construction Manager (CM) and Contractor and Subcontractors. Contractor shall: consider such coordination in his work; schedule the Work with subcontractors and the Owner and Construction Manager, particularly near the end of the Project, keep the Owner and Construction Manager advised of his schedule to complete the Work.
- F. Examination of Site and Documents: In submitting a bid and in accepting a Contract award, the Contractor represents he has examined the site, existing conditions as well as the entire set of documents, in accordance with the General Conditions and agrees to be bound by all conditions of the site, existing conditions and all documents, without additional cost.
  - 1. Contractor's questions regarding this project must be directed to the Architect of record submitted through the Construction Manager. The Owner's employees are not authorized to make decisions or give direction regarding any aspect of this project.
- G. Construction Limits: Except as specifically indicated or as may be necessary to complete the work under the contract, activities of the contract shall be limited to within the limits designated on the drawings.

## 2. USE OF BUILDING BY OWNER

- A. Owner reserves the right to let other contracts in connection with this Project or in connection with existing buildings. Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and execution of their work, and shall properly connect and coordinate his work with theirs.
- B. Owner reserves the right to jointly occupy the premises with the Contractor in the performance of his duties and functions. The Owner also reserves the right to: enter into the Project and premises at all times; make installations of materials and equipment at appropriate times as the Work progresses; install equipment, furniture and furnishings when spaces are at appropriate stages of completion. Contractor shall coordinate work with the Owner and cooperate with the Owner to minimize undue interferences. Any activities required by the Contractor that may interfere with the Owner's occupation of the premises or Project during the work must be coordinated with the Owner and Construction Manager and may be required to be completed during alternate time periods.
- C. If any part, unit, phase, or the entire Project is substantially complete or ready for occupancy, the Owner may, upon notice to the Contractor, enter into and make use of the Work that is substantially complete.

## 3. CONTRACTOR'S USE OF PREMISES

- A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises is limited only by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of the project.
  - 1. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
  - 2. Keep driveways and entrances serving the premises clear and available to the Owner at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
- B. Site Storage Areas: As determined by Construction Manager. The Construction Manager shall establish and govern the use of available space.
- C. Site Protection: Protect existing trees and other plantings which are not to be removed and all features of adjacent buildings, paved surfaces which are to remain and are susceptible to damage from ordinary operations of the Contractor, trucking or other activity.

- D. Restoration: All improvements on or about the site and adjacent property which are not shown to be altered, removed or otherwise changed, and which have been damaged or disturbed by any work or operations under this contract, shall be restored to the conditions which existed previous to starting work. All existing buildings, structures, or other features shall be protected from damage by any operation in connection with the Project. The Contractor shall replace or repair, at his own expense (and to the satisfaction of the Owner), all damage to existing buildings, sidewalks, curbs, drives, fencing, lawns, plants, trees, shrubbery and other property resulting from work of this Contract, from whatever cause.

4. CONSTRUCTION SCHEDULE

- A. Refer to Section 01041 – Schedules.

END OF SECTION 01010

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**SECTION 01027 - APPLICATIONS  
FOR PAYMENT**

**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 specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
  - 1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
  - 1. Schedules: The Contractor's Construction Schedule and Submittal Schedule are specified in Division 1 Section 01300 - SUBMITTALS.

**1.3 SCHEDULE OF VALUES**

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.
  - 1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
    - a. Contractor's Construction Schedule.
    - b. Application for Payment forms, including Continuation Sheets.
    - c. List of subcontractors.
    - d. Schedule of allowances.
    - e. Schedule of alternates.
    - f. Schedule of submittals.
  - 2. Submit 3 copies of the Schedule of Values to the Construction Manager for approval at the earliest possible date but no later than 21 days before the date scheduled for submittal of the initial Applications for Payment.
  - 3. Subschedules: Where Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.
- B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
  - 1. Identification: Include the following Project identification on the Schedule of Values:
    - a. Project name and location.
    - b. Name of the Architect.
    - c. Project number.
    - d. Contractor's name and address.

- e. Date of submittal.
2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
  - a. Related Specification Section or Division.
  - b. Description of Work / generic name of the item.
  - c. Name of subcontractor.
  - d. Name of manufacturer or fabricator.
  - e. Name of supplier.
  - f. Change Orders (numbers) that affect value.
  - g. Dollar value.
  - h. Percentage of Contract Sum to nearest one hundredth percent, adjusted to total 100 percent.
3. Provide a breakdown of the Contract Sum in sufficient detail, acceptable to the Architect, to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
4. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.
  - a. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing, if required.
6. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Margins of Cost: Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.
  - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at the Contractor's option.
8. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

#### 1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Construction Manager and paid for by the Owner.
  1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
- B. Payment Application Times: Payment applications are due to the Construction Manager on the 1st day of each month. The period of construction work covered by each payment request is the period indicated in the Owner-Contractor agreement or, if none is indicated therein, starting the day following the end of the preceding period.

Pay application meetings, which all Prime Contractors are required to attend, occur on the 3<sup>rd</sup> Thursday of each month. Refer to General Conditions and other Contract Documents for other dates related to payment application times.

- C. Payment Application Forms: Use AIA Document G702 and Continuation Sheets G703 as the form for Applications for Payment.
- D. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Architect will return incomplete applications without action.
  - 1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
  - 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
- E. Report of DBE Activity: With each Application for Payment, submit a Report of DBE Activity for the construction period covered by the application for payment.
- F. Transmittal: Submit five (5) signed and notarized original copies of each Application for Payment to the Construction Manager by a method ensuring receipt within 24 hours. One copy shall be complete, including waivers of lien and similar attachments, when required.
  - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Construction Manager.
  - 2. Each Application for Payment must be submitted directly to the Construction Manager's office at 8625 Rendova Street N.E., P.O. Box 158, Circle Pines, MN 55014 for processing. Do not submit to jobsites or branch offices.
- G. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics liens from every entity who may lawfully be entitled to file a mechanics lien arising out of the Contract, including but not limited to subcontractors, and suppliers, for the construction period covered by the previous application.
  - 1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
  - 2. When an application shows completion of an item, submit final or full waivers.
  - 3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
  - 4. Waiver Delays: Submit each Application for Payment with the Contractor's waiver of mechanics lien for the period of construction covered by the application.
    - a. Submit final Applications for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application that is lawfully entitled to a lien.
  - 5. Waiver Forms: Submit waivers of lien on forms and executed in a manner acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment, include the following:



1. List of subcontractors.
  2. List of principal suppliers and fabricators.
  3. Schedule of Values.
  4. Contractor's Construction Schedule (preliminary if not final).
  5. Schedule of principal products.
  6. Schedule of unit prices.
  7. Submittal Schedule (preliminary if not final).
  8. List of Contractor's staff assignments.
  9. List of Contractor's principal consultants.
  10. Copies of building permits.
  11. Copies of authorizations and licenses from governing authorities for performance of the Work.
  12. Certificates of insurance and insurance policies.
  13. Performance and payment bonds.
  14. Data needed to acquire the Owner's insurance.
  15. Initial settlement survey and damage report, if required.
- I. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.
1. This application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
  2. Administrative actions and submittals that shall precede or coincide with this application include:
    - a. Occupancy permits and similar approvals or certifications by governing authorities, assuring Owners full access and use of the completed work.
    - b. Warranties (guarantees) and maintenance agreements.
    - c. Test / adjust / balance records.
    - d. Maintenance instructions.
    - e. Meter readings.
    - f. Start-up performance reports.
    - g. Change-over information related to Owner's occupancy, use, operation, and maintenance.
    - h. Final cleaning.
    - i. Application for reduction of retainage and consent of surety.
    - j. Advice on shifting insurance coverages, including proof of extended coverages as required.
    - k. Final progress photographs.
    - l. List of incomplete Work recognized to be completed by the Contractor, as exceptions to Architect's Certificate of Substantial Completion.
- J. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:
1. Completion of Project closeout requirements.
  2. Completion of items specified for payment application at time of Substantial Completion (regardless of whether such application was made).
  3. Assurance, satisfactory to Owner, that unsettled claims will be settled and that work not actually completed or accepted will be completed without undue delay.
  4. Transmittal of required Project construction records to the Owner.
  5. Certified property survey.

6. Proof, satisfactory to Owner, that taxes, fees, and similar obligations of the Contractor have been paid.
7. Removal of temporary facilities and services.
8. Removal of surplus materials, rubbish, and similar elements.
9. Change of door locks and other Contractor access to Owner's property.
10. Consent of Surety for Final Payment.

1.5 RETAINAGE

A. The amount that will be retained will be as follows:

1. Refer to GP 90-06 Partial Payments specifications.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01027

**CONTRACTOR / DESIGN BUILDER'S  
REPORT OF DBE ACTIVITY**

(Required with each Pay Application)

**Duluth International Airport - New Passenger Terminal**

FAA AIP Project Number:

Mn/DOT SP Project Numbers

KACC Project Number 20225 / Reynolds, Smith & Hills Project Number 213-1882-091

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**Accompanies Application for Payment No.** **Covering period ending** \_\_\_\_\_

**Contractor**

**Name:**

**Address:**

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**Telephone No.:** \_\_\_\_\_ **E-mail Address:** \_\_\_\_\_

**The Original Contract Amount was** \_\_\_\_\_

**The net Amount of Change Orders to date is** \_\_\_\_\_

**The Current Contract Amount is** \_\_\_\_\_

**The DBE Goal has been established as** \_\_\_\_\_ **percent of original contract amount**

**The current DBE Goal is therefore calculated as (amount)** \_\_\_\_\_

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**The DBE Subcontractors who worked on this project during this pay period and the value of the work performed by each is as listed below:**

<u>NAME</u>	<u>DESCRIPTION OF WORK</u>	<u>AMOUNT</u>
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____
7	_____	_____
8	_____	_____

**The total value of work performed by DBEs during this pay period is** \_\_\_\_\_

**The accumulative value of work performed by DBEs prior to this period is** \$ \_\_\_\_\_ -

**The current total value of work performed by DBEs, including this period, is** \$ \_\_\_\_\_ -

**(The current total value of work performed by DBEs) + (The current Contract Amount) =** \_\_\_\_\_

**Contractor's strategy for meeting DBE Goal (when applicable)** \_\_\_\_\_

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**NEW PASSENGER TERMINAL  
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**SECTION 01035 - MODIFICATION  
PROCEDURES**

**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 specifies administrative and procedural requirements for handling and processing contract supplements and modifications.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1, Section 01027 "Applications For Payment" for administrative procedures governing Applications for Payment.
  - 2. Division 1, Section 01300 "Submittals" for requirements for the Contractor's Construction Schedule.
  - 3. Division 1, Section 01631 "Products and Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

**1.3 CONTRACT DOCUMENT SUPPLEMENTS**

- A. Clarification / Supplemental Instructions (C-): Shall provide further detail to requirements inferred in the Contract Documents or authorize minor changes in the work, not involving an adjustment to the Contract Sum or Contract Time, and will be issued by the Architect with supplemental or revised drawings and specifications, if necessary. Clarifications / Supplemental Instructions issued by the Architect-Engineer shall become binding and a part of the Contract as minor changes in the work unless the Contractor notifies the Architect-Engineer within 21 days that the instructions result in changes that affect the Contract Cost or Contract Time.
- B. Request for Information / Supplemental Instructions (RFI-): Shall be initiated by the Contractor when necessary for performance of the work. The Architect's reply will constitute further detail to requirements if inferred in the Contract Documents or interpretations of the requirements. Requests for information must describe all document references that pertain to the issue and any conflicts and must include the contractor's interpretation or proposed action that would be made if there was not a process to obtain the information from the Architect. Requests for information that do not include this, or that request information already included in the contract documents without conflict, will be returned without action (RWA). The Architect will record the time expended to process such requests and notify the Contractor of the charges. The owner shall deduct any such compensation due the Architect from the Contractor's monthly periodic pay requests in accordance with the compensation terms for cost, overhead and profit in the Owner / Architect agreement. Use forms

provided by the Architect. The Contractor shall maintain a sequentially numbered log of all such requests.

- C. Contractor Corrective Action Proposals (CCA-): Shall be initiated by the Contractor when deviation from the contract requirements has been constructed. The Contractor shall provide a fully detailed proposal for his corrective or remedial work. The Architect's reply will indicate approval of the proposed action as detailed, approval with certain modifications, or rejection of the proposal. Use forms provided by the Architect. The Contractor shall maintain a sequentially numbered log of all such proposals. Upon notification of a deviation and request for a CCA the Contractor shall submit one promptly. Should this not occur in a timely fashion which, in the judgment of the Architect, will allow time for processing and correction ahead of other advancing elements of work, the Architect will initiate a CCA giving direction for correction. If the Architect initiates the CCA or must provide significant direction to a Contractor initiated CCA, due to a lack of a fully detailed proposal, the Architect will record the time expended and notify the Contractor of the charges. The owner shall deduct any such compensation due the Architect from the Contractor's monthly periodic pay requests in accordance with the compensation terms for cost, overhead and profit in the Owner / Architect agreement.

#### 1.4 PROPOSAL / CHANGE ORDER REQUESTS

- A. Request for Proposal (RFP-): The Architect will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
1. Proposal requests issued by the Architect are for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.
  2. Unless otherwise indicated in the proposal request, within 20 days of receipt of a proposal request, submit an estimate of cost necessary to execute the change to the Architect for the Owner's review.
    - a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
    - b. Itemize labor charges by time and category.
    - c. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - d. Indicate overhead and profit charges.
    - e. Include a statement indicating the effect the proposed change in the work will have on the Contract Time.
- B. Contractor-Initiated Change Order Requests (RCO-): When latent or unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
  2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Comply with requirements in Section 01631 - PRODUCTS AND SUBSTITUTIONS if the proposed change requires substitution of one product or system for a product or system specified.
5. Change Order Request Form: Use forms provided by the Architect. The Contractor shall maintain a sequential log of all Requests for Change Orders.

## 1.5 ALLOWANCES

- A. Allowance Adjustment: For allowance-cost adjustment, base each Change Order Proposal on the difference between the actual purchase amount and the allowance, multiplied by the final measurement of work-in-place. Where applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
  1. Include installation costs in the purchase amount only where indicated as part of the allowance.
  2. When requested, prepare explanations and documentation to substantiate the margins claimed.
  3. The Owner reserves the right to establish the actual quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or the Contractor's handling, labor, installation, overhead, and profit. Submit claims within 20 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. The Owner will reject claims submitted later than 20 days.
  1. Do not include the Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in Contract Documents.
  2. No change to the Contractor's indirect expense is permitted for selection of higher or lower-priced materials or systems of the same scope and nature as originally indicated.

## 1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and the Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714. The Construction Change Directive instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  1. The Construction Change Directive will contain a complete description of the change in the work and designate the method to be followed to determine change in the Contract Sum or Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.



## 1.7 CHANGE ORDER PROCEDURES

- A. Upon the Owner's approval of a Change Order Proposal Request, the Architect will issue a Change Order for signatures of the Owner and the Contractor on AIA Form G701, as provided in the Conditions of the Contract.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01035

**NEW PASSENGER TERMINAL  
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**SECTION 01040 – COORDINATION**

**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 supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:
  - 1. General project coordination procedures.
  - 2. Coordination Drawings.
  - 3. Administrative and supervisory personnel.
  - 4. Cleaning and protection.
- B. Related Sections: Refer to other Division 1 sections for coordination requirements regarding field engineering services, project meetings, Contractor's construction schedule, general installation and contract closeout.

**1.3 COORDINATION**

- A. Coordinate construction operations included in various sections of these Specifications to assure efficient and orderly installation of each part of the work. Coordinate construction operations included under different sections that are dependent upon each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
  - 3. Make provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
  - 1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of schedules.
  - 2. Installation and removal of temporary facilities.
  - 3. Delivery and processing of submittals.

4. Progress meetings.
5. Project closeout activities.

#### 1.4 SUBMITTALS

- A. Coordination Drawings: Prepare coordination drawings as careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
  1. Show the relationship of components shown on separate Shop Drawings.
  2. Indicate required installation sequences.
  3. Comply with requirements contained in Section 01300 - SUBMITTALS.
  4. Refer to Division 16 for additional requirements.
- B. Staff Names: Within fifteen (15) days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
  1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.
- C. Subcontractor / Supplier Names: Within fifteen (15) days of commencement of construction operations, submit a listing of Contractor's principal subcontractors and suppliers, naming persons and listing their addresses and phone numbers.

#### 1.5 SITE USE PLAN

- A. Within ten (10) working days of Contract award, the Contractor shall develop and submit for Owner's approval a site use plan. This plan shall clearly describe the proposed temporary facilities, staging areas, ramps and major traffic ways, hazardous material storage, provisions for site services, safety and security. Changes to the site plan shall be submitted for review and approval five (5) working days prior to effecting the changes.

#### 1.6 TRADESPERSONS AND WORKMANSHIP STANDARDS

- A. General: Instigate and maintain procedures to ensure that persons performing work at site are skilled and knowledgeable in methods and craftsmanship needed to produce required quality levels for workmanship in completed work. Remove and replace work which does not comply with workmanship standards as specified and as recognized in the construction industry for applications indicated. Remove and replace other work damaged or deteriorated by faulty workmanship or its replacement.
- B. Availability of Tradespersons: At each progress or coordination meeting, review availability of tradespersons and projected needs to accomplish work as scheduled. Require each entity employing personnel to report on events which might affect progress of work. Where possible, consider alternatives and take actions to avoid disputes and delays.

#### PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 GENERAL COORDINATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.
- C. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- D. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- E. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.
- F. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.
- G. Recheck measurements and dimensions, before starting each installation.
- H. Install each component during conditions of temperature, humidity, exposure, forecasted weather and status of project completion that will ensure the best possible results, in coordination with entire work. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

### 3.2 CLEANING AND PROTECTION

- A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.
- C. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

COORDINATION  
 BID PACKAGE 2C WAYFINDING SIGNAGE REBID  
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1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining, and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High-speed operation.
21. Improper lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

### 3.3 ENVIRONMENTAL PROTECTION

- A. Soil Disposal and / or Borrow: Conduct all soil disposal and / or borrow work in accordance with requirements of local regulatory authorities. Dispose of all excess soil in a legal manner off site.
- B. Solid, Liquid and Gaseous Contaminants: Contractor shall be responsible for the proper disposal of all solid, liquid and gaseous contaminants in accordance with all local codes and regulations, together with the following requirements.
  1. Discharge gaseous contaminants so that they will be sufficiently diluted with fresh air to reduce the toxicity to an acceptable level.
  2. Liquid contaminants may, subject to local utility standards, be diluted with water to a level of quality acceptable in the local sewer system or shall be contained in approved vessels for disposal at approved sites.
- C. Disposal of Refuse: Remove refuse resulting from construction operations from the site. Burning on the site is not permissible.
- D. Hazardous Waste: All hazardous waste generated by the Contractor and the Contractor's subcontractors during the course of construction shall be stored, transported and disposed of in accordance with 40 CFR 260. The Contractor and his subcontractors shall be responsible for all documentation related to hazardous

waste generated as a result of this Contract and that documentation shall be in accordance with 40 CFR 260.

- E. Construction Site Maintenance:
  - 1. Store all supplies and equipment on project site so as to preclude mechanical and climatic damage. Maintain site in a neat and orderly manner.
  - 2. Contractor shall be responsible for maintaining the temporary structures and construction enclosure (fence) in good repair and visually pleasant. Contractor shall further provide adequate security, supplementing the existing fencing as necessary, to prevent the presence of unauthorized persons on the site and to keep gates secured when not in actual use to ensure the integrity of the barrier as well as for property security.
- F. Noise Control: Comply with all applicable state and local laws, ordinances and regulations relative to noise control.

END OF SECTION 01040

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**SECTION 01041 - SCHEDULES**

**GENERAL**

**1. RELATED DOCUMENTS**

Drawings and general provisions of Contract, including General Conditions and Division 1 Specifications, apply to work of this Section.

**2. COORDINATION**

A. The Contractor shall coordinate scheduling with the Construction Manager. In particular, the Contractor shall provide close coordination of progress schedule, schedule of values, listing of subcontractors, schedule of submittals, progress reports and payment requests.

B. Close coordination will be required between all construction trades in order that individual areas of construction can be completed by their scheduled time. Consult the proposed construction sequence schedule for start and completion dates of individual work areas.

**3. PRELIMINARY SCHEDULE**

A. The Construction Manager has developed a Preliminary Schedule included at the end of this section, showing work areas of the project which directly impact the orderly use of the facility during construction. The timing of these activities has been approved by the Owner.

B. The Preliminary Schedule may not list the work completely and may vary from the drawings and specifications.

**4. CONSTRUCTION SCHEDULE**

A. The Construction Manager shall computerize a Precedence Diagram Method (PDM) Network using data supplied by the Contractor and all subcontractor(s). The Contractor will be responsible for his own methods and procedures and the performance of the work consistent with good practice.

B. Neither the Construction Manager nor the Owner warrants the information supplied by the Contractors is accurate or correct or that the project can be performed as scheduled based upon data supplied by the Contractors.

C. The Contractor shall be responsible for providing all data to develop and update the schedule. The Contractor shall supervise all work activities to maintain progress in accordance with the schedule.

D. The Contractor and Subcontractor shall provide their own data to the Construction Manager reflecting the actual plan of operation for the Project.

**SCHEDULES**

Bid Package 2C—Wayfinding Signage Rebid  
& Hazardous Materials Abatement  
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Schedule input data shall include a comprehensive list of all activities of the construction phase of the project, including submittals (shop drawings, samples, product data), procurement of material, and on-site activity (erection, installation, construction). Activities for procurement of materials shall be included to delineate between material purchasing and fabrication/delivery.

- E. The Contractor shall assign durations and sequencing to each activity. Submittal activities shall be listed with the anticipated date of submittal. Procurement activities shall be listed with the duration required for fabrication and delivery from date of purchase. The Construction Manager shall computerize a PDM network using input data supplied by the Contractor. The Construction Manager will meet with the Contractor to revise and expand the Schedule and resolve conflicts. The revised schedule shall conform to the specific plan of operation envisioned by the Contractor.

The Construction Manager will guide the Contractor in determining the level of detail to be included in the PDM Networks. The schedule shall be adequate enough to evaluate progress, cost of work in place and serve as a control technique for the Contractor's Field Superintendent.

- F. The Contractor and all subcontractors shall be obligated to perform in accordance with the Construction Schedule and to participate in updating the schedule. The Contractor shall include provisions in all subcontracts binding Subcontractors to participate in revisions of the schedule as are necessary, and to supply data throughout the project.
- G. Upon request, the Contractor shall submit to the Construction Manager purchase orders and subcontracts. Such information shall be submitted as soon as available so the Construction Manager will be aware of the progress being made by the Contractor in the placing of orders and the status of material. The Contractor shall be solely responsible for expediting the delivery of all material furnished by him and coordinating his subcontractors so construction progress shall be maintained according to Contract Schedule.

## 5. COMPLIANCE WITH THE CONSTRUCTION SCHEDULE

- A. If the Contractor shall fail to adhere to the Construction Schedule or to the said schedule as revised, he must promptly adopt such other or additional means and methods of construction as will make up for the time lost and will assure completion of the work in accordance with said Construction Schedule at no additional cost to the Owner, except in accordance with the provision of the contract governing such costs. If the Owner or the Construction Manager notifies the Contractor of any change in the contract or any extra work performed, or if any other conditions arise which are likely to cause delays, the Contractor shall notify the Construction Manager in writing within five (5) days of the receipt of such notice or occurrence of such condition. This notice shall document the effect, if any, of such change, or extra work, of suspension or other condition upon the Construction Schedule. No time extensions will be granted due to a delay in any activity unless the



Owner deems the length of the delay exceeds the float time associated with the activity at the time the delay occurs.

6. FLOAT TIME

- A. The Contractor, in directing the compliance with Construction Schedule shall cooperate with the Owner and the Construction Manager in utilizing float time. Full control over use of total float time in the Schedule rests with the Owner and will be utilized by him in any necessary rescheduling of the Construction Schedule occasioned by design changes, field conditions, strikes, Acts of God, or unavoidable equipment and material delays. If rescheduling of any activity adversely affects the Contractor's operation, he shall advise the Construction Manager in writing no later than five (5) days after the receipt of the revised schedule or Notice of Intent to revise the schedule.

7. PRELIMINARY SCHEDULE DATES

- A. All work shall be completed as follows:
1. Work Scope 10.22C Wayfinding Signage shall be substantially complete by December 14, 2012.
  2. Work Scope 17.20C Hazardous Materials Abatement shall be substantially complete by April 1, 2013.

END OF SECTION 01041

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**SECTION 01045 - CUTTING AND PATCHING**

**1. WORK INCLUDED**

- A. Refer to Section 01010 and 01500 for special requirements, protection, constraints, timing of work, scheduling of work, enclosures and similar requirements relating to this Section.
- B. This Section covers cutting, demolition, removal work, patching and restoration of work as necessary to accomplish and complete all work under the Contract, including any relocation or reuse of existing materials, equipment, systems, or other work, as well as the disposition of salvaged materials or debris. This Section applies to all work under the Contract, including general construction, mechanical and electrical work.
- C. Drawings generally indicate the extent of demolition, removals, relocations and cutting. The drawings shall not be construed as indicating all required work, nor indicating all conditions or details which might be encountered to accomplish the work of this Contract. The Contractor and his subcontractors shall examine the spaces themselves to determine the actual conditions and requirements. All removals, demolition, cutting, restoration, new installations and other work shall be accomplished to transform the existing spaces and conditions to the new conditions required under the Contract, as well as to accomplish all tie-in work of new to existing.
- D. It is the intent that unless specially shown on the general construction type drawings (i.e., architectural and structural) and schedules, or is inherent in the work to be accomplished under the general construction work of the area, that the mechanical and electrical Contractors shall perform the demolition, cutting, removals, relocations, patching and restoration as will be required to accomplish the work under their contracts. All work shown or indicated on the general construction drawings and schedules shall be accomplished by the associated Contractor.
- E. Except for general demolition of entire areas, it is the intent that at each area, or space, the Contractor and each subcontractor shall make the removals, perform cutting or demolition and accomplish relocations of work normal to his trades (i.e., Mechanical Contractor removes or relocates piping, ductwork and similar; Electrical Contractor removes or relocates panelboards, conduit lighting and similar). At areas of general demolition of the entire spaces, the Mechanical and Electrical shall make removals of work normal to their trades or as may be called for, for reuse or relocation, make any relocations and cut-off, terminate, cap or otherwise discontinue services that will be abandoned or removed in the space.

2. GENERAL REQUIREMENTS

- A. Accomplish all work of cutting, removal, demolition, relocation, patching and other restoration by using only mechanics skilled in the trade. If necessary, sublet the work to skilled contractors or subcontractors.
- B. The Contractor shall coordinate all work of this Section with all subcontractors so the work will progress without interruption and minimum delays. The Contractor shall also coordinate and schedule the work with the Owner and Construction Manager where possible disturbance may occur and where relocations or other potential disruptions of the Owner's functions and services may occur. All work affecting the Owner's functions and services shall be performed at times acceptable to the Owner.

END OF SECTION 01045

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**SECTION 01200 - PROJECT MEETINGS**

**1. GENERAL**

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
1. Pre-Construction Conference.
  2. Pre-Installation Conference.
  3. Progress Meetings.

**2. PRE-CONSTRUCTION CONFERENCE**

- A. Pre-Construction Conference shall be scheduled as directed by Construction Manager. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attendees: Construction Manager, the Owner, Architect and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.
- C. Agenda: Discuss items of significance that could affect progress including such topics as:
1. Construction schedule.
  2. Critical work sequencing.
  3. Designation of responsible personnel.
  4. Procedures for processing field decisions and change orders.
  5. Procedures for processing Applications for Payment.
  6. Distribution of contract documents.
  7. Submittal of shop drawings, product data and samples.
  8. Preparation of record documents.
  9. Use of the premises.
  10. Office, work and storage areas.
  11. Equipment deliveries and priorities.
  12. Safety procedures.
  13. First aid.
  14. Security.
  15. Housekeeping.
  16. Working hours.

**3. PRE-INSTALLATION CONFERENCES**

- A. The Contractor shall conduct a pre-installation conference at the Project Site before each construction activity that requires coordination with other construction.
- B. Attendees: The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with

other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Architect at least ten (10) working days in advance of scheduled meeting dates.

- C. Do not schedule conferences until the submittals required by the Contract Documents for work associated with the construction activity requiring the conference have been approved and returned to the Contractor.
- D. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for the following:

1. Contract Documents.
2. Options.
3. Related Change Orders.
4. Purchases.
5. Deliveries.
6. Shop Drawings, Product Data, and quality-control samples.
7. Review of mockups.
8. Possible conflicts.
9. Compatibility problems.
10. Time schedules.
11. Weather limitations.
12. Manufacturer's recommendations.
13. Warranty requirements.
14. Compatibility of materials.
15. Acceptability of substrates.
16. Temporary facilities.
17. Space and access limitations.
18. Governing regulations.
19. Safety.
20. Inspecting and testing requirements.
21. Required performance results.
22. Recording requirements.
23. Protection.

- E. The Contractor shall record the results of the meeting and distribute copies to attendees and other interested parties.
- F. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of work and reconvene the conference at the earliest feasible date.

#### 4. PROGRESS MEETINGS

- A. Construction Manager shall conduct regular progress meetings at the Project site. Time of meeting to be scheduled by Construction Manager.
- B. Attendees: In addition to representatives of the Owner, Construction Manager and Architect, each prime contractor, subcontractor, supplier or other entity concerned

with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
  - 1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
  - 2. Review the present and future needs of each entity present, including such items as:
    - a. Interface requirements.
    - b. Time.
    - c. Sequences.
    - d. Deliveries.
    - e. Off-site fabrication problems.
    - f. Access.
    - g. Site utilization.
    - h. Temporary facilities and services.
    - i. Hours of work.
    - j. Hazards and risks.
    - k. Housekeeping.
    - l. Quality and work standards.
    - m. Change orders.
    - n. Documentation of information for payment requests.
- D. Reporting: No later than three (3) days after each progress meeting date, the Construction Manager shall distribute copies of minutes of the meeting to each party present and to other parties as applicable.
  - 1. Schedule Updating: The construction schedule shall be revised after each progress meeting where revisions to the schedule have been made or recognized. The revised schedule shall be issued to all applicable parties.

END OF SECTION 01200

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**SECTION 01210 - ALLOWANCES**

**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 governing allowances.
  - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
  - 1. Lump-sum allowances.
  - 2. Unit-cost allowances.
  - 3. Quantity allowances.
  - 4. Contingency allowances.
  - 5. Testing and inspecting allowances.
- C. Related Sections include the following:
  - 1. Division 1 Section 01035 "Modification Procedures" for procedures for submitting and handling Change Orders for allowances.
  - 2. Divisions 2 through 16 Sections for items of Work covered by allowances.

**1.3 SELECTION AND PURCHASE**

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

**1.4 SUBMITTALS**

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

- B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

#### 1.5 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

#### 1.6 LUMP-SUM / UNIT-COST AND QUANTITY ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner under allowance and shall include taxes, freight, and delivery to Project site.
- B. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.

#### 1.7 TESTING AND INSPECTING ALLOWANCES

- A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.
- B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.
- C. Costs of services not required by the Contract Documents are not included in the allowance.
- D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

#### 1.8 UNUSED MATERIALS

- A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
  - 1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

### PART 2 - PRODUCTS (Not Used)



## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

### 3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

### 3.3 SCHEDULE OF ALLOWANCES

- A. **Allowance No. 1:** Include allowance in Work Scope 10.22C for additional regulatory signage in the amount of \$12,000.

END OF SECTION 01210

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**SECTION 01270 – UNIT  
PRICES**

**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 unit prices.
- B. Related Sections include the following:
  - 1. Division 1 Section 01035 "Modification Procedures" for procedures for submitting and handling Change Orders.

**1.3 DEFINITIONS**

- A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

**1.4 PROCEDURES**

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: Refer to 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 Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: Refer to Section 01014 "Work Scope Descriptions" and the Bid Form Package in Volume 1 of the Project Manual.

**PART 2 - PRODUCTS (Not Used)**

**EXECUTION (Not Used)**

**END OF SECTION 01270**

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**SECTION 01300 - SUBMITTALS**

1. GENERAL

- A. This Section defines procedures for the following submittals required by the Contract Documents.

2. SCHEDULE OF SUBMITTALS - REQUIRED

- A. The following documents are required to be submitted to the Construction Manager for review at the times indicated.

1. Prior to Bidding (ten days prior to bid opening):  
Request for approval of substitute material and equipment.
2. Within 10 days of Letter of Contract Award:  
Performance and Payment Bonds  
Insurance Certificate  
Schedule of Values (based on specification sections – no Pay Application will be processed without approval of Schedule of Values)  
List of materials and equipment  
List of subcontractors
3. During Progress of Project as specified:  
Samples  
Test results  
Application for Payment (see Specifications Section 01027)
4. Upon receipt of Substantial Completion Certificate, submit the following documents within 30 days:  
Shop drawings and required submittals  
Equipment and material guarantees  
Operations manuals  
As-built drawing notes  
Completed punch lists  
Final payment request accompanied by:  
Affidavit of Payment of Claims      Affidavit of Release of Liens  
Withholding Tax Affidavit      Consent of Surety to Final Payment

**Note: No final retainage payment will be released without the receipt and approval of the above referenced documents.**

3. SHOP DRAWINGS

- A. Shop drawings prepared specifically for this work shall be submitted to the Construction Manager electronically for submittal to the Architect. Contractors are to review and stamp shop drawings or they will be returned. At least 40 square inches of space in the lower right hand corner of each sheet shall be left blank for approval

stamps and notes. After the Architect has checked and approved each drawing, he will so stamp it, make such copies as he requires and return it through the Construction Manager to the Contractor who shall make and distribute such copies as he requires. In instances where minor corrections are required, they will be so noted on the drawing and it will be stamped "Make Corrections Noted" and returned to the Contractor as above. Where major corrections are required, the shop drawings will be returned to the Contractor who shall make a new drawing incorporating the required corrections and resubmit the revised drawings for approval electronically to the Construction Manager.

- B. Shop drawings in the form of printed descriptive information shall be bound together with a title and index sheet listing each sheet in the binding. The title and index sheet shall have a blank rectangular space of at least 4" x 8" for notes and approval stamps. Shop drawings are to be submitted electronically to the Construction Manager.
- C. Shop drawings and samples shall be dated and contain: Names of project, description or names of equipment, materials and items; and complete identification of locations at which materials or equipment are to be installed.
- D. Submission of shop drawings shall be accompanied by transmittal letter and required Submittal Cover Sheet, containing project name, Contractor's name, number of drawings, titles and other pertinent data such as section and article numbers.

#### 4. SAMPLES

- A. Deliver samples of materials, equipment, assemblies and components as required by specifications to Construction Manager for submittal to the Architect (or other designated location) with delivery costs prepaid. At Construction Manager's direction, remove samples after approval. Samples shall be of like kind to the products to be provided for building and shall have finish and other characteristics required by work. Samples shall indicate type of construction and quality proposed for installation in the project.
- B. Where the Contractor requires approved samples to be returned, submit the number of samples required by the Contractor plus three (3) which shall be retained by the Architect and Construction Manager.
- C. Submission of samples shall be accompanied by transmittal letter and required Submittal Cover Sheet, containing project name, Contractor's name, number of samples, titles and other pertinent data such as section and article numbers.

#### 5. LIST OF MATERIALS

- A. Within ten (10) days after the award of the contract (notice to proceed or letter of intent), the Contractor shall submit three (3) copies of a complete list of all materials, products, and equipment proposed to be used in construction to the Construction Manager for acceptance. Materials shall not be ordered until the proposed listed materials, products and equipment proposed to be used in construction are reviewed by the Architect for acceptance and the listed materials are accepted.

- B. Where two or more makes or kinds of items are named in the specifications (or additional names are called for in addendum), the Contractor shall state which particular make or kind of each item he proposes to provide. If the Contractor fails to state a preference, the Owner shall have the right to select any of the makes of kinds named without change in price.
- C. This list shall be arranged in order of specification sections. The items listed shall fully conform to project requirements and specifications. All materials are subject to the Architect's acceptance. After acceptance, there shall be no changes or substitutions.
- D. The list shall clearly identify the material, product or equipment by manufacturer and brand by listing the names, for all items, including those where only one material or product is specified. Each and all material, products and equipment shall be specifically named, not listed "as specified".

## 6. LIST OF SUBCONTRACTORS

- A. Within ten (10) days after the award of the contract (notice to proceed) and prior to the execution of the Contract, the Contractor shall submit three (3) copies of a complete list of all work he proposes to subcontract and the subcontractors (and major material suppliers) he proposes to use in performance of the Contract to the Construction Manager for review by the Architect, Construction Manager and Owner. The list shall include Sub-subcontractors. No subcontracts shall be executed until the proposed list of subcontractors is accepted.
- B. Reasonable objection shall be deemed to have been exercised when, in the opinion of the Architect or Owner, objections have been made based on their reasonable belief that the proposed Subcontractor, Sub-subcontractor or material supplier: (1) cannot provide materials, equipment, facilities or other products as specified or required by the Contract Documents; (2) cannot provide labor and skill necessary to accomplish the part of Work for which he is proposed, including but not limited to quality of workmanship; (3) lacks adequate and appropriate experience for the part of the Work for which he is proposed, including materials or methods required; (4) has previously failed to perform timely or satisfactorily, including in cooperation and in necessary services after project completion; (5) proposed deviations in material or methods that are unacceptable to the Architect or Owner, such as proposing materials or methods that were not specified or not listed in addenda; (6) there is reasonable doubt he can satisfactorily perform the part of the Work for which he is proposed, within the time schedule, due to size of organization or existing work load; (7) cannot demonstrate his ability through quality or representative work to perform the part of the Work for which he is being considered; (8) of questionable integrity; (9) or other similar considerations bearing on the possibility of unsatisfactory performance. If the Owner, Construction Manager or the Architect has a reasonable objection to any person or entity proposed by a substitute to whom neither the Owner, Construction Manager, nor the Architect has any reasonable objection and no increase in the Contract Sum shall be allowed as a result of any such substitution.

- C. After review of the proposed list, no change of any Subcontractor, Sub-subcontractor or supplier not objected to by the Architect, Construction Manager or Owner, shall be made, except for cause acceptable to all parties. In the event of a proposed change, the Contractor shall submit the reasons for the change, in writing, along with the alternate proposed Subcontractor, Sub-subcontractor or material supplier. The proposed change is subject to the conditions of this Article and the requirements of the General Conditions.

## 7. GUARANTEES AND WARRANTIES

- A. Refer to Section 01740 - Warranties.
- B. Special Warranties: Contractor shall complete all manufacturer's warranty registrations and shall submit same to Construction Manager for transmittal to Owner.

## 8. INSTRUCTION MANUALS

- A. For all items of mechanical equipment and electrical apparatus, the Contractor shall obtain from the manufacturer and furnish to the Construction Manager three (3) copies of the following:
  - 1. Operating instructions.
  - 2. Parts lists (including name and address of nearest vendor or service agent).
  - 3. Maintenance instructions.
  - 4. Shop Drawings.
- B. These items are separate from and in addition to the operating placards required to be attached to or posted near the equipment.
- C. Contractor shall provide field instruction to Owner's personnel as required to fully instruct them in correct operating and maintenance procedure, for all equipment installed under this contract.
- D. Manual shall be submitted in 8-1/2" x 11" form in adequately sized three (3) ring loose leaf binders with entire contents indexed and thumb-tabbed.

## 9. RECORD SET OF DRAWINGS

- A. Contractor shall provide the record set of drawings to the Construction Manager at the completion of Contract.
- B. During construction, Contractor shall maintain a clean set of drawings for the sole purpose of recording changes and actual "as installed" information.
- C. As a general guide, the type of information to be recorded on the record set includes: (1) changes, deviations or revisions made, except minor or noncritical dimensions, including those made by Change Order or Supplementary Instructions; (2) omissions, including work omitted by accepted alternates; (3) dimensioned locations of major or main utility lines, such as main conduit runs, piping mains and similar work; (4) locations of control valves; (5) additions to the work; (6) changes

in significant details; (7) changed footing or other elevations; (8) changes in locations of panelboards, outlets, drains, piping, opening, dampers and similar features; (9) other similar data. Refer to Section 01720 – Project Record Documents.

END OF SECTION 01300

**NEW PASSENGER TERMINAL  
DULUTH INTERNATIONAL AIRPORT****SECTION 01361 - SUSTAINABLE DESIGN  
REQUIREMENTS****DULUTH, MINNESOTA****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 RELATED SECTIONS**

- A. Construction Waste Management - Section 01524
- B. Construction IAQ Management - Section 01525
- C. Soil Erosion and Sedimentation Control Plan - Section 02125

**1.3 SUMMARY**

- A. The Owner requires the Contractor to implement practices and procedures to meet the Project's environmental performance goals, which include obtaining a LEED Silver certification based on LEED-NC, Version 2.2. Specific project features include (but are not limited to): materials and equipment that reduce the facility's energy and water consumption; recycled-content materials, locally-manufactured materials, low-emitting materials, construction waste recycling, and the implementation of a construction indoor air quality management plan. The Contractor shall ensure that the requirements related to these goals, as defined in this section and throughout the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work proposed by the Contractor or their subcontractors shall not be allowed if such changes compromise the stated LEED Requirements.

**1.4 DEFINITIONS**

- A. Certificates of Chain-of-Custody: Certificates signed by manufacturers verifying that the wood used to make products was obtained from forests certified by a Forest Stewardship Council (FSC) accredited certification body to comply with FSC "Principles and Criteria." Certificates shall include evidence that the mill is certified for chain-of-custody by an FSC-accredited certification body.
- B. LEED: The Leadership in Energy & Environmental Design rating system developed by the United States Green Building Council (USGBC). LEED-NC, New Construction, Version 2.2, is the rating system used for this project.
- C. Green Label Plus: The Carpet & Rug Institute's testing/certification program for carpet VOC emissions. Certification numbers guarantee product is within allowable VOC emission rates. Approved products are listed under the manufacturer's name at [www.carpet-rug.com/](http://www.carpet-rug.com/).



## 1.5 LEED OVERVIEW AND GENERAL REQUIREMENTS

### A. OVERVIEW:

1. LEED certification is determined by a system of assigned points (credits) based on sustainable building goals being met by a project.
2. There are some prerequisites for a project to qualify for LEED certification.
3. Some prerequisites and credits depend on material selections and may not be specifically identified as LEED requirements in this document. Refer to Item 1.7, LEED Prerequisites.
4. Some prerequisites and credits depend on the Architect's design and other aspects of the project that are not part of the work of the contractor.
5. LEED New Construction (NC) v. 2.2 Reference Guide is available at [www.usgbc.org/](http://www.usgbc.org/).

### B. GENERAL REQUIREMENTS:

For specific contractor requirements refer to Item 1.7, LEED Prerequisites and LEED ACTION PLANS under Item 1.9, LEED SUBMITTALS.

1. Erosion and Sedimentation Control (ESC)
  - a. Refer to Items 1.7 LEED Prerequisites and 1.9 LEED Submittals (Action Plans)
  - b. Typical precautions are:
    - 1) Silt fences, hay bales, and water retention areas to prevent sediment runoff
    - 2) Graveled truck wash-off areas
    - 3) Construction fencing to prevent dust from escaping the site
    - 4) Installation and maintenance of sump pumps
    - 5) Use of mulching and seeding, sometimes on a temporary basis
  - c. Refer to Civil Engineer's documents for project specific information
  - d. The Contractor shall in part:
    - 1) Develop an Erosion and Sedimentation Control (ESC) Plan in accordance with Section 02125
    - 2) Maintain ESC measures throughout the project
    - 3) Take dated photographs of the ESC measures in place
    - 4) Log maintenance activities, inspections and repairs after major rain falls.
2. Construction Waste Management (CWM)
  - a. Refer to Item 1.9 LEED Submittals (Action Plans).
  - b. CWM is the reuse of materials that otherwise would have been sent to a landfill.
  - c. The project requires that at least 50% of the construction waste be recycled.
  - d. Reused site materials such as stone, excavated soil and land-clearing debris cannot count towards the recycled percent.
  - e. The contractor shall in part:

- 1) A Construction Waste Management Plan shall be developed in accordance with Section 01524, Construction Waste Management outlining methods, goals and strategies.
  - 2) Maintain a spreadsheet with weight, category (e.g. concrete, metal, wood, paper), percent (%) diverted from landfill, method of diversion (i.e. recycled, reused, sold), dated, name of the hauler, and site of disposal.
  - 3) Keep back-up documentation (e.g. hauler's tickets, receipts from recycling centers, sales receipts).
3. Materials with Recycled Content
- a. LEED Recycled Content is the percent of a product that comes from recycled material. The percentage by weight of constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer), or after consumer use (post-consumer)
    - 1) Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.
    - 2) Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.
  - b. The project requirement is that at least 10% of the value of the project materials (without labor and equipment) be from recycled materials.
  - c. The manufacturer must provide the recycled content of the product.
  - d. To determine Recycled Content:
    - 1) The recycled content is determined by weight. 100% of post-consumer recycled content contributes, and 50% of pre-consumer (also called post-industrial) content contributes.
      - a) "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
      - b) "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.
    - 2) Determine the percentage of recycled content by weight:
      - a) Determine the total weight of the material or product.
      - b) Determine the weight of the recycled content contained in the product (100% post-consumer + 50% pre-consumer).
      - c) Divide the recycled content weight by the total weight to get a percentage (%) of recycled content by weight.

- 3) Determine the value of recycled content:
  - a) Determine the total value of the product (without labor and equipment)
  - b) Multiply the total value of the product by the percentage of recycled content to get the value of the recycled content.
- e. The contractor shall in part:
  - 1) Maintain a spreadsheet showing the recycled materials purchased, including the material name, supplier, percentage of pre-consumer and percentage of post consumer recycled material, the weight of the material, the value of the material (without labor and equipment), and the source of the recycled content information.
  - 2) Maintain records of recycled materials, including cut sheets, published product information and cost back up.
  - 3) Submit a completed "Green Building Materials Reporting Form" (GBMRF) in accordance with Item 1.9, LEED Submittals for each product, along with back up. A blank copy of the GBMRF is included at the end of this document.
4. Regional Materials
  - a. To qualify as LEED Regional Content a material must:
    - 1) Be manufactured within a 500 mile radius, AND
    - 2) Be extracted or harvested within a 500 mile radius.
  - b. The project goal is that at least 10% of the value of the project materials (without labor and equipment) be from regional materials.
  - c. The manufacturer must provide the location of manufacture and the location of extraction/harvest.
  - d. To determine Regional Content for LEED:
    - 1) Determine that the product is manufactured regionally
    - 2) Determine the percentage (%) of regional material weight:
      - a) Determine the total weight of the material or product
      - b) Determine the weight of the regional harvested/extracted component
    - 3) Divide the regionally harvested weight by the total weight to get a percentage (%) of regionally manufactured and harvested material.
  - e. Determine the value of the regional content:
    - 1) Determine the total cost of the product (without labor and equipment).
    - 2) Multiply the total value of the product by the percentage (%) of regionally manufactured and harvested material content to get the value of the Regional Content.
  - f. The contractor shall in part:
    - 1) Maintain a spreadsheet showing the Regional Materials purchased, including the material name, supplier, percentage (%) of locally extracted/harvested materials (by weight), the total weight of the material, the cost of the material (without labor and equipment), and the source of the regional content information.

- 2) Maintain records of Regional Materials, including cut sheets, published product information and cost back up.
  - 3) Submit a completed "Green Building Materials Reporting Form" (GBMRF) in accordance with Item 1.9, LEED Submittals for each product, along with back up. A blank copy of the GBMRF is included at the end of this document.
5. Low-Emitting Materials
- a. Refer to Items 1.9 LEED Submittals (Action Plans) and 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials".
  - b. Carpet Systems
    - 1) Use carpets and carpet backing that meet the requirements for the Carpet and Rug Institute's Green Label Plus Program.
    - 2) Use carpet adhesives that do not have Volatile Organic Compound (VOC) contents in excess of 50 grams/liter
  - c. Adhesives, Sealants, Paints and Coatings
    - 1) Use adhesives, sealants paints and coating that have a Volatile Organic Compound (VOC) limit below certain thresholds.
    - 2) Chemical component limitations are also defined for some categories of paint and primer.
    - 3) Maintain records of adhesives, sealants, paints and coatings including the manufacturer, product name and VOC content in grams per liter or pound per gallon.
  - d. Non-Urea-formaldehyde Resins (Engineered Wood Products and Laminate Adhesives)
    - 1) Do not use engineered wood, composite wood or agrifiber board that contains urea-formaldehyde glue for any permanently installed materials or assemblies.
    - 2) Do not use adhesives containing urea-formaldehyde resins for bonding veneers and other laminates to substrates, both on-site and for shop work.
    - 3) Examples of materials included in this restriction are plywood, medium density fiberboard, door cores, wheat-board, strawboard, and panel substrates.
    - 4) Maintain records of engineered wood products with manufacturer, product name and manufacturer's written statement that product does not contain urea-formaldehyde resin.
  - e. Forest Stewardship Council (FSC) Certified Materials
    - 1) To qualify as FSC wood material must:
      - a) Have its own FSC label and Chain of Custody (COC) Certificate (Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD 01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for Chain of Custody by an FSC-accredited certification body), OR

- b) Be manufactured in a shop that has its own FSC Certificate out of at least 70% FSC Certified wood.
  - 2) The FSC wood content of the project can be determined by material costs (without labor and equipment), weight, or volume, but the same criteria must be applied consistently.
  - 3) The Contractor shall in part:
    - a) Maintain a spreadsheet showing the new wood materials purchased, including the material name, supplier, percentage (%) FSC Certified content, the total cost/weight/volume of the material, the cost of the material (without labor and equipment), the supplier and the COC Certificate number.
    - b) Maintain records of FSC wood, including COC Certificates, cut sheets, published product information and cost back up.
    - c) Submit a completed "Green Building Materials Reporting Form" (GBMRF) in accordance with Item 1.9, LEED Submittals for each product, along with back up. A blank copy of the GBMRF is included at the end of this document.
- 6. Indoor Air Quality (IAQ) During Construction
  - a. IAQ during construction addresses the reduction of pollutants in the project
  - b. Comply with Sheet Metal and Air Conditioning National Contractors' Association (SMACNA) Guidelines, as stated in Chapter 3 of the referenced "IAQ Guidelines for Occupied Buildings Under Construction". The Construction IAQ Management Plan shall be organized in accordance with the SMACNA format, and shall address measures to be implemented by the Contractor and/or Subcontractors in each of the five categories (including subsections).
  - c. The Contractor Shall in part:
    - 1) Develop an IAQ Management Plan in accordance with Section 01525, Construction IAQ Management to be implemented by the Construction Manager, and by their subcontractors throughout the duration of the project construction, under the direction of the Construction Manager, and shall be documented per the Submittal Requirements of Item 1.9, LEED Submittals.
    - 2) Take Photographs (18 Total) that document the implementation of the Construction IAQ Management Plan throughout the course of the project construction. Examples include photographs of ductwork sealing and protection, temporary ventilation measures, and conditions of on-site materials storage (to prevent moisture damage). Photographs shall include integral date stamping, and shall be submitted with brief descriptions, or a reference to project meeting minutes or similar project documents.
- 7. Commissioning of Building Systems

- a. The project is required to meet the LEED requirements for Enhanced Commissioning
- b. Coordinate and support the efforts of the Commissioning Agent.

## 1.6 REFERENCES, STANDARDS, AND REGULATORY REQUIREMENTS

- A. General: Comply with the applicable provisions of the referenced standards except as modified by governing codes and the Contract Documents. Where a recommendation or suggestion occurs in the referenced standards, such recommendation or suggestion shall be considered mandatory. In the event of conflict between referenced standards, this specification or within themselves, the more stringent standard or requirement shall govern.
  - 1. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
  - 2. Carpet and Rug Institute (CRI)
  - 3. Environmental Protection Agency (EPA)
  - 4. Forest Stewardship Council (FSC)
  - 5. Green Seal (GS)
  - 6. Illuminating Engineering Society of North America (IESNA)
  - 7. Sheet Metal and Air-Conditioning National Contractor Association (SMACNA)
  - 8. South Coast Air Quality Management District (SQAMD)
  - 9. United States Green Building Council (USGBC): Leadership in Energy and Environmental Design (LEED) Green Building Rating System, Version CS-2.0.
- B. Rule 1168 – “Adhesive and Sealant Applications”, effective dated of July 1, 2005 and Rule Amendment date of January 7, 2005: South Coast Air Quality Management District (SCAQMD), State of California, [www.aqmd.gov](http://www.aqmd.gov).
- C. “Green Seal Standard for Commercial Adhesives”, GS-36, requirements in effect October 19, 2000, [www.greenseal.org/](http://www.greenseal.org/).
- D. “Green Seal Standard for Architectural Coating”, GS-11, plus “Green Seal Standard for Anti-Corrosive Paints”, GS-03, [www.greenseal.org/](http://www.greenseal.org/).
- E. Rule 1113 “Architectural Coatings”, amended 7/9/04: South Coast Air Quality Management District (SQAMD), State of California, [www.aqmd.gov](http://www.aqmd.gov).
- F. SMACNA IAQ “Guidelines for Occupied Buildings Under Construction”: Sheet Metal and Air-Conditioning National Contractor Association (SMACNA) November 1995, [www.smacna.org](http://www.smacna.org).
- G. ANSI/ASHRAE 52.2, “Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size”. [www.ashrae.org](http://www.ashrae.org).

## 1.7 LEED PREREQUISITES

- A. The following LEED Prerequisites are required in order to achieve the project's targeted LEED rating. Compliance with all applicable prerequisite criteria, as defined in this specification and the contract drawings, is mandatory.
1. Prerequisite SS 1, Construction Activity Pollution Prevention
  2. The contractor and their subcontractors shall develop and implement a site Erosion and Sediment Control Plan which complies with all applicable regulatory requirements and the applicable control measures established in Chapter 3, "Sediment and Erosion Control" of the U.S. Environmental Protection Agency (EPA) document No. 832R92005, Storm Water Management for Construction Activities, September 1992.
  3. Prerequisite EA 1, Fundamental Commissioning of the Building Energy Systems
  4. Building systems including HVAC, lighting, electrical, domestic hot water and renewable energy systems (if applicable) shall be commissioned, with oversight provided by a third-party Commissioning Authority contracted directly to the Owner. Commissioning requirements shall be defined under Divisions 1, 15, 16 and 17.
  5. Prerequisite EA 2, Minimum Energy Performance
  6. The project is designed to meet or exceed the energy conservation requirements of the standard ASHRAE/IESNA 90.1-2004, "Energy Standard for Buildings except Low-Rise Residential Buildings".
  7. Prerequisite EA 3, CFC Fundamental Refrigerant Management
  8. Chlorofluorocarbon (CFC) refrigerants are prohibited from all HVAC&R systems installed as part of the project.
  9. Prerequisite MR 1, Storage & Collection of Recyclables
  10. The project includes dedicated storage/collection facilities for recyclable materials, including paper, corrugated cardboard, glass, plastics and metals.
  11. The project is designed to meet or exceed the ventilation performance requirements of standard ASHRAE 62.1-2004, "Ventilation for Acceptable Indoor Air Quality", including approved Addenda.
  12. Prerequisite EQ 1, Minimum IAQ Performance
  13. Prerequisite EQ 2, Environmental Tobacco Smoke (ETS) Control
  14. Smoking shall be prohibited in the public areas of the building and exterior designated smoking areas shall be 25 feet from entries, air intakes and operable windows. No applicable contractor/subcontractor requirements.

## 1.8 LEED PERFORMANCE CRITERIA FOR MATERIALS

- A. The following sub-sections, organized by CSI Division, list the required LEED performance criteria for materials used in this project. Product substitutions, if proposed by the Contractor or their subcontractors, shall not be allowed if such changes compromise the stated LEED requirements. The percentages should be adjusted to reflect availability of products with the greatest amount of recycled content within the S. Korean market.
1. It is the responsibility of the contractors to bring to the attention of the Architect any conflicts between the LEED Performance criteria listed in this section and any additional performance criteria or "acceptable products" listed in other sections of the contract documents (specifications or drawings). These conflicts shall be brought to the Architect's attention for resolution prior to the purchase or installation of the materials in question. LEED criteria will not be waived unless specifically approved, in writing, by the Architect.
- B. DIVISION 2 – SITE CONSTRUCTION
1. Recycled Content Materials:
    - a. While there is no minimum requirement for the use of flyash, ground granulated blast furnace (GGBF) slag, or other recycled materials within the concrete mix designs, the use of such products is encouraged where: 1) it is readily available; 2) it does not negatively impact the performance characteristics of the concrete; and 3) it does not add to the product cost. Any use of flyash, GGBF slag, or other recycled materials within the concrete mix designs shall be reported and documented in accordance with Item 1.9, LEED Submittals below. All design mixes are subject to review and approval by the project's Structural Engineer.
    - b. Recycled materials within the concrete mix designs shall be reported and documented in accordance with Item 1.9, LEED Submittals below. All design mixes are subject to review and approval by the project's Structural Engineer.
    - c. Steel reinforcing bar, rods, wire, and welded wire fabric shall contain a minimum of 25% combined post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with Item 1.9, LEED Submittals below.
  2. Regionally-manufactured/Harvested Materials
    - a. The manufacturing locations for concrete and bituminous pavement materials shall be within 500 miles (by air) of the project site, and shall be documented in accordance with Item 1.9, LEED Submittals below.
    - b. The location of the nursery or other source for all landscape plantings shall be documented in accordance with Item 1.9, LEED Submittals below.
- C. DIVISION 3 - CONCRETE



1. Recycled Content Materials:

- a. While there is no minimum requirement for the use of flyash, ground granulated blast furnace (GGBF) slag, or other recycled materials within the concrete mix designs, the use of such products is encouraged where: 1) it is readily available; 2) it does not negatively impact the performance characteristics of the concrete; and 3) it does not add to the product cost. Any use of flyash, GGBF slag, or other recycled materials within the concrete mix designs shall be reported and documented in accordance with Item 1.9, LEED Submittals below. All design mixes are subject to review and approval by the project's Structural Engineer.
- b. Steel reinforcing bar, rods, wire, welded wire fabric, anchors, and ties shall contain a minimum of 25% combined post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with Item 1.9, LEED Submittals below.

2. Regionally-manufactured/Harvested Materials

- a. The manufacturing location(s) for cast-in-place concrete shall be within 500 miles (by air) of the project site, and shall be documented in accordance with Item 1.9, LEED Submittals below.
- b. The manufacturing location(s) for steel reinforcing products shall be documented in accordance with Item 1.9, LEED Submittals below.
- c. The origin of the raw materials from which the concrete and steel reinforcing products were manufactured shall be documented in accordance with Item 1.9, LEED Submittals below.

3. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

D. DIVISION 4 – MASONRY

1. Recycled Content Materials:

- a. Steel reinforcing bar, rods, wire, anchors, and ties shall contain a minimum of 25% combined post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with Item 1.9, LEED Submittals below.

2. Regionally-manufactured/Harvested Materials

- a. The manufacturing location(s) for all concrete masonry units shall be within 500 miles (by air) of the project site, and shall be documented in accordance with Item 1.9, LEED Submittals below.
  - b. The manufacturing location(s) for dimensional stone and for steel reinforcing products shall be documented in accordance with Item 1.9, LEED Submittals below.
  - c. The origin of the raw materials from which the concrete masonry units and dimensional stone products were manufactured shall be documented in accordance with Item 1.9, LEED Submittals below.
3. Low-emission Products:
- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

#### E. DIVISION 5 – METALS

1. Recycled Content Materials:
- a. Structural Steel, steel deck and miscellaneous steel shall contain a minimum of 35% combined post-industrial/post consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with item 1.9, LEED Submittals below.
2. Regionally-manufactured/Harvested Materials
- a. The manufacturing location(s) for all structural steel products shall be documented in accordance with Item 1.9, LEED Submittals below. For the purposes of this LEED credit, the steel fabricator can be considered the manufacturer.
  - b. The origin of the raw materials from which the structural steel and steel deck was manufactured shall be documented in accordance with Item 1.9, LEED Submittals below. For the purposes of this LEED credit, the steel mill can be considered the source of the raw material.

3. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

F. DIVISION 6 – WOODS, PLASTICS AND COMPOSITES shall be revised to state the following:

1. Certified Wood:

- a. The use of "FSC Certified" products is required in all wood products as listed under Item 1.11, Products where available. If a wood product with the "FSC Certified" label does not exist or is not available, a non "FSC Certified" product may be substituted in place. Any use of "FSC Certified" wood products (except recycled or salvaged wood) which have been harvested in accordance with the "FSC Principles and Criteria" for well-managed forests developed by the Forest Stewardship Council (FSC) shall be reported and documented in accordance with Item 1.9, LEED Submittals below.

2. Low-emission Products:

- a. All composite wood, engineered wood, or agrifiber products (e.g., plywood, particleboard, and medium-density fiberboard) shall contain no added urea-formaldehyde resins. Acceptable resins and binders include, but are not limited to, phenol formaldehyde and methyl diisocyanate (MDI). Certification of these products shall be in accordance with Item 1.9, LEED Submittals below.
- b. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

G. DIVISION 7 - THERMAL AND MOISTURE PROTECTION

1. Recycled Content Materials:

- a. The post-industrial and/or post-consumer recycled content (by weight) of fiberglass insulation products shall be reported and documented in accordance with Item 1.9, LEED Submittals below.
- b. The post-industrial and/or post-consumer recycled content (by weight) of Mineral-wool insulation products shall be reported and documented in accordance with Item 1.9, LEED Submittals below.

- c. The post-industrial and/or post-consumer recycled content (by weight) of metal wall panels shall be documented in accordance with Item 1.9, LEED Submittals below.
  - d. The post-industrial and/or post-consumer recycled content (by weight) of metal roof panels shall be documented in accordance with Item 1.9, LEED Submittals below.
  - e. The post-industrial and/or post-consumer recycled content (by weight) of Cementitious and/or fibrous fireproofing shall be reported and documented in accordance with Item 1.9, LEED Submittals below. Metal lath and reinforcing fabric shall contain a minimum of 25% (combined) post-industrial/post-consumer recycled content. Certification of recycled content shall be in accordance with Item 1.9, LEED Submittals below.
  - f. The post-industrial and/or post-consumer recycled content (by weight) of Polystyrene Insulation products shall be reported and documented in accordance with Item 1.9, LEED Submittals below. Certification of recycled content shall be in accordance with Item 1.9, LEED Submittals below.
2. Regionally-manufactured/Harvested Materials
- a. The manufacturing location(s) for metal wall panels shall be documented in accordance with Item 1.9, LEED Submittals below. For the purposes of this LEED credit, the steel fabricator can be considered the manufacturer.
  - b. The manufacturing location(s) for metal roof panels shall be documented in accordance with Item 1.9, LEED Submittals below. For the purposes of this LEED credit, the steel fabricator can be considered the manufacturer.
  - c. The origin of the raw materials from which the metal wall panels were manufactured shall be documented in accordance with Item 1.9, LEED Submittals below. For the purposes of this LEED credit, the steel mill can be considered the source of the raw material.
  - d. The origin of the raw materials from which the metal roof panels were manufactured shall be documented in accordance with Item 1.9, LEED Submittals below. For the purposes of this LEED credit, the steel mill can be considered the source of the raw material.
  - e. Energy Star roof materials manufactured within 500 miles (by air) of the project site shall be documented in accordance with Item 1.9, LEED Submittals below.
3. Energy Star Roofing
- a. All exposed roofing products including membranes and pavers shall be ENERGY STAR® compliant and have a Solar Reflectance Index (SRI) of at least 78 when tested in accordance with ASTM E-1980. Any selected product with an SRI less than 78 requires the Architect's approval.

4. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

H. DIVISION 8 – DOORS AND WINDOWS

1. Recycled Content Materials:

- a. The post-industrial and/or post-consumer recycled content (by weight) of Aluminum curtain wall shall be reported and documented in accordance with Item 1.9, LEED Submittals below.
- b. Steel doors with recycled content shall be documented in accordance with Item 1.9 (LEED Submittals) below.

2. Regionally-manufactured/Harvested Materials

- a. Aluminum curtain wall systems manufactured within a 500 mile radius of the project shall be documented in accordance with Item 1.9, LEED Submittals below.
- b. Steel doors manufactured within a 500 mile radius of the project shall be documented in accordance with Item 1.9, LEED Submittals below.

3. Certified Wood

- a. Wood doors made from "FSC Certified" products (except recycled or salvaged wood) which have been harvested in accordance with the "FSC Principles and Criteria" for well-managed forests developed by the Forest Stewardship Council (FSC) shall be reported and documented in accordance with Item 1.9, LEED Submittals below.

4. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.
- b. All composite wood, engineered wood, or agrifiber products (e.g., plywood, particleboard, and medium-density fiberboard) shall contain no added urea-formaldehyde resins. Acceptable resins and binders include, but are not limited to, phenol formaldehyde and methyl diisocyanate (MDI). Certification of these products shall be in accordance with Item 1.9, LEED Submittals below.

## I. DIVISION 9 – FINISHES

### 1. Recycled Content Materials:

- a. Gypsum wallboard shall contain “synthetic” gypsum produced with a minimum of 90% post-industrial recycled content, if readily available. Recycled content shall be documented in accordance with Item 1.9, LEED Submittals below.
- b. Steel studs, track, and miscellaneous framing shall contain a minimum of 25% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Recycled content shall be documented in accordance with Item 1.9, LEED Submittals below.
- c. The post-industrial and/or post-consumer recycled content (by weight) of Mineral Fiber Acoustical Ceiling Panels shall be reported and documented in accordance with Item 1.9, LEED Submittals below.
- d. Steel ceiling grid and suspension system shall have a minimum of 25% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Recycled content shall be documented in accordance with Item 1.9, LEED Submittals below.
- e. The post-industrial and/or post-consumer recycled content (by weight) of Carpet tile face fibers and/or backings shall be reported and documented in accordance with Item 1.9, LEED Submittals below.
- f. The post-industrial and/or post-consumer recycled content (by weight) of Broadloom carpet shall be reported and documented in accordance with Item 1.9, LEED Submittals below.

### 2. Regionally-manufactured/Harvested Materials

- a. Gypsum wallboard products manufactured within 500 miles (by air) of the project site shall be documented in accordance with Item 1.9, LEED Submittals below.
- b. The origin of the raw materials from which the gypsum wallboard was manufactured shall be documented in accordance with Item 1.9, LEED Submittals below.
- c. The manufacturing location(s) for steel studs, track, and miscellaneous framing shall be documented in accordance with Item 1.9 LEED Submittals below. For the purposes of this LEED credit, the steel fabricator can be considered the manufacturer.
- d. Acoustical panel ceiling products manufactured within 500 miles (by air) of the project site shall be documented in accordance with Item 1.9, LEED Submittals below.
- e. The origin of the raw materials from which the miner fiber acoustical ceiling panels were manufactured shall be documented in accordance with Item 1.9, LEED Submittals below.

### 3. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.
- b. Carpet, Carpet Backing and Carpet tiles and adhesives shall meet or surpass all criteria of the "Green Label Plus" Indoor Air Quality Test Program established by the Carpet and Rug Institute (CRI) of Dalton, Georgia.

#### J. DIVISION 10 – SPECIALTIES

##### 1. Recycled Content Materials:

- a. The post-industrial and/or post-consumer recycled content (by weight) of Plastic toilet partitions shall be reported and documented in accordance with Item 1.9, LEED Submittals below.

##### 2. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

#### K. DIVISION 11 – EQUIPMENT

##### 1. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

#### L. DIVISION 12 – FURNISHINGS

##### 1. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to

comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

- b. All composite wood, engineered wood, or agrifiber products (e.g., plywood, particleboard, and medium-density fiberboard) shall contain no added urea-formaldehyde resins. Acceptable resins and binders include, but are not limited to, phenol formaldehyde and methyl diisocyanate (MDI). Certification of these products shall be in accordance with Item 1.9, LEED Submittals.

#### M. DIVISION 13 – SPECIAL CONSTRUCTION

##### 1. Low-emission Products:

- a. All composite wood, engineered wood, or agrifiber products (e.g., plywood, particleboard, medium density fiberboard) in fixed audience seating shall contain no added urea-formaldehyde resins. Acceptable resins and binders include, but are not limited to, phenol formaldehyde and methyl diisocyanate (MDI). Certification of these products shall be in accordance with Item 1.9, LEED Submittals below.
- b. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., “VOC Limits for Low-Emitting Materials”. Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

#### N. DIVISION 14 – CONVEYING SYSTEMS

##### 1. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., “VOC Limits for Low-Emitting Materials”. Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

#### O. DIVISION 15 – MECHANICAL

##### 1. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., “VOC Limits for Low-Emitting Materials”. Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

#### P. DIVISION 16 – ELECTRICAL



1. Low-emission Products:

- a. Field-applied adhesives, sealants, and paints shall meet the requirements of Item 1.11, Products, Sub-Item D., "VOC Limits for Low-Emitting Materials". Only those products used on the interior of the building (inside of the weatherproofing system) are required to comply with these requirements. VOC content shall be documented in accordance with Item 1.9, LEED Submittals below.

1.9 LEED SUBMITTALS

- A. LEED submittals are required for all installed materials in specification Divisions 2 through 12 and adhesives, sealants, and paints through Divisions 16. The GREEN BUILDING Submittal information shall be assembled into one (1) package per Specification section or sub-contractor. Two (2) copies of the submittals are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies. Contractor and/or subcontractors shall submit the following LEED BUILDING reporting items:

- 1. A completed GREEN BUILDING MATERIALS REPORTING FORM (GBMRF) for each trade (sample to be provided by architect). Information to be supplied for this form shall include:
  - a. Cost breakdowns for the materials included in the contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and itemized material costs.
  - b. The amount of post consumer and/or post industrial recycled content in the supplied products.\*
  - c. Identification (Y/N) of materials manufactured within 500 miles of the project site.\*
  - d. Identification (Y/N) of materials harvested or extracted within 500 miles of the project site.\*
  - e. Identification (Y/N) of "FSC Certified" wood products used.\*
  - f. VOC content of all field applied adhesives, sealants, and paints used in interior applications.

\*If applicable – see Item 1.8 (LEED Performance Criteria for Materials) above to determine the applicable reporting based on the material type.

- B. MATERIALS REPORTING FORM BACK-UP DOCUMENTATION: These documents are used to validate the information provided on the Green Building Materials Reporting Form (except cost data). For each material listed on the form, provide documentation to certify the material's LEED BUILDING attributes, as applicable:
  - a. Recycled content: Provide published product literature or letter of certification on the manufacturer's letterhead certifying the amounts of post-consumer and/or post-industrial content.
  - b. Regional manufacturing (within 500 miles): Provide published product literature or letter of certification on the manufacturer's letterhead

indicating the city/state where the manufacturing plant is located and the distance in miles from the project site.

- c. Regional raw materials (within 500 miles): Provide published product literature or letter of certification on the manufacturer's letterhead indicating the city/state from which each of the raw materials in the product were extracted, harvested or recovered, and the distance in miles from the project site.
    - 1) If only some of the raw materials for a particular product or assembly originate within 500 miles of the project site, provide the percentage (by weight) that these materials comprise in the complete product.
  - d. FSC Certified Wood:
    - 1) Provide vendor invoices for each wood product that has been harvested in accordance with the "FSC Principles and Criteria" for well-managed forests developed by the Forest Stewardship Council (FSC) of Bonn, Germany. Invoices shall include chain-of-custody certificate numbers and itemized costs for all certified products.
    - 2) For assemblies, provide the percentage (by cost and by weight) of the assembly that is FSC-certified wood.
  - e. VOC content: Provide Material Safety Data Sheets (MSDS) certifying the Volatile Organic Compound (VOC) content of the adhesive, sealant, paint, or coating products. VOC content is to be reported in grams/liter or lbs/gallon. If the MSDS does not show the product's VOC content, this information must be provided through other published product literature from the manufacturer, or stated in a letter of certification from the product manufacturer on the manufacturer's letterhead.
1. PRODUCT CUT SHEETS: Provide product cut sheets with the Contractor's or sub-contractor's stamp, confirming that the submitted products are the products installed in the Project.
  2. CRI GREEN LABEL CERTIFICATION: For carpets and carpet cushions, provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying that the products comply with the "Green Label Plus" IAQ testing program of the Carpet and Rug Institute of Dalton, GA.
  3. CARPET COMPONENT IDENTIFICATION: For all synthetic carpets, provide documentation from the manufacturer on the manufacturer's letterhead of the specific carpet component identification code that is printed on, or attached to, the carpet supplied for the project. The code must identify the carpet face fiber, and may identify its primary backing, secondary backing, adhesive, adhesive filler, and dyes.

4. **CERTIFICATION OF COMPOSITE WOOD OR AGRIFIBER RESINS:** For all composite wood, engineered wood and agrifiber products, provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying that the products do not contain added urea-formaldehyde resins.
5. **CERTIFICATION OF COMPOSITE WOOD OR AGRIFIBER LAMINATING ADHESIVES:** For all composite wood, engineered wood and agrifiber products, provide published product literature or letter from the manufacturer on the manufacturer's letterhead verifying that the products do not contain added urea-formaldehyde or phenol-formaldehyde resins.
6. **GREEN SEAL COMPLIANCE:** Provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying that the following product types comply with the VOC limits and chemical component restrictions developed by the Green Seal organization of Washington, DC ([www.greenseal.org/](http://www.greenseal.org/)):
  - a. Topcoat paints: refer to Green Seal standard GS-11 (1st edition, May 1993)
  - b. Anti-corrosive and Anti-rust paints: refer to Green Seal standard GS-03 (2nd Edition, January 1997)
  - c. Aerosol Adhesives: refer to Green Seal standard GS-36 (1st edition, October 2000)
7. **ENERGY STAR ROOFING:** For exposed roofing materials, including membranes and pavers, provide certification from the manufacturer of ENERGY STAR compliance for the Solar Reflectance Index (SRI). (An SRI of at least 78 when tested in accordance with ASTM E-1980).
8. **HIGH ALBEDO ROOFING:** For exposed roofing membranes, pavers, and ballast products, provide published product literature or letter from the manufacturer on the manufacturer's letterhead verifying the following minimum Solar Reflectance Index (SRI) values:
  - a. 78 for low-sloped roofing applications (slope  $\leq$  2:12)
  - b. 29 for steep-sloped roofing applications (slope  $>$  2:12)
  - c. SRI values shall be calculated according to ASTM E 1980.
  - d. Reflectance shall be measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance shall be measured according to ASTM E 408 or ASTM C 1371.
  - e. Vegetated roof surfaces are exempt from the SRI criteria.
9. **HIGH ALBEDO PAVEMENT AND WALKWAYS:** For paving and walkway materials made from concrete or brick provide published product literature or letter from the manufacturer on the manufacturer's letterhead verifying a minimum Solar Reflectance Index (SRI) value of 29. SRI values shall be calculated according to ASTM E 1980. Reflectance shall be measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance shall be measured according to ASTM E 408 or ASTM C 1371.

C. CONSTRUCTION PROGRESS

1. Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
2. Waste Reduction Progress Reports complying with Division 01524 Section "Construction Waste Management".
3. Regional Materials. Provide updated spreadsheet to track Regional Materials.
4. Recycled Content Materials. Provide updated spreadsheet to track Recycled Content.
5. FSC Certified Wood Products. Provide updated spreadsheet to track FSC Certified Wood Materials.
6. Low Emitting VOC Content Materials. Provide updated spreadsheet to track Low Emitting VOC Content Materials.
7. Low Emitting Composite Wood. Provide updated spreadsheet to track low emitting (non-urea-formaldehyde) composite and engineered wood products.

D. LEED ACTION PLANS

- a. The following plans are to be prepared by the Contractor and refer to work reviewed in Items 1.5, LEED Overview and General Requirements of this section.
- b. Erosion and Sedimentation Control Plan (ESC): Indicate what ESC for site work measures are anticipated and how they will be documented.

E. Construction Waste Management (CWM):

- a. General: Develop a plan consisting of waste identification, waste reduction work plan, and progress reporting per the requirements of Section 01524, Construction Waste Management. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
1. Construction Indoor Air Quality Management (IAQ): A copy of the draft and final versions of the Construction IAQ Management Plan, as defined below.
  - a. General: Develop a plan in accordance with Section 01525, Construction IAQ Management where construction activities are planned to meet or exceed standards included in Chapter 3 of the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction", First Edition, 1995.
  - b. Upon the Plan's approval by the Owner and Consultant, the Contractor and subcontractors shall implement the Plan through the duration of the construction process.
    - 1) Develop a construction schedule outlining the start-up date and expected duration of all Construction IAQ Management Plan control measures.

1.10 QUALITY ASSURANCE

- A. Contractor's Quality Control Responsibilities: Contractor is solely responsible for the quality control of the work.

- B. Contractor's LEED Representative: Designate a Representative that is LEED accredited by the USGBC. Contractor's LEED Representative shall oversee the sustainable building for the project, shall instruct workers concerning these goals, and shall be present on site when work is in progress.
- C. LEED Certification Meetings: Schedule and conduct LEED Certification meetings monthly in addition to those outlined in Division 1 "Project Management and Coordination". Meeting attendees shall include at least the following: Owner's Representative, Architect, Contractor's Project Manager, Contractor's LEED Representative, and Sub-Contractor Representatives as appropriate to the stage of work. Discuss LEED Certification at Pre-bid, Pre-construction, and regular job site meetings.
- D. LEED Training: Provide environmental training for workers performing work on the project site. Training shall include the following:
  - 1. Overview of environmental issues related to the building industry
  - 2. LEED Building System – Requirements for this project

#### 1.11 PRODUCTS

- A. Materials with Recycled Content
  - 1. Provide recycled content and/or report recycled content as indicated in Items 1.8, LEED Performance Criteria for Materials and 1.9, LEED Submittals.
- B. Regional Materials
  - 1. Report regional content as indicated in Items 1.8, LEED Performance Criteria for Materials and 1.9, LEED Submittals.
- C. Forest Stewardship Council Certified Materials
  - 1. Track and report (by cost) of permanently all installed wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
    - a. Wood-based materials included, but are not limited to, the following materials when made from wood, engineered wood products, or wood based panels products:
      - 1) Rough carpentry
      - 2) Miscellaneous carpentry
      - 3) Heavy timber construction
      - 4) Wood decking
      - 5) Metal-plate-connected wood trusses
      - 6) Structural glued-laminated timber
      - 7) Finish carpentry
      - 8) Architectural woodwork
      - 9) Wood paneling
      - 10) Wood veneer wall covering
      - 11) Wood flooring
      - 12) Wood lockers
      - 13) Wood cabinets
- D. VOC Limits for Low-Emitting Materials

1. Field-Applied Adhesives and Sealants:
  - a. The VOC content of adhesives, adhesive bonding primers, or adhesive primers used in this project shall not exceed the limits defined in Rule 1168 "Adhesives and Sealant Applications" of the South Coast Air Quality Management District (SCAQMD) of the State of California.
  - b. The VOC content of aerosol adhesives shall not exceed the limits defined in the Green Seal Standards for Commercial Adhesives GS-36, requirements in effect October 19, 2000.
  - c. Sealants used as filler must meet or exceed California Bay Area Air Resources Board Reg. 8, Rule 51, Organic Compounds: Adhesive and Sealant Products (Adopted November 18, 1992, with Amendments through January 7, 1998).
  - d. The VOC limits defined by SCAQMD (based on 1/7/05 amendments) are as follows. All VOC limits are defined in grams per liter, less water and less exempt compounds.
  - e. General: Unless otherwise specified below, the VOC content of all adhesives, adhesive bonding primers, or adhesive primers shall not be in excess of 250 grams per liter.
  - f. Non-General: For specified applications, the allowable VOC content is as follows (in grams/liter):
    - 1) Architectural Applications
 

a)	Indoor carpet adhesive	50
b)	Carpet pad adhesive	50
c)	Outdoor carpet adhesive	150
d)	Wood flooring adhesive	100
e)	Rubber floor adhesive	60
f)	Sub-floor adhesive	50
g)	Ceramic tile adhesive	65
h)	VCT and asphalt tile adhesive	50
i)	Drywall and panel adhesive	50
j)	Cove base adhesive	50
k)	Multipurpose construction adhesive	70
l)	Structural glazing adhesive	100
m)	Single ply roof membrane adhesives	450
    - 2) Specialty Applications
 

a)	PVC welding	510
b)	CPVC welding	490
c)	ABS welding	325
d)	Plastic cement welding	250
e)	Adhesive primer for plastic	550
f)	Contact adhesive	80
g)	Special purpose contact adhesive	250
h)	Structural wood member adhesive	140
i)	Sheet applied rubber lining operations	850
    - 3) Substrate Specific Applications
 

a)	Metal to metal	30
b)	Plastic foams	50
c)	Porous material (except wood)	50

- |  |    |            |    |
|--|----|------------|----|
|  | d) | Wood       | 30 |
|  | e) | Fiberglass | 80 |
2. If an adhesive is used to bond dissimilar substrates together, the adhesive with the highest VOC content shall be allowed.
  3. VOC limits for aerosol adhesives (defined as % of VOC weight in grams per liter less water):
    - a. General purpose mist spray 65% VOC by weight
    - b. General purpose web spray 55% VOC by weight
    - c. Special purpose aerosol adhesives 70% VOC by weight
  4. The VOC content of sealants or sealant primers used in this project shall not exceed the limits defined in Rule 1168 "Adhesives and Sealant Applications" of the South Coast Air Quality Management District (SCAQMD) of the State of California.
  5. The VOC limits defined by SCAQMD Rule 1168 are as follows. All VOC limits are defined in grams per liter, less water and less exempt compounds.
    - a. Sealants
 

1)	Architectural	250
2)	Marine deck	760
3)	Roadways	250
4)	Single ply roof material installation/repair	450
5)	Non-membrane roof installation/repair	300
6)	Other	420
    - b. Sealant Primer
 

1)	Architectural - nonporous	250
2)	Architectural - porous	775
3)	Other	750
  6. Paints and Coatings:
    - a. Paints and primers (non-specialized applications): Paints and primers used in non-specialized interior and exterior applications (i.e. For wallboard, plaster, wood, metal doors and frames, etc.) shall meet the VOC and chemical component limitations of the Green Seal Paint Standard GS-11, and anti-corrosive paints (IE used in preventing the corrosion of ferrous metal substrates) shall meet the VOC and chemical component limitations of Green Seal Standard GC-03 of Green Seal, Inc., Washington, DC. Product-specific environmental requirements are as follows:
      - 1) VOC concentrations (in grams per liter) of the product shall not exceed those listed below as determined by U.S. Environmental Protection Agency (EPA) Reference Test Method 24. The calculation of VOC shall exclude water and tinting color added at the point of sale.
        - a) Interior coatings
          - i. Non-flat 150
          - ii. Flat 50
        - b) Interior anti-corrosive paints
          - i. Gloss 250
          - ii. Semi-gloss 250
          - iii. Flat 250

- c) Exterior coatings
      - i. Non-flat 200
      - ii. Flat 100
  - b. Chemical Component Limitations – Aromatic Compounds: The product must contain no more than 1.0% by weight of the sum total of aromatic compounds. Testing for the concentration of these compounds will be performed if they are determined to be present in the product during a material audit.
  - c. Chemical Component Limitations – Other Chemicals: The manufacturer shall demonstrate that the following chemical compounds are not used as ingredients in the manufacture of the product.
    - 1) Halomethanes: methylene chloride
    - 2) Chlorinated ethanes: 1,1,1-trichloroethane
    - 3) Aromatic solvents: benzene, toluene (methylbenzene), ethylbenzene
    - 4) Chlorinated ethylenes: vinyl chloride
    - 5) Polynuclear aromatics: naphthalene
    - 6) Chlorobenzenes: 1,2-dichlorobenzene
    - 7) Phthalate esters: di (20ethylhexyl) phthalate, butyl benzyl phthalate, di-n-butyl phthalate, di-n-octyl phthalate, diethyl phthalate, dimethyl phthalate
    - 8) Miscellaneous semi-volatile organics: isophorone
    - 9) Metals and their compounds: antimony, cadmium, hexavalent chromium, lead, mercury
    - 10) Preservatives (antifouling agents): formaldehyde
    - 11) Ketones: methyl ethyl ketone, methyl isobutyl ketone
    - 12) Miscellaneous volatile organics: acrolein, acrylonitrile
  - d. Paints and other Architectural Coatings (specializes applications): Paints and other architectural coatings used in specialized interior and exterior applications (as defined below) shall meet the VOC limitations defined in Rule 1113, "Architectural Coatings" of SCAQMD, of the State of California. The VOC limits defined by SCQMD, based on 7/9/04 amendments, are as follows. VOC limits are defined in grams per liter (g/L), less water and less exempt compounds.
    - 1) Clear wood finishes:
      - a) Varnish 350
      - b) Lacquer 550
    - 2) Sealers
      - a) Sanding 275
      - b) Waterproofing 250
    - 3) Floor Coatings 100
    - 4) Stains 250
  - e. Low-Emitting Carpet Systems



- 1) Document that the installed carpets products and carpet backing are CRI Green Plus Certified.
- 2) Document that all carpet adhesives contain fewer than 50 grams per liter VOC content.
- f. Non-Urea-Formaldehyde Resins in Engineered Woods
  - 1) Document that the bonding resins in all engineered wood products do not contain added urea-formaldehyde or phenol-formaldehyde resins.
  - 2) Document that the adhesives used for field and shop applied laminations (veneers, plastics, metals) do not contain added urea-formaldehyde resins.

## 1.12 EXECUTION

- A. EROSION AND SEDIMENTATION CONTROL (ESC)
  1. Comply with requirements for Construction Activity Pollution Prevention as outlined in the Sedimentation and Erosion Control Plan.
- B. CONSTRUCTION WASTE MANAGEMENT (CWM)
  1. Comply with Section 01524, Construction Waste Management.
  2. Maintain spreadsheet tracking waste material description, hauler or recycling location and tabulation of material diverted or recycled based on weight or volume.
- C. RECYCLED CONTENT
  1. Maintain a spreadsheet to track Recycled content of materials specified in Divisions 02-10. Include material description, material costs (without labor and equipment), post consumer recycled content, pre consumer recycled content and recycled content information source. Recycled content is based on the cost of qualifying materials as a percent of overall materials costs for Divisions 02 -10.
- D. REGIONAL MATERIALS
  1. Maintain a spreadsheet to track Regional Materials specified in Divisions 02-10. Include the product name, manufacturer, material cost (without labor and equipment), direct line distance from project to extraction/harvest location, direct line distance from project to manufacturer's location and source of information regarding harvest/extraction and manufacturing locations.
- E. (FSC) MATERIALS
  1. Maintain a spreadsheet listing all new wood on the project. Identify which components are FSC certified, the source of the materials, the value of all FSC certified wood materials (as a % of total product value), and the COC number. Recycled wood fiber that qualifies as contributing to recycled content shall be excluded.
- F. LOW EMITTING VOC CONTENT MATERIALS
  1. Maintain a spreadsheet of all adhesives, sealants, and sealant primers, paints and coatings used on the project. Include product manufacturer, product name/model, VOC content, allowable VOC content as per Item 1.11, Products, Sub-Item D., VOC Limits for Low-Emitting Materials, the source of

the VOC data, an estimated quantity of the product used on the project and an estimated cost for each product.

G. LOW EMITTING CARPET

1. Maintain a spreadsheet of all installed carpets and carpet backings. Include manufacturer, recycled content, manufacturing location, and confirmation that the product meets the requirements of the CRI 'Green Label Plus' program. Maintain a listing of all carpet adhesives including the manufacturer, product name and VOC content as reported by the manufacturer.
2. For all synthetic carpets maintain a spreadsheet including the manufacturer, the product name, the specific carpet component identification code that is printed on, or attached to, the carpet supplied for the project.

H. LOW EMITTING COMPOSITE WOOD

1. Maintain a spreadsheet of all install composite wood, engineered wood and agrifiber, including manufacturer, product name and confirmation that the product does not contain any added urea formaldehyde resins. Maintain a listing of the glues used for bonding veneers and laminates to substrates with confirmation that they do not contain any added urea-formaldehyde resins.

I. CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

1. Comply with the requirements for indoor air quality during construction activity as outlined in the Construction IAQ Management Plan, Section 01525.

END OF SECTION 01361

GREEN BUILDING MATERIALS REPORTING FORM						PROJECT NAME:				
CONTRACTOR:				TEL NO:		SPEC SECTION:				
Product	Vendor or Manufacturer	REQUIRED for ALL products identified in specifications		Is the product salvaged, refurbished or reused?	If contains		100% Extracted & Manufactured 4 w/n 500 mile radius of	Partially Extracted & Manufactured 5 w/n 500 mile radius of	For Wood Product s: FSC Certified (Y/N)	VOC Content 8 (for adhesives, sealants, paints and coatings)
		Total Installed COST	Material COST (excluding labor & equipment)		% post-consumer 2	% Pre-consumer 3				
1.										
2.										
3.										
4.										
5.										
6.										
7.										

1. Salvaged: Material or product which has been recovered from existing buildings or construction sites and reused in other buildings (e.g., structural beams, doors, brick).
2. Post-Consumer Recycled Content: Portion of material or product which derives from discarded consumer waste that has been recovered for use as a raw material (e.g., plastic bottles, newspaper)
3. Pre-Consumer Recycled Content: Portion of material or product which derives from recovered industrial and mfg. materials that are diverted from municipal solid waste for use in a different mfg. process, prior to use by a consumer (e.g., fly-ash in concrete or synthetic gypsum board, both of which are by-products of coal-burning power plants). Note that spills and scraps from the original mfg. process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product do not qualify.
4. Regional Extraction/Manufacture: Extracted: Extraction, harvesting or recovery of materials that are used for manufacturing of products to be installed in the building. Manufactured: Final assembly of components into a finished product that is furnished and installed by trades (e.g., If the lumber is from Missoula, MT, and the joist (the finished product in this case) is assembled in Kent, WA; then the location of final assembly is Kent, WA). Since Missoula, MT is within a 500 mile radius of Kent, WA the answer for this example would be 'Yes'
5. Partial Extraction/Manufacture: If only a fraction of the material is extracted/harvested/recovered and manufactured within a 500 mile radius then (only) that percentage (by weight) contributes to the regional value.
6. Rapidly Renewable: Materials and products made from raw materials that are harvested within a 10-year cycle (e.g., bamboo, cork, linoleum, fast-growing poplar, wheatboard, wool carpet)
7. FSC Certified: Wood-based products which are certified by the Forest Stewardship Council and carry a Chain-of-Custody certificate number from the vendor or manufacturer.

8. VOC Content: The quantity of volatile organic compounds contained in products such as adhesives, sealants and architectural coatings. VOC content is to be reported in grams/liter or lbs/gallon

Contractor Certification:

I, \_\_\_\_\_ a duly authorized representative of \_\_\_\_\_ hereby certify that the material information contained herein is an accurate representation of the material qualifications to be provided by us, as components of the final building construction. Furthermore, I understand that any change in such qualifications during the purchasing period will require prior written approval from the Construction Manager and Owner.

SIGNATURE OF AUTHORIZED REPRESENTATIVE: \_\_\_\_\_ Date: \_\_\_\_\_ p. \_\_\_\_ of \_\_\_\_

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**SECTION 01400 - QUALITY CONTROL -  
TESTING SERVICES**

**1. GENERAL**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.
- B. This section specifies the general requirements for testing and inspection services.
- C. Cooperate with Owner's testing laboratory and all others responsible for testing and inspecting the Work.
- D. Provide other testing and inspecting as specified to be furnished by the Contractor in this Section and/or elsewhere in these Specifications.
- E. Provide quality control by the observation and acceptance of work by others being built upon.
- F. Related work described elsewhere:
  - 1. Requirements for testing are described in Divisions 2, 3, 4 and 5 product sections of these Specifications.
  - 2. Where no testing requirements are described, but the Construction Manager decides that testing is required, he may direct that such testing be performed under current standards for testing and Section 7.7 of the General Conditions.
- G. Selection of testing laboratory: The Owner shall hire and pay for an independent testing laboratory.

**2. CODES AND STANDARDS**

- A. Testing, when required, will be in accordance with pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

**3. REVIEW OF THE CONTRACT DOCUMENTS**

- A. On all Project Drawings, figures take precedence over measurement by scale, and any scaling is done at the Contractor's own risk. Before ordering any materials or performing any Work, the Contractor shall verify all measurements at the project site and be responsible for the correctness of same.
- B. Promptly respond to test reports and related instructions to ensure necessary retesting and replacement of materials with the least possible delay in progress of the Work.

#### 4. FIELD CONDITIONS

- A. The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions with the Contract Documents and any shop drawings and product data before commencing any related work. Errors, inconsistencies or omissions shall be reported to the Construction Manager and the Architect at once.

#### 5. PAYMENT FOR TESTING

- A. Initial Services: The Owner's Testing Laboratory shall be responsible for initial testing services as outlined in various sections and Section 7.7 of the General Conditions.
- B. Re-Testing Services: When initial tests indicate non-compliance with the Contract Documents, all subsequent retesting occasioned by the non-compliance shall be performed by the same testing agency and the costs thereof will be borne by the Contractor responsible for the work that is non-compliant.

#### 6. TESTING

- A. Code Compliance Testing: Inspections and tests required by codes or ordinances, or by a plan approval authority, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.
- B. Contractor's Convenience Testing: Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

#### 7. INSPECTION

- A. Inspection by Owner's Personnel: From time to time, personnel in the employ of the Owner may inspect the Work where the Work is in progress, but shall have no authority to direct the Contractor or request changes in the Work except through the Construction Manager and the Architect.
- B. Inspection of Work by Others: Each Contractor shall inspect Work of others which will receive or is adjacent to his Work before commencing his Work. Do not proceed until conditions which would result in a less than first class installation are satisfactorily corrected. Commencing Work shall be construed as acceptance of the Work of others, by the Contractor, as satisfactory to receive his Work. The Contractor shall bear all costs to correct the unsatisfactory Work.

#### 8. COOPERATION WITH TESTING LABORATORY

- A. Representatives of the testing laboratory shall have access to the Work at all times. Provide facilities for such access in order that the laboratory may properly perform its function.

- B. Specimens and samples for testing, unless otherwise provided in the Contract Documents, will be taken by the testing personnel. Sampling equipment and personnel will be provided by the testing laboratory. Deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.
- C. Test results and reports shall be furnished simultaneously to the Engineer (2 copies) and the Construction Manager (1 copy) within one week of testing.

9. TESTING SCHEDULE

- A. The Owner shall pre-qualify and identify qualified independent inspection agencies in a timely manner, allowing Engineer adequate time for review and approval.
- B. Special Structural Testing Schedule to be implemented per specifications.
- C. When changes of construction schedule are necessary during construction, the Construction Manager shall coordinate such changes of schedule with the testing laboratory as required.
- D. When the testing laboratory is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra charges for testing attributable to the delay may be backcharged to the Contractor and shall not be borne by the Owner.

END OF SECTION 01400

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**SECTION 01421 – STANDARDS  
AND DEFINITIONS**

**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 DEFINITIONS**

- A. General: Basic contract definitions are included in the Conditions of the Contract.
- B. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. No limitation on location is intended.
- C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases. However, no such implied meaning will be interpreted to extend the Architect's responsibility into Contractor's area of construction supervision.
- D. "Approved": The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.
- E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": The term "furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": The term "install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.
- I. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.



1. Trades: Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
- J. "Project Site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- K. "Testing Agencies, Laboratories or Service": All terms interchangeably refer to an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.
- L. "Nationally Recognized Testing Laboratories": The term "nationally recognized testing laboratory (NRTL)" shall mean a firm or organization which is recognized by OSHA in accordance with 29 CFR Part 1910.7 to test and approve (i.e., certify, label or list) equipment or materials as being safe for the intended use. Labeling and / or listing of products by NRTL is acceptable wherever a reference to the UL or FMRC label is made in the specifications.
- M. "Label": The label must be provided by a nationally recognized testing laboratory. The Contractor shall provide a statement from the testing laboratory attesting that the laboratory has been approved by OSHA to certify the category of product(s) being submitted for approval.

### 1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Content: These Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
  2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.
    - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

## 1.4 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
  - 1. Reference standards (standards referenced directly in the contract documents) take precedence over standards that are not referenced but generally recognized in the industry for applicability to the work.
  - 2. Unreferenced Standards: Except as otherwise limited by the contract documents, standards not referenced but recognized in the construction industry as having direct applicability will be enforced for performance of the work. The decision as to whether an industry code or standard is applicable, or as to which of several standards are applicable, is the sole responsibility of the Architect.
- B. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents.
  - 1. Updated Standards: Submit a change order proposal where an applicable industry code or standard has been revised and reissued after the date of the Contract Documents and before the performance of the work affected. The Architect will decide whether to issue a change order to proceed with the updated standard.
- C. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different but apparently equal to the Architect for a decision before proceeding.
  - 1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.
  - 2. The Architect is the sole interpreter of what constitutes "minimum requirements" in any given situation. Exceeding minimum requirements in one or more aspects of any given specification does not cancel or replace the need to meet minimum requirements of any other aspect of that specification.
- D. Copies of Standards: Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.
- E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the

trade association, standards-generating organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.

#### 1.5 GOVERNING REGULATIONS AND AUTHORITIES

- A. The Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents. Contact authorities having jurisdiction directly for information and decision having a bearing on the work.

#### 1.6 SUBMITTALS

- A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01421

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**SECTION 01450 – STRUCTURAL TESTS  
AND SPECIAL INSPECTIONS**

**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 INTENT AND CONDITIONS**

- A. Intent:
1. For compliance with the Minnesota State Building Code, the Owner shall employ and pay for a special inspector (or inspectors) as required by Chapter 17 of the International Building Code.
  2. Duties and responsibilities of the special inspector(s) shall be as outlined in Chapter 17 of the International Building Code and as herein specified.
  3. Define and coordinate structural tests and special inspection services.
  4. Define and coordinate conventional testing and inspection services.
  5. Testing and Inspection services are intended to assist in determining probable compliance of the work with requirements specified. These services do not relieve the Contractor of responsibility for compliance with the requirements of the Contract Documents.
- B. Conditions:
1. If inspection of fabricator's work is required, the Owner's representative may require testing and inspection of the work at the plant, before shipment. Owner, Architect and Structural Engineer of Record (SER) reserve the right to reject material not complying with Contract Documents.
  2. Perform testing and inspection in accordance with industry standard used as reference for specific material or procedure unless other criteria are specified. In the absence of a referenced standard, accomplish tests in accordance with generally accepted industry standards.
  3. Failure to detect defective work or materials shall in no way prevent later rejection if defective work or materials are discovered.

**1.3 RELATED REQUIREMENTS**

- A. Refer to individual technical specification sections for additional qualifications, inspections, tests, frequency and standards required.

**1.4 DEFINITIONS**

- A. Testing: Evaluation of systems, primarily requiring physical manipulation and analysis of materials, in accordance with approved standards.
- B. Inspection: Evaluation of systems, primarily requiring observation and judgment.

- C. Structural Tests and Special Inspections: Structural Tests and Special Inspection Services herein include items required by Chapter 17 of the International Building Code as adopted by the current Minnesota State Building Code, and other items which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure.
- D. Conventional Testing and Inspections: Conventional Testing and Inspection Services herein describe those items not specially required by Code but may be considered essential to the proper performance of the building systems.
- E. Architect of Record: The prime consultant in charge of overall design and coordination of the Project.
- F. Structural Engineer of Record (SER): The Licensed Engineer in responsible charge of the structural design for the Project.
- G. Licensed Structural Engineer: A professional engineer with education and experience in the design of structures similar to this Project and licensed in Minnesota.
- H. Testing Agency (TA):
  - a. Testing Agency: Approved independent testing agency acceptable to the Owner, Architect, SER and as noted below:
  - b. Authorized to operate in the State of Minnesota and experienced with the requirements and testing methods specified in the Contract Documents.
  - c. Meeting applicable requirements of references stated in paragraph 1.4.
  - d. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards, or to accepted values of natural physical constants.
- I. Special Inspector (SI): A properly qualified individual or firm performing special inspections.
- J. The categories of special inspector are:
  - 1. Special Inspector - Technical I, II and III: Usually an employee of a testing agency:
    - a. Technical I (Division 02) - Technician shall be under the direct supervision of a licensed civil/geotechnical engineer regularly engaged in this type of work. Work shall be performed in a qualified geotechnical/testing laboratory.
    - b. Technical I (Division 03)
      - 1) ACI Certified Concrete Field Testing Technician – Grade I.
      - 2) ACI Certified Concrete Strength Testing Technician.
      - 3) ACI Certified Concrete Laboratory Testing Technician – Grade 1.
      - 4) ACI Certified Concrete Construction Inspector-In-Training.
      - 5) Inspector shall be employed by a testing laboratory, experienced in the type of work being performed, and under the direct supervision of a licensed civil/structural engineer.
    - c. Technical I (Division 04) - Technician shall be under the direct supervision of a licensed civil/structural engineer regularly engaged in testing and inspection of this type of work. The licensed engineer shall review and approve all inspection reports.

- d. Technical I (Division 05) - Non-destructive Testing Technician SNT-TC-1A Level I, and/or AWS Certified Associate Weld Inspector (CAWI).
  - e. Technical I (Division 07) - Shall be familiar with the interpretation and use of ASTM E 605, and have prior field experience in testing and inspection of spray-applied fireproofing. Shall be supervised by an engineer licensed to practice in the state of Minnesota.
  - f. Technical II (Division 02) - Technician with a minimum of 2 years' experience, or a graduate engineer, and is an employee of a qualified and approved geotechnical/technical laboratory, under the direct supervision of a licensed civil/geotechnical engineer regularly engaged in this type of work.
  - g. Technical II (Division 03)
    - 1) ACI Certified Concrete Laboratory Testing Technician - Grade II.
    - 2) ACI Certified Laboratory Aggregate Testing Technician.
    - 3) ACI Certified Concrete Construction Inspector.
    - 4) Inspector shall be employed by a testing laboratory, experienced in the type of work being performed, and under the direct supervision of a licensed civil/structural engineer.
  - h. Technical II (Division 04) - Graduate civil/structural engineer, with experience in this type of work. Supervised by a licensed civil/structural engineer. The licensed engineer shall review and approve all inspection reports.
  - i. Technical II (Division 05) - Non-destructive Testing Technician ASNT TC-1A Level II, (NDE Technician II), AWS/CAWI, with minimum 3 years' experience, or an AWS/CWI.
  - j. Technical III (Division 02) - A civil/geotechnical engineer regularly engaged in this type of work with a minimum of 4 years' experience, licensed in the state of Minnesota, and is an employee of a qualified and approved geotechnical/testing laboratory. This licensed engineer shall review and approve all final field reports.
  - k. Technical III (Division 03) - A civil/structural engineer regularly engaged in this type of work, with a minimum of 4 years' experience and licensed in the state of Minnesota and is an employee of a qualified and approved testing laboratory. The licensed engineer shall review and approve all reports.
  - l. Technical III (Division 05) - ASNT Level III with a minimum of 10 years' experience or an AWS/CWI with a minimum of 10 years' experience.
  - 2. Special Inspector - Structural I and II: Usually an employee of the Structural Engineer of Record.
    - a. Structural I (Division 03) - Graduate civil/structural engineer, or other personnel acceptable to the SER, with experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a licensed civil/structural engineer.
    - b. Structural II (Division 03) - Civil/structural engineer regularly engaged in the design of structural systems of this type, licensed in the state of Minnesota. The licensed engineer shall review and approve all inspection reports.
- K. Building Official: The Officer or duly authorized representative charged with the administration and enforcement of the State Building Code.

## 1.5 REFERENCES

- A. ANSI/ASTM E329 – Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
- B. ASTM E543 – Standard Practice for Agencies Performing Non-destructive Testing.
- C. ASTM C1077 – Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- D. ASTM C1093 – Standard Practice for the Accreditation of Testing Agencies for Unit Masonry.
- E. ANSI/ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- F. Minnesota State Building Code.
- G. International Building Code.
- H. See technical specification sections for specific references.

## 1.6 RESPONSIBILITIES/AUTHORITY

- A. Structural Tests and Special Inspections:
  - 1. Special Inspector:
    - a. Attend all pre-installation meetings to review scope of structural tests and special inspections.
    - b. Test and/or inspect the work assigned for conformance with the building department approved plans, specifications, and applicable material and workmanship provisions of the code. Perform testing and inspection in a timely manner to avoid delay of work.
    - c. Bring nonconforming items to the immediate attention of the Contractor for correction, then, if uncorrected after a reasonable period of time, to the attention of the Structural Engineer of Record, the Building Official, and to the Architect.
    - d. Submit test and/or inspection reports to the Building Official, Contractor, the Structural Engineer of Record, and other designated persons in accordance with the Structural Testing and Special Inspection Schedule.
    - e. Submit a final signed report stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans, specifications and the applicable workmanship provisions of the code.
    - f. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
  - 2. Architect:
    - a. Coordinate the flow of reports and related information to expedite resolution of construction issues.
    - b. Attend pertinent pre-installation meetings to review scope of structural testing and special inspection.

- c. Complete and sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction. Provide a completed copy of the schedule to all signed parties including Building Official.
- 3. Structural Engineer of Record:
  - a. Identify items requiring structural testing and special inspection including special cases.
  - b. Define "type" of special inspector required for "description" of work indicated on the Structural Testing and Special Inspection Schedule.
  - c. Attend pertinent pre-installation meetings to review scope of structural testing and special inspection.
  - d. Complete and sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
  - e. Review reports issued by all special inspectors.
  - f. If engaged as a special inspector, provide structural testing and special inspection services as noted in Article 1.6.A.1.
- 4. Testing Agency:
  - a. When engaged as a special inspector, provide structural testing and special inspection services as noted in Item 1.6.A.1.
  - b. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
  - c. Attend pertinent pre-installation meetings to review scope of structural testing and special inspection.
- 5. Contractor:
  - a. Arrange and attend all pre-installation meetings to review scope of structural testing and special inspection. Include the Building Official, Owner, Architect, SER, Testing Agency and other parties concerned.
  - b. Post or make available the Structural Testing and Special Inspection Schedule within project site office. Provide timely notification to those parties designated on the schedule so they may properly prepare for and schedule their work.
  - c. Provide special inspector access to the approved plans and specifications at the project site.
  - d. Review all reports issued by special inspectors.
  - e. Retain at the project site all reports submitted by the special inspectors for review by the building official upon request.
  - f. Correct in a timely manner, deficiencies identified in inspection and/or testing reports.
  - g. Provide safe access to the work requiring inspection and/or testing.
  - h. Provide labor and facilities to provide access to the work and to obtain, handle and deliver samples, to facilitate testing and inspection and for storage and curing of test samples.
  - i. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
  - j. Verification of conformance of work within specified tolerances is solely the responsibility of the Contractor.
- 6. Fabricator:
  - a. Submit a Certificate of Compliance to the Building Official, Special Inspector, and Structural Engineer of Record stating the work was performed in accordance with the Contract Documents.



- b. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.
- 7. Building Official:
  - a. Review all special inspector qualifications.
  - b. Review all fabricators who perform work in their shop, which requires special inspection.
  - c. Accept and sign completed Structural Testing and Special Inspection Schedule.
  - d. Review reports and recommendations submitted by special inspector.
  - e. Review the "final signed reports" submitted by special inspector. These documents must be accepted and approved by the building department prior to issuance of a Certificate of Occupancy.
  - f. Determine work, which, in the Building Officials opinion, involves unusual hazards or conditions.
- 8. Owner:
  - a. Provide and pay cost of structural testing and special inspection services.
  - b. Provide special inspector with Contract Documents and accepted shop drawings.
  - c. Provide special inspectors and testing agencies with full access to the site at all times.
  - d. Sign the Structural Testing and Special Inspection Schedule in conjunction with other responsible parties prior to commencing construction.

- B. Inspections by Building Official: provide timely notice for inspections performed by the building official, as required by IBC Chapter 17, the State Building Code, and local ordinance.

## 1.7 INSPECTION NOTICES

- A. Contractor: Provide minimum of 24 hours notice for all items requiring testing or inspection. Do not place items requiring testing and inspection services prior to or during placement until testing and inspection services are available. Do not enclose or obscure items requiring testing and inspection services after placement until testing and inspection services are performed.

## 1.8 REPORTS

- A. Testing agency and/or special inspectors shall submit a report in accordance with the Structural Testing and Special Inspection Schedule and shall conduct and interpret tests and inspections and state in each report whether; (1) test specimens and observations comply with Contract Documents, and specifically state any deviations, (2) record types and locations of defects found in work, (3) record work required and performed, to correct deficiencies.
- B. Submit reports for structural testing and special inspection, in timely manner to the Contractor, Building Official, SER, and Architect.
  - 1. Submit reports for ongoing work, to provide the information noted below:
    - a. Date issued.
    - b. Project title and number.
    - c. Firm name and address.
    - d. Name and signature of tester or inspector.

- e. Date and time of sampling.
  - f. Date of test or inspection.
  - g. Identification of product and specification section.
  - h. Location in project, including elevations, grid location and detail.
  - i. Type of test or inspections.
  - j. Results of tests or inspections and interpretation of same.
  - k. Observations regarding compliance with Contract Documents or deviations there from.
2. Submit final signed report stating that, to the best of the special inspector's knowledge, the work requiring testing and/or inspection conformed to the Contract Documents.

## 1.9 FREQUENCY OF TESTING AND INSPECTION

- A. For detailed requirements see individual technical specification sections, and Part 3 of this section.

## 1.10 PROTECTION AND REPAIR

- A. Upon completion of testing, sample-taking, or inspection, repair damaged work and restore substrates and finishes to eliminate deficiencies, including deficiencies in the visual qualities of exposed surfaces, as judged solely by the Architect/Engineer of Record. Protect work exposed by or for testing and/or inspection and protect repaired work. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for testing and/or inspection.

## 1.11 TESTS TO DEMONSTRATE QUALIFICATION

- A. If the Contractor proposes a product material, method, or other system that has not been pre-qualified, the Architect or SER may require applicable tests, to establish a basis for acceptance or rejection. These tests will be paid for by the Contractor.
- B. The Architect or SER reserves the right to require certification or other proof that the system proposed, is in compliance with any tests, criteria or standards called for. The certificate shall be signed by a representative of an independent testing agency.

## PART 2 - PRODUCTS (NOT USED)

### 2.1

## PART 3 - EXECUTION

### 3.1 SCOPE OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

- A. Refer to individual specification section articles for Quality Control testing and inspection items.

### 3.2 STRUCTURAL TESTS AND SPECIAL INSPECTIONS PROGRAM SUMMARY

- A. The parties involved shall complete and sign the Structural Testing and Special Inspection Schedule. The completed schedule is an element of the Contract Documents and after permit issuance, becomes part of the building department approved plans and specifications. The completed schedule shall include the following:
1. Specific listing of items requiring inspection and testing.
  2. Associated specification section which defines applicable standards by which to judge conformance with approved plans and specifications in accordance with IBC Chapter 17 as adopted by the State Building Code. The specification section should also include the degree or basis of inspection and testing; i.e., intermittent/will-call or full-time/continuous.
  3. Frequency of reporting, i.e., intermittent, weekly, monthly, per floor, etc.
  4. Parties responsible for performing inspection and testing work.
  5. Required acknowledgments by each designated party.
- B. See attached "Structural Testing and Special Inspection Schedule".

END OF SECTION 01450

## Structural Tests and Special Inspections Schedule

Project Name: \_\_\_\_\_  
 Location: \_\_\_\_\_  
 Permit No.: \_\_\_\_\_ (1)

<b>STRUCTURAL TESTS AND SPECIAL INSPECTIONS</b>				
Specification Reference (2)	Description (3)	Type of Inspector (4)	Report Frequency (5)	Assigned Firm (6)
03100	Concrete Formwork	Tech II	Periodic	
03200	Concrete Reinforcement Footings, Foundation Walls, and Columns	Tech II	Periodic	
03300	Cast-In-Place Concrete Material Sampling & Testing	Tech I	Daily	
03300	Cast-In-Place Concrete Concrete Mix Verification	Tech I	Daily	
03300	Cast-In-Place Concrete Concrete Placement	Tech I	Daily	
03300	Cast-In-Place Concrete Protection & Curing	Tech II	Daily	
03300	Cast-In-Place Concrete Embedded Items	Tech II	Periodic	
04200	Unit Masonry Material Testing	Tech II	Periodic	
04200	Unit Masonry Preparation & Placement	Tech II	Periodic	
04200	Unit Masonry Reinforcement	Struc I	Periodic	
04200	Unit Masonry Grouting	Tech II	Daily	
05120	Structural Steel High Strength Bolting	Tech II	Periodic	
05120	Structural Steel Welding	Tech I / Tech II	Periodic	
05120	Structural Steel Headed Shear Studs	Tech I	Periodic	
05120	Structural Steel Mechanical Fasteners	Tech I	Periodic	
05 20	Structural Steel General Configuration	Struc I	Periodic	
05310	Steel Roof Deck Welding	Tech II	Periodic	
02220	Earthwork	Tech II	Daily	

Notes: This schedule to be filled out and included in the project specification. Information unavailable at that time shall be filled out when applying for a building permit.

Permit No. to be provided by the Building Official.

Reference to specific technical scope section in program.

Use descriptions per IBC Chapter 17, as adopted by State Building Code.

Special Inspector – Technical, Special Inspector – Structural.

Weekly, monthly, per test/inspection, per floor, etc.

Firm contracted to perform services.

## ACKNOWLEDGEMENTS

Each appropriate representative shall sign below:

Owner:	Firm:	Date:
Contractor:	Firm:	Date:
Architect:	Firm:	Date:
SER:	Firm:	Date:
SI-S:	Firm:	Date:
TA:	Firm:	Date:
SI-T:	Firm:	Date:
TA:	Firm:	Date:
SI-T:	Firm:	Date:
F:	Firm:	Date:
F:	Firm:	Date:

\* The individual names of all prospective special inspectors and the work they intend to observe shall be identified. (Use reverse side of form, if more room is needed.).

## LEGEND:

SER = Structural Engineer of Record

SI-S = Special Inspector – Structural

TA = Testing Agency

SI-T = Special Inspector – Technical

F = Fabricator.

Accepted for the Building Department By \_\_\_\_\_

Date. \_\_\_\_\_

**NEW PASSENGER TERMINAL  
DULUTH INTERNATIONAL AIRPORT  
DULUTH, MINNESOTA**

**SECTION 01500 - CONSTRUCTION  
FACILITIES AND TEMPORARY  
CONTROLS**

**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.
- B. Temporary heaters and fuel for heating the enclosed building will be provided by the CM. Any other misc. temp. heat equipment, fuel and associated costs are by the corresponding Work Scope.
- C. Temporary electric service: The CM will contract the work to bring in one - 100 amp temporary power panel per level centrally located.

**1.2 SUMMARY**

- A. This section includes requirements for temporary services and facilities, including temporary utilities, support facilities, security and protection.
- B. Temporary utilities include, but are not limited to, the following:
  - 1. Water service and distribution.
  - 2. Temporary electric power and light.
  - 3. Temporary heat.
  - 4. Ventilation.
  - 5. Telephone service.
  - 6. Sanitary facilities, including drinking water.
  - 7. Storm and sanitary sewer.
- C. Temporary construction and support facilities include, but are not limited to, the following:
  - 1. Field offices and storage sheds.
  - 2. Temporary roads and paving.
  - 3. Dewatering facilities and drains.
  - 4. Temporary enclosures.
  - 5. Temporary project identification signs and bulletin boards.
  - 6. Waste disposal services.
  - 7. Rodent and pest control.
  - 8. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities include, but are not limited to, the following:
  - 1. Temporary fire protection.
  - 2. Barricades, warning signs, and lights.
  - 3. Sidewalk bridge or enclosure fence for the site.
  - 4. Environmental protection.

### 1.3 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
  - 1. Building Code requirements.
  - 2. Health and safety regulations.
  - 3. Utility company regulations.
  - 4. Police, Fire Department, and Rescue Squad rules.
  - 5. Environmental protection regulations.
- B. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

### 1.4 PROJECT CONDITIONS

- A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.2 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
  - 1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Contractor's Facilities: Provide a field office building and sheds adequate in size and accommodation for all Contractor's offices, supply and storage.
  - 1. Within the Contractor's facilities, provide enclosed space adequate for holding project meetings. Furnish with all required tables, chairs and utilities.

2. The entire facilities, including furniture, will remain the property of the Contractor and shall be removed from the site after completion of the work.
- C. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat or as required by conditions to allow continuation of scheduled construction activities. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
  2. Protection and temporary closures shall be provided at all exterior openings in the building including doors, walls and roof to maintain the building weather and dust tight. All protection shall be substantial so that it will not be disturbed by wind and weather normal to the area and season.
  3. Openings in floors shall be protected and closures provided to prevent floor to floor transfer of dust, debris and conditioned air. Conform to fire and safety regulations of the authorities having jurisdiction.
- D. Project Identification and Temporary Signs: Furnish and install and maintain one project identification sign of the size, graphic design, style of lettering and construction as shown on the drawings or included at the end of this section.
1. Finishes and painting materials shall be adequate to resist weathering and fading for the scheduled construction period.
  2. Location: Unless noted otherwise, erect on the site at a lighted location of high public visibility, adjacent to the main entrance to the site, as approved by the Architect.
  3. Informational Signs: Provide informational signs with painted lettering, or standard products. Size of signs and lettering shall be as required by regulatory agencies, or as appropriate to the usage. Colors as required by regulatory agencies, otherwise of uniform colors throughout the project. Erect at appropriate locations to provide the required information and at a height for optimum visibility.
  4. Materials: Structure and framing may be preservative-treated wood or steel, in sound condition and structurally adequate to the work and suitable specified finish. Paint is specified in Division 9.
  5. Maintenance: Maintain signs and supports in a neat, clean condition, and repair damages to structure, framing or sign as required.
  6. Relocate informational signs as required by progress of the work.
  7. Remove signs, framing, supports and foundations at project completion.
- E. No other signs or advertising of any kind shall be allowed on the job site, except as specifically approved by the Architect.

### 3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Architect.



- B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."
  - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
  - 2. Store combustible materials in containers in fire-safe locations.
  - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
  - 4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- C. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- D. Covered Walkway: Comply with regulations of authorities having jurisdiction as necessary if determined required by applicable codes erect a structurally adequate, protective covered walkway for passage of persons along the adjacent public street. Coordinate with entrance gates, other facilities, and obstructions.
  - 1. Construct covered walkways using scaffold or shoring framing. Provide wood plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage. Extend the back wall beyond the structure to complete the enclosure fence. Paint and maintain in a manner acceptable to the Owner and the Architect.
- E. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- F. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

### 3.4 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
  2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.
  2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances, as required by the governing authority.
  3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:
    - a. Replace air filters and clean inside of ductwork and housings.
    - b. Replace significantly worn parts and parts subject to unusual operating conditions.
    - c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 01500

**NEW PASSENGER TERMINAL  
DULUTH INTERNATIONAL TERMINAL  
DULUTH, MINNESOTA**

**SECTION 01631 – PRODUCTS  
AND SUBSTITUTIONS**

**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 handling requests for substitutions made after award of the Contract.
- B. Related Sections: The following sections contain requirements that relate to this section:
  - 1. Division 1, Section 01421 "Standards and Definitions" specifies the applicability of industry standards to products specified.
  - 2. Division 1, Section 01300 "Submittals" specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.

**1.3 DEFINITIONS**

- A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.
  - 1. "Products" are items purchased for incorporation in the work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
    - a. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature that is current as of the date of the Contract Documents.
  - 2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the work.
  - 3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:
  - 1. Substitutions requested by bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this section for substitutions.
  - 2. Revisions to the Contract Documents requested by the Owner or Architect.
  - 3. Specified options of products and construction methods included in the Contract Documents.

4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

#### 1.4 SUBMITTALS

- A. Materials, products, equipment and systems are specified in the Contract Documents by manufacturer, trade name or distributor to establish a standard of the required criteria, including function, performance, dimension, appearance and quality to be met by any proposed substitution. Unless otherwise specified, application for substitutions will be considered by the Owner and the Architect after execution of the agreement. The burden of proof of merit of proposed substitute is upon the proposer. Substitute items shall not be incorporated in the work without prior written approval of the item by the Architect.
- B. Where an item is specified by one or more manufacturer's model number or specific item identification and "or approved equal" is included, only the item(s) that is specified by manufacturer's model number or specific identification is approved and any other item must be submitted for approval as a substitution.
- C. Where an item is specified by a referenced standard, the item must be submitted for approval same as a substitute.
- D. Submit three (3) copies of each request for substitution for consideration. Submit requests in the form and according to procedures required for change-order proposals.
- E. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and drawing numbers.
- F. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
  1. Coordination information, including a list of changes or modifications needed to other parts of the work and to construction performed by the Owner and separate contractors that will be necessary to accommodate the proposed substitution.
  2. A detailed comparison of significant qualities of the proposed substitution with those of the work specified. Significant qualities may include elements such as performance, weight, size, durability, and visual effect.
  3. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  4. Samples, where applicable or requested.
  5. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
  6. Cost information, including a proposal of the net change, if any in the Contract Sum.
  7. The Contractor's certification that the proposed substitution conforms to or exceeds requirements in the Contract Documents in every respect and is appropriate for the applications indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

- G. Architect's Action: If necessary, the Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. The Architect will notify the Contractor of acceptance or rejection of the substitution within two (2) weeks of receipt of the request, or one week of receipt of additional information or documentation, whichever is later. Acceptance will be in the form of a change order. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified.

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
  2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
  4. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.
    - a. Where no product available within the specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category.
  5. Visual Selection: Where specified product requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected.
- B. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturers or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.
1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
  2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
    - a. Name of product and manufacturer.
    - b. Model and serial number.
    - c. Capacity.
    - d. Speed.
    - e. Ratings.

## 2.2 SUBSTITUTIONS

- A. Conditions: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests without action except to record noncompliance with these requirements.
1. The specified product or method of construction cannot be provided within the Contract Time. The Architect will not consider the request if the product or method cannot be provided as a result of failure to pursue the work promptly or coordinate activities properly.
  2. The request is directly related to an "or-equal" clause or similar language in the Contract Documents.
  3. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting offsetting responsibilities the Owner may be required to bear. The Owner's additional responsibilities may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
  4. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
  5. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.
  6. The specified product or method of construction cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.
  7. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.
- B. The Contractor's submittal and the Architect's acceptance of shop drawings, product data, or samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.
- C. Whether or not the Architect and Owner accept a proposed substitution, the Contractor shall reimburse the Owner for the Architect's cost for the Architect and the Architect's consultants for evaluating any proposed substitute including changes required in the Contract Documents for the substitute.
- D. The Architect's decision of approval or disapproval of a proposed substitution shall be final.
- E. All costs that may be incurred associated with a substitution proposed by the Contractor shall be borne by the Contractor. This shall apply to all interfacing components recognized prior to or after approval of the substitution by the Architect.

## PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01631

**NEW PASSENGER TERMINAL  
DULUTH INTERNATIONAL AIRPORT  
DULUTH, MINNESOTA**

**SECTION 01700 - CONTRACT  
CLOSEOUT**

**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.

**1.1 SUMMARY**

- A. This section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:
  - 1. Inspection procedures.
  - 2. Project record document submittal.
  - 3. Operation and maintenance manual submittal.
  - 4. Submittal of warranties.
  - 5. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate sections in Divisions 2 through 16.
- C. Definitions: Closeout is hereby defined to include general requirements near the end of Contract time, in preparation for final acceptance, final payment, normal termination of contract, occupancy by Owner and similar actions evidencing completion of the work. Specific requirements for individual units of work are specified in sections of Division 2 through 16. Special requirements for mechanical and electrical work are specified in Division 16 sections, respectively. Time of closeout is directly related to "Substantial Completion" and, therefore, may be either a single time period for entire work or a series of time periods for individual parts of the work which have been certified as substantially complete at different dates. That time variation (if any) shall be applicable to other provisions of this section, regardless of whether resulting from "phased completion" originally specified by the Contract Documents or subsequently agreed upon by Owner and Contractor.

**1.2 SUBSTANTIAL COMPLETION**

- A. Certificates of Substantial Completion: Certificates of Substantial Completion will be filled out with punch lists attached and shall define the areas of the work which are being accepted. Procedures required to call for inspections and to request certificates shall be as required in this section.
- B. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, for either the entire work or portions thereof, complete the following. List exceptions in the request.

1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the work claimed as substantially complete.
    - a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
    - b. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the work is not complete.
  2. Advise the Owner of pending insurance changeover requirements.
  3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
  4. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  5. Deliver tools, spare parts, extra stock, and similar items.
  6. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
  7. Complete startup testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue or change over and remove temporary facilities and services from the site, along with mockups, construction tools, and similar elements.
  8. Complete final cleanup requirements, including touchup painting. Touch up and otherwise repair and restore marred, exposed finishes.
- C. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
1. The Architect will repeat inspection when requested and assured that the work is substantially complete.
  2. Results of the completed inspection will form the basis of requirements for final acceptance.

### 1.3 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
  2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
  3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, endorsed and dated by the Architect.
  4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the work.



5. Submit consent of surety to final payment.
  6. Submit a final liquidated damages settlement statement.
  7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  8. Submit record documents, final project photographs, property survey and similar final record information.
- B. Reinspection Procedure: The Architect will reinspect the work upon receipt of notice that the work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Architect.
1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance. If the work is incomplete, the Architect will advise the Contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
  2. If necessary, reinspection will be repeated. Contractor will promptly reimburse the Architect for all incurred costs.

#### 1.4 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Architect's reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the work.
  2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
  3. Note related change-order numbers where applicable.
  4. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.
  5. Preparation of Transparencies: In preparation for certification of Substantial Completion on the last major portion of the work, review completed markup of record drawings with Architect. When authorized, proceed with preparation of a full set of corrected transparencies for Contract Drawings and shop drawings. Incorporate changes and additional information previously marked-up on print sets, by erasing and redrawing where applicable, and by adding details and notations where applicable; refer instances of uncertainty to Architect for determination. Identify and date each updated drawing.
  6. One set of transparencies of original Contract Drawings will be furnished by Architect to Contractor for use in recording changes and additional information. Other printing as required herein is Contractor's responsibility.

7. Review of Transparencies: Prior to forwarding to Architect, submit corrected transparencies to Architect for review and acceptance. Architect will review each transparency for general scope of changes and information recorded thereon, and of the general quality of draftsmanship thereon (erasures and drafting). Transparencies will be returned to Contractor for organizing into a set and for final submittal.
  8. Copies, Distribution: At the completion of the Work the Contractor shall forward one set of original marked-up transparencies to Architect for distribution to Owner. Organize transparencies into a set matching print sets, place set in a durable tube-type drawing container (with end caps), and mark end cap with suitable identification.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda. Include with the Project Manual one copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.
1. Mark these documents to show substantial variations in actual work performed in comparison with the text of the Specifications and modifications.
  2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
  3. Note related record drawing information and Product Data.
  4. Upon completion of the work, submit record Specifications to the Architect for the Owner's records.
- D. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor shall meet with the Architect and the Owner's personnel at the site to determine which of the submitted samples that have been maintained during progress of the work are to be transmitted to the Owner for record purposes. Comply with the Owner's instructions regarding packaging, identification marking and delivery to the Owner's designated storage area. Dispose of other samples in a manner specified for disposal of surplus and waste materials, unless otherwise indicated by the Architect.
- E. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to the Architect for the Owner's records.
- F. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch, 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Provide the Architect with two (2) copies of each manual. Include the following types of information:
1. Emergency instructions.
  2. Spare parts list.
  3. Copies of warranties.
  4. Wiring diagrams.

5. Recommended "turn-around" cycles.
6. Inspection procedures.
7. Shop Drawings and Product Data.
8. Fixture lamping schedule.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 CLOSEOUT PROCEDURES

- A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:
  1. Maintenance manuals.
  2. Record documents.
  3. Spare parts and materials.
  4. Tools.
  5. Lubricants.
  6. Fuels.
  7. Identification systems.
  8. Control sequences.
  9. Hazards.
  10. Cleaning.
  11. Warranties and bonds.
  12. Maintenance agreements and similar continuing commitments.
- B. As part of instruction for operating equipment, demonstrate the following procedures:
  1. Startup.
  2. Shutdown.
  3. Emergency operations.
  4. Noise and vibration adjustments.
  5. Safety procedures.
  6. Economy and efficiency adjustments.
  7. Effective energy utilization.

### 3.2 FINAL CLEANING

- A. General: The General Conditions require general cleaning during construction. Regular site cleaning is included in Division 1, Section 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturers' instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.
  - a. Remove labels that are not permanent labels.
  - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
  - c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces. Leave concrete floors broom clean. Vacuum carpeted surfaces.
  - d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
  - e. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.
  - f. Remove debris and surface dust from limited access spaces including roofs, plenums, shafts, trenches, equipment vaults, man-holes, attics and similar spaces.
  
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests. Submit report (letter) of compliance from exterminator.
  
- D. Removal of Protection: Remove temporary protection and facilities installed for protection of the work during construction, where applicable.
  
- E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
  1. Where extra materials of value remain after completion of associated work, they become the Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION 01700

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**SECTION 01710 - CLEANING UP**

**1. GENERAL**

- A. The Contractors shall furnish all labor, materials, tools, equipment, and perform all work and services necessary for cleaning up required in conjunction with work performed, as shown on drawings and as specified, in accordance with provisions of the Contract Documents and completely coordinated with work of all other trades.
- B. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
- C. This Section specifies administrative and procedural requirements for final cleaning at Substantial Completion.
  - 1) Special cleaning requirements for specific elements of the Work are included in appropriate Sections of Divisions 2 through 16.
  - 2) Multiple Prime Contracts: Except as otherwise indicated, each Prime Contractor is responsible for coordination of final cleaning where more than one Prime Contractor is involved in final cleaning a single area or piece of equipment.
  - 3) Environmental Requirements: Conduct cleaning and waste disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.
    - a. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains.
    - b. Burning or burying of debris, rubbish or other waste material on the premises will not be permitted.
  - 4) Related work specified elsewhere:
    - a. Section 01700 - Contract Closeout, include general project closeout requirements.
    - b. Section 01500 - Temporary Facilities, include general cleanup and waste removal requirements.

**2. MATERIALS**

- A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property, or that might damage finished surfaces.

3. DURING CONSTRUCTION

- A. Oversee cleaning and ensure that building and grounds are maintained free from accumulation of waste and rubbish.
  - 1) Special attention shall be given to cleaning up the site of debris, waste and rubbish. The Owner is extremely concerned over items left in the open that can be thrown through windows.
- B. Sprinkle dusty debris with water.
- C. At reasonable intervals, minimum once a week, clean up site and access and dispose of debris.
- D. Provide metal containers for collection of debris.
- E. Remove debris from site. Legally dispose of off Owner's site.
- F. Vacuum interior areas when ready for painting.
- G. Handle waste materials in a controlled manner. Do not drop or throw materials from heights.
- H. Schedule cleaning operations so that contaminants resulting from cleaning do not fall on wet painted surfaces.

END OF SECTION 01710

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**SECTION 01720 - PROJECT RECORD  
DOCUMENTS**

**1. GENERAL**

- A. This section covers the furnishing of all labor, materials, tools, equipment, and performing all work and services to provide record documents as specified, in accordance with the provisions of the Contract Documents, and completely coordinated with work of all other trades.
- B. This Section specifies administrative and procedural requirements for Project Record Documents.
  - 1) Project Record Documents required include:
    - a. Marked-up copies of Contract Drawings.
    - b. Marked-up copies of Shop Drawings.
    - c. Newly prepared Drawings.
    - d. Marked-up copies of Specifications, addenda and Change Orders.
    - e. Marked-up Product Data submittals.
    - f. Record Samples.
    - g. Field records for variable and concealed conditions.
    - h. Record information on Work that is recorded only schematically.
  - 2) Maintenance of Documents and Samples: Store record documents and Samples in the field office apart from Contract Documents used for construction. Do not permit Project Record Documents to be used for construction purposes. Maintain record documents in good order, and in a clean, dry, legible condition. Make documents and Samples available at all times for inspection by the Architect.
- C. Related work specified elsewhere:
  - 1) Section 01700 - Contract Closeout, includes general project closeout requirements.
  - 2) Section 01300 - Submittals, includes general requirements for submittal of Project Record Documents.

**2. RECORD DRAWINGS**

- A. Mark-Up Procedure: During the construction period, maintain a set of blue- or black-line white-prints of Contract Drawings and Shop Drawings for Project Record Document purposes. Include the printed designation "PROJECT RECORD DRAWINGS" in a prominent location on each Drawing.
  - 1) Mark these Drawings to indicate the actual installation where the installation varies appreciably from the installation shown originally. Give particular attention to information on concealed elements which would be difficult to identify or

measure and record later. Items required to be marked include but are not limited to:

- a. Dimensional changes to the Drawings.
  - b. Revisions to details shown on the Drawings.
  - c. Changes made by Change Order.
  - d. Details not on original Contract Drawings.
  - e. RFPs, SIs, PCOs.
- 2) Mark completely and accurately record prints of Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.
  - 3) Mark record sets with red erasable colored pencil; use other colors to distinguish between changes for different categories of the Work at the same location.
  - 4) Mark important additional information which was either shown schematically or omitted from original Drawings.
  - 5) Note construction change directive numbers, alternate numbers, Change Order numbers and similar identification.
  - 6) Responsibility for Mark-Up: Where feasible, the individual or entity who obtained record data, whether the individual or entity is the installer, subcontractor, or similar entity, is required to prepare the mark-up on record Drawings.
    - a. Accurately record information in an understandable Drawing technique.
    - b. Record data as soon as possible after it has been obtained. In the case of concealed installations, record and check the mark-up prior to concealment.
    - c. At time of Substantial Completion, submit three (3) copies of the record Drawings to Construction Manager for the Architect's approval. Upon Architect's approval, the Drawings will then become the Owner's records. Organize into sets, bind and label sets for Owner's continued use.

### 3. RECORD SPECIFICATIONS

- A. During the construction period, maintain one copy of the Project Specifications, including addenda and modifications issued, for Project Record Document purposes.
  - 1) Mark the Specifications to indicate the actual installation where the installation varies substantially from that indicated in Specifications and modifications issued. Note related Project Record Drawing information, where applicable. Give particular attention to substitutions, selection of product options, and information on concealed installations that would be difficult to identify or measure and record later.
    - a. In each Specification Section where products, materials or units of equipment are specified or scheduled, mark the copy with the proprietary name and model number of the product furnished.



- 2) Upon completion of mark-up, submit record Specifications to the Construction Manager for Owner's records.

#### 4. RECORD PRODUCT DATA

- A. During the construction period, maintain one copy of each Product Data submittal for Project Record Document purposes.
  - 1) Mark Product Data to indicate the actual product installation where the installation varies substantially from that indicated in Product Data submitted. Include significant changes in the product delivered to the site, and changes in manufacturer's instructions and recommendations for installation.
  - 2) Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 3) Note related Change Orders and mark-up of record Drawings, where applicable.
  - 4) Upon completion of mark-up, submit a complete set of record Product Data to the Construction Manager for the Owner's records.
  - 5) Where record Product Data is required as part of maintenance manuals, submit marked-up Product Data as an insert in the manual, instead of submittal as record Product Data.
  - 6) Each prime Contractor is responsible for mark-up and submittal of record Product Data for its own Work.

#### 5. MISCELLANEOUS RECORD SUBMITTALS

- A. Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Immediately prior to Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Submit to the Construction Manager for the Owner's records.
  - 1) Categories of requirements resulting in miscellaneous records include, but are not limited to the following:
    - a. Field records on excavations and foundations.
    - b. Field records on underground construction and similar Work.
    - c. Survey showing locations and elevations of underground lines.
    - d. Invert elevations of drainage piping.
    - e. Surveys establishing building lines and levels.
    - f. Authorized measurements utilizing unit prices or allowances.
    - g. Records of plant treatment.
    - h. Ambient and substrate condition tests.
    - i. Certifications received in lieu of labels on bulk products.
    - j. Batch mixing and bulk delivery records.
    - k. Testing and qualification of tradesmen.

- l. Documented qualification of installation firms.
- m. Load and performance testing.
- n. Inspections and certifications by governing authorities.
- o. Leakage and water-penetration tests.
- p. Fire resistance and flame spread test results.
- q. Final inspection and correction procedures.

6. RECORDING

- A. Post changes and modifications to the Documents as they occur. Do not wait until the end of the Project.

END OF SECTION 01720

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**SECTION 01740 – WARRANTIES**

**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 specifies general administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
  - 1. Refer to the General Conditions for terms of the Contractor's period for correction of the work and special warranty of workmanship and materials.
- B. The Contractor will provide a warranty on all project work (including that added by subsequent change order after execution of the construction contract) for a period of one (1) year following the formal declaration of Substantial Completion. This one (1) year warranty will be separate from and in no way affect other standard product / manufacturer or workmanship warranties that extend beyond this one (1) year period for goods and services provided to this project.
- C. Related Sections: The following sections contain requirements that relate to this section:
  - 1. Division 1, Section 01300 - SUBMITTALS specifies procedures for submitting warranties.
  - 2. Division 1, Section 01700 - CONTRACT CLOSEOUT specifies contract closeout procedures.
  - 3. Divisions 2 through 16 sections for specific requirements for warranties on products and installations specified to be warranted.
  - 4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- D. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

**1.3 WARRANTY REQUIREMENTS**

- A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace other work that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

- B. Reinstatement of Warranty: When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether the Owner has benefited from use of the work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
  - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
- E. Where the Contract Documents require a special warranty, or similar commitment on the work or part of the work, the Owner reserves the right to refuse to accept the work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

#### 1.4 SUBMITTALS

- A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the work, or a designated portion of the work, submit written warranties upon request of the Architect.
  - 1. When a designated portion of the work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within fifteen (15) days of completion of that designated portion of the work.
- B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.
  - 1. Refer to Divisions 2 through 16 sections for specific content requirements and particular requirements for submitting special warranties.
- C. Form of Submittal: At Final Completion compile two (2) copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- D. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES AND BONDS," Project title or name, and name of the Contractor.
3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01740

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**SECTION 01742 - CONSTRUCTION  
WASTE MANAGEMENT**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for the following:
  - 1. Salvaging non-hazardous demolition and construction waste
  - 2. Recycling non-hazardous demolition and construction waste
  - 3. Disposing of non-hazardous demolition and construction waste
- B. Related Sections include the following:
  - 1. Division 1 Section 01040 "Coordination" for coordination of responsibilities for waste management
  - 2. Division 1 Section 01361 "Sustainable Design Requirements"
  - 3. Division 1 Section 01500 "Temporary Facilities and Controls" for environmental-protection measures during construction

**1.3 DEFINITIONS**

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, paint, or the like
- B. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- C. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations
- D. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction
- E. Diversion: Avoidance of demolition and construction waste sent to landfill or incineration. Diversion does not include using materials for landfill, alternate daily cover on landfills, or materials used as fuel in waste-to-energy processes
- F. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitability, corrosiveness, toxicity or reactivity

- G. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse
- H. Recycling: The process of sorting, cleansing, treating, and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Salvage: Recovery of demolition or construction waste and subsequent reuse or sale in another facility
- J. Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work
- K. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste
- L. Toxic: Poisonous to humans either immediately or after a long period of exposure
- M. Trash: Any product or material unable to be reused, returned, recycled, or salvaged
- N. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. The Owner has established that this Project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.
- B. Of the waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled. Waste disposal in landfills or incinerators shall be minimized, thereby reducing disposal costs.
- C. Develop a construction waste management plan that results in end-of-Project rates for salvage / recycling of 95% (by weight) of construction and demolition waste.
- D. Salvage / Recycle Requirements: Salvage and recycle as much non-hazardous demolition and construction waste as possible, including the following materials:
  - 1. Demolition Waste:
    - a. Asphaltic concrete paving
    - b. Concrete
    - c. Concrete reinforcing steel
    - d. Brick
    - e. Concrete masonry units
    - f. Wood studs
    - g. Wood joists
    - h. Plywood and oriented strand board
    - i. Wood paneling

- j. Wood trim
- k. Structural and miscellaneous steel
- l. Rough hardware
- m. Roofing
- n. Insulation
- o. Doors and frames
- p. Door hardware
- q. Windows
- r. Glazing
- s. Metal studs
- t. Gypsum board
- u. Acoustical tile and panels
- v. Carpet
- w. Carpet pad
- x. Demountable partitions
- y. Equipment
- z. Cabinets
- aa. Plumbing fixtures
- bb. Piping
- cc. Supports and hangers
- dd. Valves
- ee. Sprinklers
- ff. Mechanical equipment
- gg. Refrigerants
- hh. Electrical conduit
- ii. Copper wiring
- jj. Lighting fixtures
- kk. Lamps
- ll. Ballasts
- mm. Electrical devices
- nn. Switchgear and panelboards
- oo. Transformers
- 2. Construction Waste:
  - a. Masonry and CMU
  - b. All untreated wood, including lumber and finish materials
  - c. Wood sheet materials
  - d. Wood trim
  - e. Metals
  - f. Roofing
  - g. Insulation
  - h. Carpet and pad
  - i. Gypsum board
  - j. Unused (leftover) paint
  - k. Piping
  - l. Electrical conduit
  - m. Packaging: Regardless of salvage / recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
    - 1) Paper
    - 2) Cardboard
    - 3) Boxes



- 4) Plastic sheet and film
- 5) Polystyrene packaging
- 6) Wood crates
- 7) Plastic pails
- n. Beverage and packaged food containers

## 1.5 SUBMITTALS

- A. Construction Waste Management Plan (CWMP): It is the intent of this specification to maximize the diversion of demolition and construction waste from landfill disposal. Accordingly, not more than 30 days after receipt of Notice to Proceed and prior to the generation of any waste, prepare and submit a draft Construction Waste Management Plan in accordance with Section 01742 including, but not limited to, the following:
  - 1. Procedures for Recycling / Reuse Program to divert a minimum of 95% (by weight) of construction and demolition waste from landfill disposal, including waste resulting from demolition of any existing building and site paving scheduled for demolition; any site paving is required to be ground on site and reused as granulated fill on site.
  - 2. Approval of the Contractor's CWMP shall not relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures.
- B. Submit a 3-ring binder with calculations on end-of-project recycling rates, salvage rates, and landfill rates itemized by waste material, demonstrating that a minimum of 75% of construction wastes were recycled or salvaged and diverted from landfill. Include documentation of recovery rate (if commingled); waste hauling certificates or receipts, and a brief narrative explaining how and to where each waste type has been diverted.
- C. Construction Waste Management Plan: Submit four copies of plan within forty-five (45) days of date established for the Notice to Proceed.
- D. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit four (4) copies of report. Include separate reports for demolition and construction waste. Include the following information:
  - 1. Material category
  - 2. Generation point of waste
  - 3. Total quantity of waste in tons
  - 4. Quantity of waste salvaged, both estimated and actual in tons
  - 5. Quantity of waste recycled, both estimated and actual in tons
  - 6. Total quantity of waste recovered (salvaged plus recycled) in tons
  - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste
  - 8. Include up-to-date records of donations, sales, recycling and landfill / incinerator manifests, weight tickets, hauling receipts, and invoices.
- E. Waste Reduction Calculations: Before request for Substantial Completion, submit four copies of calculated end-of-project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work. Complete a table similar to the example below.

Recycled / Salvaged / Diverted Materials	Hauler or Location	Quantity of Material (tons)
Total Construction Waste Diverted		
Landfilled Materials		
Total Construction Waste Landfilled		

Total Construction Waste		Total Construction Waste Diverted + Total Construction Waste Landfilled
Percentage of Construction Waste Diverted from Landfill		$(\text{Total Construction Waste Diverted} / \text{Total Construction Waste}) * 100$

- F. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax-exempt.
- G. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax-exempt.
- H. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- I. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills (or transfer stations) and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

## 1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with all applicable local ordinances and regulations.
- B. Waste Management Meetings: Conduct an initial conference at Project Site to comply with requirements in Division 1 Section "Project Management and Coordination." Contractor shall include discussions on construction waste

management requirements in the preconstruction meeting. Contractor shall include discussions on construction waste management requirements in the regular job meetings conducted during the course of the Project; at these meetings, review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of the Waste Management Coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

## 1.7 CONSTRUCTION WASTE MANAGEMENT PLAN

- A. General: Develop and implement a CWMP consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume, but use the same units of measure throughout the CWMP.
- B. Draft Construction Waste Management Plan: Within 30 days after receipt of Notice to Proceed, or prior to any waste removal, whichever occurs sooner, the Contractor shall submit to the Owner and Architect a Draft Waste Management Plan.
- C. Final Construction Waste Management Plan: Once the Owner has determined which of the recycling options addressed in the draft Waste Management Plan are acceptable, the Contractor shall submit, within 10 calendar days, a Final Waste Management Plan.
- D. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- E. Landfill Options: Indicate the name of the landfill(s) and / or transfer station(s) and / or incinerator(s) where trash will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all Project waste in the landfill(s).
- F. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, reused, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
  1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
  2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
  3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
  4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.

5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
  6. Handling and Transportation Procedures: Describe method that will be used for separating recyclable waste, including sizes of containers, container labeling, and designated location on Project Site where materials separation will be located.
- G. Materials: The following list of required materials, at a minimum, must be included for salvaging / recycling:
1. Cardboard
  2. Clean dimensional wood
  3. Beverage and food containers
  4. Paper
  5. Concrete
  6. Concrete Masonry Units (CMUs)
  7. Asphalt: Include the approximate weight of the asphalt paving to be crushed and utilized as granulated fill from the existing paving as a component of waste material diverted from the landfill.
  8. Ferrous and non-ferrous metals (banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze)
  9. Stretch and shrink wrap
  10. Gypsum wallboard
  11. Paint containers and other clean, empty plastic containers
- H. Meetings: Provide a description of the regular meetings to be held to address waste management.
- I. Materials Handling Procedures: Provide a description of the means by which any waste materials identified will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.
- J. Transportation: Provide a description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site) and destination of materials.

## 1.8 CONSTRUCTION WASTE MANAGEMENT RESOURCES

- A. General information contacts regarding construction and demolition waste:
1. EPA Construction and demolition (C&D) debris website:  
<http://www.epa.gov/epaoswer/non-hw/debris-new/bytype.htm>
  2. Directory of Wood-Framed Building Deconstruction and Reused Building Materials  
Companies:  
[http://www.fpl.fs.fed.us/documnts/fplgtr/fpl\\_gtr150.pdf](http://www.fpl.fs.fed.us/documnts/fplgtr/fpl_gtr150.pdf)
  3. Additional resources to be developed by Contractor with assistance from Owner and Architect, as requested.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by Architect and Owner. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
  - 1. Comply with Division 1 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at the Project Site full-time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project Site.
  - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
  - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Designate and label specific areas on Project Site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
  - 2. Recycling and waste bin areas are to be kept neat, and clean, and clearly marked in order to avoid contamination of materials.
  - 3. Comply with Division 1 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
- E. Hazardous Wastes: Hazardous wastes shall be separated, stored, and disposed of according to local regulations and should not be included in Construction Waste Management Plan's calculations of waste.

### 3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until installation.
  - 4. Protect items from damage during transport and storage.

5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Owner's Use:
1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area designated by Owner.
  5. Protect items from damage during transport and storage.
  6. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

### 3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:
1. List to be developed by Contractor.
- C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project Site to the maximum extent practical.
1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project Site. Include list of acceptable and unacceptable materials at each container and bin.
    - a. Inspect containers and bins for contamination and remove contaminated materials if found.
  2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  4. Store components off the ground and protect from the weather.
  5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

### 3.4 RECYCLING DEMOLITION WASTE

- A. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility or recycle on-site into new paving.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
1. Pulverize concrete to maximum 4-inch (100-mm) size.

2. Crush concrete and screen to comply with requirements in Division 2 Section "Earthwork" for use as satisfactory soil for fill or subbase.
- C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
1. Pulverize masonry to maximum 1-1/2-inch (38-mm) size.
    - a. Crush masonry and screen to comply with requirements in Division 2 Section "Earthwork" for use as general fill or subbase.
    - b. Crush masonry and screen to comply with requirements in Division 2 Section "Exterior Plants" for use as mineral mulch.
  2. Clean and stack undamaged, whole masonry units on wood pallets.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, and panel products for reuse and / or recycling. Separate wood material treated with heavy metal preservatives for reuse or landfill disposal.
- E. Metals: Separate metals by type.
1. Structural Steel: Stack members according to size, type of member, and length.
  2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts for recycling into asphalt paving or by other recycling entities.
- G. Gypsum Board: Stack large, clean pieces on wood pallets and store in a dry location for recycling off-site. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
1. Moisture-damaged gypsum board with evidence of significant mold growth shall be disposed of in accordance with New York City's "Guidelines on Assessment and Remediation of Fungi in Indoor Environments": <http://www.nyc.gov/html/doh/html/epi/moldrpt1.shtml>
- H. Acoustical Ceiling Panels and Tile: Stack large, clean pieces on wood pallets and store in a dry location.
1. Separate suspension system, trim, and other metals from panels and tile and sort with other metals.
- I. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
1. Store clean, dry carpet and pad in a closed container or trailer provided by a carpet recycler or manufacturer-related carpet reclamation agency.
- J. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- K. Plumbing Fixtures: Separate by type and size.
- L. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- M. Lighting Fixtures: Separate lamps by type and protect from breakage.

- N. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.
- O. Conduit: Reduce conduit to straight lengths and store by type and size.

### 3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project Site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.
  - 1. Comply with requirements in Division 2 Section "Exterior Plants" for use of chipped organic waste as organic mulch.
- C. Wood Materials:
  - 1. Clean Cut-Offs of Lumber: Grind or chip into material appropriate for mulch or erosion control.
  - 2. Lumber Treated with Heavy-Metal Preservatives: Do not grind, chip, or incinerate; must be reused or landfilled.
- D. Gypsum Board: Stack large, clean pieces on wood pallets and store in a dry location for recycling and / or reuse on-site or off-site.
  - 1. Moisture-damaged gypsum board with evidence of significant mold growth shall be disposed of in accordance with New York City's "Guidelines on Assessment and Remediation of Fungi in Indoor Environments": <http://www.nyc.gov/html/doh/html/epi/moldrpt1.shtml>
  - 2. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
    - a. Comply with requirements in Division 2 Section "Exterior Plants" for use of clean ground gypsum board as inorganic soil amendment.
- E. Miscellaneous: Anything called out to be ground and used on site should utilize an on-site grinder.
  - 1. Grinder should be able to accommodate a variety of materials including masonry, asphalt shingles, wood, and drywall.

### 3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project Site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.



1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Do not burn or bury waste materials on or off site. Appropriate on-site topical application of ground gypsum or wood, or use of site paving as granulated fill is considered reuse, not waste.

END OF SECTION 01742

**NEW PASSENGER TERMINAL  
DULUTH INTERNATIONAL AIRPORT  
DULUTH, MINNESOTA**

**SECTION 02220 - BUILDING  
EARTHWORK**

**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. Provide building excavation, dewatering, fill, backfill and compaction specified and shown on the drawings. Included is preparation of subgrade for footings, slabs and pavement within the general building area.

**1.3 SUBMITTALS**

- A. Test Reports: The independent testing lab shall submit copies of the following reports to the Architect-Engineer and Owner:
  - 1. Report and certification of backfill and fill materials.
  - 2. Test reports on borrow material.
  - 3. Verification of each footing subgrade.
  - 4. Field density test reports.
  - 5. One optimum moisture-maximum density curve for each type of soil encountered.
  - 6. Other tests and material certificates, as required.

**1.4 QUALITY ASSURANCE**

- A. Codes and Standards: Comply with the provisions of the following codes, specifications and standards except as otherwise shown or specified:
  - 1. Governing Local Building Code.
  - 2. American Society for Testing and Materials (ASTM) C136 -- Standard Test for Sieve Analysis of Fine and Coarse Aggregates
  - 3. ASTM D 698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>)
  - 4. ASTM D1556 Standard Test method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
  - 5. ASTM D 1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>)
  - 6. ASTM D 2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
  - 7. ASTM D 2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- B. Regulations: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

- C. Inspection Testing Laboratory: The Owner shall employ and pay an independent geotechnical testing laboratory, acceptable to the Architect-Engineer, to perform sampling and testing of soil materials proposed for use in the work, field observation and testing for quality control during earthwork operations. All testing and inspection shall be performed by an Inspector Type Technical II as indicated in Division 01 Structural Tests and Special Inspections.

## 1.5 PROJECT / SITE CONDITIONS

- A. Site Information: The data on subsurface conditions shall be as interpreted in the Project Geotechnical Report and the General Conditions. Additional test borings and other exploratory operations may be made at no cost to the Owner.
- B. Verify that survey bench marks and intended elevations for the Work are as indicated in the Contract Documents.
- C. Existing Utilities: Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protecting during excavation operations.
  - 1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the utility owner immediately for directions. Cooperate with the Owner, the public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility Owner.
  - 2. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by the Architect-Engineer and then only after acceptable temporary utility services have been provided.
  - 3. Demolish and completely remove from the site existing underground utilities indicated to be removed. Coordinate with local utility companies for shut-off of services if lines are active.
- D. Use of explosives is not permitted.
- E. Protection: Protect structures, utilities, sidewalks, pavements and other facilities from damages caused by settlement, lateral movement, undermining, washout and other hazards created by excavation operations.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. Non-Frost Susceptible (NFS) Engineered Fill: Gradation as defined in the Project Geotechnical Report.
- B. General Engineered Fill: Non-organic granular material as defined in the Project Geotechnical Report. Excavated on-site soils can also be used as engineered fill under conditions noted in the Project Geotechnical Report.
- C. Future Aircraft Pavement Backfill: As defined in the Contract Documents.

## 2.2 COMPACTION EQUIPMENT

- A. Vibratory Rollers: The vibratory drum roller shall have the following minimum requirements:
  - 1. Drum Roller: 36 to 48 inches in diameter.
  - 2. Static at Drum Weight: 6,000 to 10,000 pounds.
  - 3. Approved compactors include Galion, Dynapac and Bros.
  - 4. Vibratory compaction shall be performed so as not to damage existing structures. Rollers shall not be used adjacent to the existing structures or within a distance which will have an adverse effect. When compacting within 15 feet of the existing structure, a lightweight walk-behind sled or roller compactor should be used. Use mechanical hand equipment or alternate compaction equipment as needed.
- B. Alternate Compaction Equipment: Steel wheeled or pneumatic-tired nonvibratory rollers capable of meeting the compaction requirements specified herein. Use for clayey fine sands and adjacent to existing structures.
- C. Mechanical Hand Equipment: Hand vibratory sleds, rollers and tampers shall be capable of meeting the compaction requirements specified herein. Total weight shall be on the order of 100 to 500 pounds.

## 2.3 SOURCE QUALITY CONTROL

- A. Testing: The independent testing laboratory shall perform the following:
  - 1. Test soil materials proposed for use in the work and promptly submit test result reports.
  - 2. Provide one optimum moisture-maximum density curve for each type of soil encountered in subgrade and fills under building slabs and foundations and paved areas. Determine maximum densities in accordance with ASTM D1557.
  - 3. For backfill and fill materials, perform a mechanical analysis, AASHTO T88; plasticity index, AASHTO T90; and moisture-density curve, AASHTO T180 or ASTM D1557.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine the areas and conditions under which building excavation and fill is to be performed and do not proceed with the work prior to correcting unsatisfactory conditions.

### 3.2 CLEARING AND STRIPPING BUILDING AREAS

- A. Clear and strip the entire building area to at least 10 feet beyond perimeter to building footings and foundation, walks and slabs to remove existing vegetation, concrete and asphalt pavement layers and other obstructions to the work.
- B. Strip topsoil from areas within the building and slab areas and stockpile on the site for future use in site grading.

### 3.3 COMPACTION OF EXPOSED SOILS

- A. No compactive effort should be used on exposed soils.

### 3.4 EXCAVATION

- A. Excavation consists of the removal and disposal of materials encountered when establishing the required grade elevations for the site including footings, utilities and all other items indicated in the drawings and specifications.
- B. If any existing or former building foundations or any other unexpected subsurface conditions are encountered in the required excavation, notify the Architect-Engineer immediately.
- C. Earth excavation includes the removal and disposal of pavement and other obstructions visible on the ground surface, under-ground structures and utilities to be demolished and removed, material of any classification indicated in data on subsurface conditions, and other materials encountered that are not classified as unauthorized excavation.
- D. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or side dimensions –indicated in the Project Geotechnical Report. Unauthorized excavation, as well as remedial work shall be at the Contractor's expense. Backfill and compact unauthorized excavations as specified for authorized excavations of the same classification, unless otherwise directed by the Architect - Engineer.
- E. Additional Excavation:
  - 1. When excavation has reached required subgrade elevations, notify the independent testing laboratory which shall make an inspection of conditions.
  - 2. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and replace the excavated material as directed by the Geotechnical Engineer.
  - 3. If an excavation extends below the bottom of footing elevation in suitable bearing material, a 1H:1V excavation oversize shall be required for every foot of new fill placed below the base of the footing. The contractor shall not receive additional compensation.
  - 4. Removal of unsuitable material in excess of one foot in depth and its replacement as directed will be paid on the basis of contract conditions relative to changes in the work.
- F. Stability of Excavations:
  - 1. Comply with local codes and ordinances and requirements of agencies having jurisdiction. Slope sides of excavations as necessary for stability and compliance. Shore and brace where sloping is not possible either because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in a safe condition until completion of backfilling. Refer to the Geotechnical Report for further excavation stability requirements.
  - 2. Shoring and Bracing: Provide shoring and bracing designed for and adequate to resist all imposed loads.

- G. Dewatering:
1. Prevent surface water and subsurface or ground water from flowing into the excavations and flooding the project site and surrounding area.
  2. Do not allow water to accumulate in excavations. Remove water from excavations to prevent softening of foundation bottoms, undercutting footings and soil changes detrimental to the stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines and other dewatering system components necessary to convey the water away from excavations.
  3. Convey water removed from excavations and rainwater to collecting or run-off area. Establish and maintain temporary drainage ditches and other diversions outside the excavation limits for each structure. Do not use trench excavations for site utilities as temporary drainage ditches.
  4. Provide groundwater control as required to maintain groundwater levels at least 12 inches below the bottom of any excavation made during construction and at least 24 inches below the surface of any vibratory compaction operations.
- H. Material Storage:
1. Stockpile excavated materials classified as satisfactory soil material where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
  2. Locate and retail fill materials away from edges of excavations.
  3. Dispose of excess soil material and waste materials as herein specified.
- I. Excavation for Structures:
1. Conform to the elevations and dimensions shown on the drawings, within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction and for inspection.
  2. After excavating footings and foundations to approximate bearing elevations, perform final excavation in the presence of the Inspection and Testing Service Representative.
    - a. In excavating for final grading of footings and foundations, take care not to disturb the bottom of the excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to the required lines and grades to leave a solid base to receive concrete.
- J. Excavation for Trenches: Dig trenches to the uniform width required for the particular item to be installed, sufficiently wide to provide ample working room.
1. Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations. Beyond the building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
  2. Grade bottom of trenches as indicated, notching under pipe bells to provide solid bearing for the entire body of the pipe.
  3. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and which are carried below the bottom of such footings, or which pass under wall footings. Place concrete to the level of the bottom of adjacent footing. Concrete is specified in Division 3.

- 4. Do not backfill trenches until tests and inspections have been made and backfilling authorized by the Architect-Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.
- K. Closing Abandoned Underground Utilities: Fully grout any abandoned underground utilities not indicated to be removed.
- L. Cold Weather Protection: Protect excavation bottoms against freezing when the atmospheric temperature is less than 35 degrees F.

### 3.5 BACKFILL AND FILL

- A. General:
  - 1. In all excavations, use satisfactory excavated or borrow material that has been sampled, tested and approved by the soil testing agency.
  - 2. Backfill excavations as promptly as the work permits, but not until completion of the following:
    - a. Completion of construction below finish grade including, where applicable, damproofing, waterproofing and perimeter insulation.
    - b. Inspection, testing, approval and recording locations of underground utilities.
    - c. Removal of concrete framework.
    - d. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
    - e. Removal of trash and debris.
    - f. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
- B. Placement and Compaction:
  - 1. Place backfill and fill materials in layers not more than 8 to 10 inches in loose depth for material compacted by vibratory compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
  - 2. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content of the soil material. Compact each layer to the required percentage of maximum dry density or relative dry for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen or contain frost or ice.
  - 3. Place backfill and fill materials evenly adjacent to structures, to the required elevations. Take care to prevent wedging action of the backfill against structures by carrying the material uniformly around the structure to approximately the same elevation in each lift. Do not overcompact against retaining walls and structures. Provide temporary bracing for retaining walls which are backfilled prior to construction of any restraining slab or other element.
- C. Backfill at Specific Locations:
  - 1. Building footings shall bear directly on undisturbed native soils or lean-mix concrete over undisturbed native soil as defined by the Addendum to the Project Geotechnical Report dated January 29, 2010, and the Contract

Documents. Determination of all footing bearing elevations shall be made in the field by a qualified geotechnical engineer.

2. Floor slabs shall bear on a 6 inch thick clean sand layer over engineered fill as defined in the Project Geotechnical Report.
3. Retaining Wall Backfill: Backfill within 6 horizontal feet of retaining walls shall consist of NFS sand fill with gradation as defined in the Project Geotechnical Report.

### 3.6 COMPACTION

- A. General: Control soil compaction during construction for compliance with the percentage of density specified.
- B. Percentage of Maximum Density Requirements: Compact soil to the following percentages of maximum dry density determined in accordance with ASTM D1557:
  1. Typical Floor Slab Supporting Areas: Prepare slab subgrade areas as defined in the Project Geotechnical Report. Compact each layer of engineered fill material to not less than 95 percent maximum dry density determined in accordance with ASTM D1557.2.
  2. Against Retaining Structures: Compact to not less than 95 percent maximum dry density determined in accordance with ASTM D1557.
  3. Lawn and Planting Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum dry density.
- C. Moisture Control:
  1. Where the subgrade or layer or soil material must be moisture conditioned before compaction uniformly apply water to the surface of subgrade, or layer of soil material, to prevent free water appearing on the surface during or subsequent to compaction operations.
  2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
  3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing, until the moisture content is reduced to a satisfactory value.

### 3.7 FIELD QUALITY CONTROL

- A. Allow independent testing laboratory to inspect and approve subgrades and fill layers before further construction work is performed.
- B. The independent testing laboratory shall perform the following:
  1. Field density tests in accordance with ASTM D1556 (sand cone method) or ASTM D2922 (nuclear method).
  2. Footing Subgrade: For each strata of soil on which footings will be placed, conduct, at least one density test to verify the required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with the related tested strata, when acceptable to the Architect-Engineer.



3. Paved Areas and Building Slab Subgrade: Make at least one field density test of the subgrade and each lift of compacted fill for every 5,000 square feet of paved area or building slab, but in no case less than three tests at each level.
- C. If, in the opinion of the Architect-Engineer, based on testing service reports and inspection, the subgrade or fills which have been placed are below the specified density, provide additional compaction and testing at no additional expense.
  1. The results of density tests will be considered satisfactory when the average of any four consecutive test are each instance equal to or greater than the specified density, and if not more than one density test out of five has a value greater than two percent below the required density.

### 3.8 PROTECTION

- A. Protection of Graded Areas:
  1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
  2. Repair and re-establish grades in settled, eroded and rutted areas to the specified tolerances.
- B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, re-shape and compact to the required density prior to further construction. Use hand tamping for re-compaction over underground utilities and underfloor subdrains, if any.

### 3.9 DISPOSAL OF EXCESS AND WASTE MATERIAL

- A. Removal from Owner's Property: Remove all waste materials, including excavated material classified as unsatisfactory soil material, trash and debris, and legally dispose of it off the Owner's property.

### 3.10 TESTING AND INSPECTION

- A. General: Inspection and testing of soils shall conform to the requirements of Section 1704.7 of the International Building Code, 2006 Edition in addition to other requirements as stated herein.

END OF SECTION 02220

**NEW PASSENGER TERMINAL  
DULUTH INTERNATIONAL AIRPORT  
DULUTH, MINNESOTA**

**SECTION 02466 – DRILLED CONCRETE  
PIERS**

**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. Dry-installed drilled piers.
- B. Related Sections:
  - 1. Division 01 Section "Project Record Documents."
  - 2. Division 01 Section "Construction Facilities and Temporary Controls."
  - 3. Division 03 Section "Cast-In-Place Concrete".
  - 4. Division 31 Section "Site Clearing" for preparation of subgrade for drilled-pier operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface.

**1.3 REFERENCES**

- A. American Concrete Institute (ACI):
  - 1. ACI 301 – Specification for Structural Concrete.
  - 2. ACI 336.1 – Reference Specification for the Construction of Drilled Piers.
- B. American Society for Testing and Materials (ASTM).
- C. American Welding Society (AWS):
  - 1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.
- D. Concrete Reinforcing Steel Institute (CRSI): Manual of Standard Practice.

**1.4 UNIT PRICES**

- A. Unit prices are included in Division 01 Section "Unit Prices."
- B. Drilled Piers: Actual net volume of drilled piers in place and approved. Actual length, shaft diameter, and bell diameter if applicable, may vary, to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments will be made on net variation of total quantities, based on design dimensions for shafts.
  - 1. Base bids on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft, and the diameter of shaft.
  - 2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, testing

and inspecting, removal of boulders (rocks with a diameter greater than 12 inches), and all other items for complete drilled-pier installation.

## 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Shop Drawings: For concrete reinforcement detailing fabricating, bending, supporting, and placing.
- D. Welding certificates, if applicable.
- E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
  - 1. Aggregates.
- F. Field quality-control reports.
- G. Sustainable Design Submittals:
  - 1. LEED Credit: Product Data for Credit MR 4.1: For products having recycled content, documentation indicating weights, costs, and percentages by weight of postconsumer and preconsumer recycled content.
    - a. Include statement indicating material weights and costs for each product having recycled content.
  - 2. LEED Credit: Product Data for Credit MR 5.1: For products having Regional content (Extracted, and processed or manufactured within 500 miles of site), documentation indicating total weights, costs and percentages by weight of regional content.
    - a. Include statement indicating material weights, and costs for each product having regional content.
- H. Other Informational Submittals:
  - 1. Record drawings.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in drilled-pier work.
- B. Testing Agency Qualifications: Qualified according to ASTM C 1077, ASTM D 3740, and ASTM E 329 for testing indicated.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code - Steel."
  - 2. AWS D1.4, "Structural Welding Code - Reinforcing Steel."
- D. Drilled-Pier Standard: Comply with ACI 336.1 unless modified in this Section.
- E. Preinstallation Conference: Conduct conference at project site.

1. Review methods and procedures related to drilled piers including, but not limited to, the following:
  - a. Review geotechnical report.
  - b. Discuss existing utilities and subsurface conditions.
  - c. Review coordination with temporary controls and protections.

## **1.7 PROJECT CONDITIONS**

- A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.
  1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.
- B. Interruption of Existing Utilities: Do not interrupt any utility to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
  1. Notify Construction Manager and Owner no fewer than three days in advance of proposed interruption of utility.
  2. Do not proceed with interruption of utility without Construction Manager's and Owner's written permission.
- C. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
  1. Make additional test borings and conduct other exploratory operations necessary for drilled piers.
  2. The geotechnical report is included elsewhere in the Project Manual.
- D. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.
  1. Record and maintain information pertinent to each drilled pier and cooperate with Owner's testing and inspecting agency to provide data for required reports.

## **PART 2 - PRODUCTS**

### **2.1 STEEL REINFORCEMENT**

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

### **2.2 CONCRETE MATERIALS**

- A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source, throughout Project:
  1. Portland Cement: ASTM C 150, Type I. Supplement with the following:
    - a. Fly Ash: ASTM C 618.

- B. Normal-Weight Aggregate: ASTM C 33, graded, 1-1/2 inch nominal maximum coarse-aggregate size. Provide aggregate from a single source
  - 1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94 and potable.
- D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C 494, Type A.
  - 2. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
  - 3. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
  - 4. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

### **2.3 STEEL CASINGS**

- A. Steel Pipe Casings: ASTM A 283, Grade C, or ASTM A 36, carbon-steel plate, with joints full-penetration welded according to AWS D1.1.
- B. Liners: Comply with ACI 336.1.

### **2.4 CONCRETE MIXTURES**

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement to 15%.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Proportion normal-weight concrete mixture as follows:
  - 1. Compressive Strength (28 Days): 4000 psi.
  - 2. Maximum Water-Cementitious Materials Ratio: 0.50.
  - 3. Minimum Slump: Capable of maintaining the following slump until completion of placement:
    - a. 4 inches for dry, uncased, or permanent-cased drilling method.
    - b. 6 inches for temporary-casing drilling method.
    - c. 7 inches for slurry displacement method.
  - 4. Air Content: Do not air entrain concrete.

### **2.5 FABRICATING REINFORCEMENT**

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

### **2.6 CONCRETE MIXING**

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.

#### **3.2 EXCAVATION**

- A. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
  1. Obstructions: Unclassified excavated materials may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. Payment for removing obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work will be according to Contract provisions for changes in the Work.
- B. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.
- C. Excavate shafts for drilled piers to indicated elevations. Remove loose or disturbed material from bottom of excavation exposing undisturbed native soils or bedrock.
  1. Excavate bottom of drilled piers to level plane within 1:12 tolerance.
  2. Remove water from excavated shafts before concreting.
  3. Excavate rock sockets of dimensions indicated.
  4. Cut series of grooves about perimeter of shaft to height from bottom of shaft, vertical spacing, and dimensions indicated.
- D. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Architect.
  1. Do not excavate shafts deeper than elevations indicated unless approved by Architect.
  2. Payment for additional authorized excavation will be according to Contract provisions for changes in the Work.
- E. Excavate shafts for closely spaced drilled piers and for drilled piers occurring in fragile or sand strata only after adjacent drilled piers are filled with concrete and allowed to set.
- F. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.
  1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete.
- G. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.
  1. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit design and construction proposals to Architect for review before proceeding.

### 3.3 STEEL REINFORCEMENT

- A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.
- C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.
- D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover over reinforcement.
- E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.
- F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

### 3.4 CONCRETE PLACEMENT

- A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by Owner's independent testing and inspecting agency.
  - 1. Construction joints are not allowed without written permission from the Architect.
- B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.
  - 1. Where concrete cannot be directed down shaft without striking reinforcement, place concrete with chutes, tremies, or pumps.
  - 2. Vibrate top 60 inches of concrete.
- C. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing.
  - 1. Vibrate top 60 inches of concrete after withdrawal of temporary casing.
- D. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.
- E. Protect concrete work, according to ACI 301, from frost, freezing, or low temperatures that could cause physical damage or reduced strength.
  - 1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.
- F. If hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to ACI 301 to maintain delivered temperature of concrete at no more than 90 deg F.

1. Place concrete immediately on delivery. Keep exposed concrete surfaces and formed shaft extensions moist by fog sprays, wet burlap, or other effective means for a minimum of seven days.

### 3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
  1. Drilled piers.
  2. Excavation.
  3. Concrete.
  4. Steel reinforcement welding.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.
  1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual drilled-pier lengths below existing adjacent ground surface and bearing capacities will be determined by testing and inspecting agency. Final evaluations and approval of data will be determined by Architect.
- D. Concrete Tests and Inspections: ASTM C 172 except modified for slump to comply with ASTM C 94.
  1. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no fewer than one test for each concrete load.
  2. Concrete Temperature: ASTM C 1064; 1 test hourly when air temperature is 40 deg F and below and 80 deg F and above, and 1 test for each set of compressive-strength specimens.
  3. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test unless otherwise indicated. Mold and store cylinders for laboratory-cured test specimens unless field-cured test specimens are required.
  4. Compressive-Strength Tests: ASTM C 39; one set for each drilled pier but not more than one set for each truck load. One specimen will be tested at 7 days, 2 specimens will be tested at 28 days, and 1 specimen will be retained in reserve for later testing if required.
  5. If strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
  6. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
  7. Report test results in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. List Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests in reports of compressive-strength tests.
  8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.



9. Additional Tests: Testing and inspecting agency will make additional tests of concrete if test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by Architect.
    - a. Continuous coring of drilled piers may be required, at Contractor's expense, if temporary casings have not been withdrawn within specified time limits or if observations of placement operations indicate deficient concrete quality, presence of voids, segregation, or other possible defects.
  10. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
  11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. An excavation, concrete, or a drilled pier will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports for each drilled pier as follows:
1. Actual top and bottom elevations.
  2. Actual drilled-pier diameter at top and bottom.
  3. Description of soil materials.
  4. Description, location, and dimensions of obstructions.
  5. Final top centerline location and deviations from requirements.
  6. Variation of shaft from plumb.
  7. Shaft excavating method.
  8. Design and tested bearing capacity of bottom.
  9. Levelness of bottom and adequacy of cleanout.
  10. Ground-water conditions and water-infiltration rate, depth, and pumping.
  11. Description, purpose, length, wall thickness, diameter, tip, and top and bottom elevations of temporary casings. Include anchorage and sealing methods used and condition and weather tightness of splices if any.
  12. Description of soil or water movement, sidewall stability, loss of ground, and means of control.
  13. Date and time of starting and completing excavation.
  14. Inspection report.
  15. Condition of reinforcing steel and splices.
  16. Position of reinforcing steel.
  17. Concrete placing method, including elevation of consolidation and delays.
  18. Elevation of concrete during removal of casings.
  19. Locations of construction joints.
  20. Concrete volume.
  21. Concrete testing results.
  22. Remarks, unusual conditions encountered, and deviations from requirements.

### 3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it as directed by the Owner and/or Construction Manager.

#### END OF SECTION 02466

**NEW PASSENGER TERMINAL  
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**SECTION 03100 - CONCRETE  
FORMWORK**

**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 specifies formwork for cast-in-place concrete for the following:
  - 1. Footings.
  - 2. Foundation walls.
  - 3. Slabs-on-grade.
  - 4. Concrete toppings.
  - 5. Building walls.
- B. Related Sections include the following:
  - 1. Division 01 Section "Structural Testing and Special Inspections".
  - 2. Division 03 Section "Concrete Reinforcement".
  - 3. Division 03 Section "Cast-In-Place Concrete".
  - 4. Division 05 Section "Structural Steel" for embedded items.

**1.3 REFERENCES**

- A. ACI 117 – Specifications for Tolerance for Concrete Construction and Materials
- B. ACI 301 – Specification for Structural Concrete for Buildings.
- C. ACI 318 – Building Code Requirements for Structural Concrete.
- D. ACI 347 – Guide to Formwork for Concrete.
- E. PS1 – Construction and Industrial Plywood.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Formwork Shop Drawings: Prepared by or under the supervision of a Specialty Structural Engineer detailing fabrication, assembly, and support of formwork.
  - 1. Engineering Responsibility: Formwork, bracing, shoring, and reshoring design for construction loads are sole responsibility of Installer's Specialty Structural Engineer.
- C. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Form materials and form-release agents.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Submittal Schedule for all action submittal items.
- B. Minutes of Pre-Installation conference.
- C. Sustainable Design Submittals:
  - 1. LEED Credit: Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
  - 2. Product Data for Credit EQ 4.4: For composite-wood products, documentation indicating that product contains no urea formaldehyde.
  - 3. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
    - a. Include statement indicating costs for each certified wood product.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Specialty Structural Engineer Qualifications: Employ professional Engineer, registered in the State of Minnesota, to perform design of formwork and shoring for construction loads. Sign and seal design Shop Drawings submitted to Owner for review.
- C. Mockups: See Specification Section 03300 "Cast in Place Concrete."
- D. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
  - 1. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, forms and form removal limitations.

## 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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

## 2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  - 1. Plywood, metal, or other approved panel materials.
  - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. High-density overlay, Class 1 or better.
    - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    - c. Structural 1, B-B or better; mill oiled and edge sealed.
    - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- E. Soil Retainers: Material to be rigid and non-degradable.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips.
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
  - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
  - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## PART 3 - EXECUTION

### 3.1 FORMWORK

- A. Work shall conform to ACI 117 and ACI 301, except as modified by requirements of these Contract Documents.
- B. Design, erect, shore, brace, and maintain formwork, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- C. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated.
- D. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
  - 1. Class B, 1/4 inch for smooth-formed finished surfaces exposed to view and as indicated by the Architect.
  - 2. Class C, 1/2 inch, for rough-formed finished surfaces unless noted otherwise.
- E. Construct forms tight enough to prevent loss of concrete mortar.
- F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 1. Install keyways, reglets, recesses, and the like, for easy removal.
  - 2. Do not use rust-stained steel form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete. Size chamfer as indicated on drawings.
- J. Form openings, chases, offsets, sinkages, keyways, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- K. Fastening Devices for Other Work:
  - 1. Provide for installation of inserts, reglets, hangers, metal ties, anchor bolts and other fastening devices required for attachment of other work.
  - 2. Properly locate fastening devices in cooperation with other trades and secure position before concrete is placed.

3. Where concrete surfaces are veneered with masonry, install masonry anchor slots.
    - a. In concrete forms set vertically 2'-0" on center.
    - b. Install two continuous slots per face at each column face wider than 1'-4".
  4. Where masonry abuts concrete surface, install one continuous masonry anchor slot in concrete forms set vertically for each eight inches width of masonry, centered in masonry width.
- L. Install sleeves in concrete piers, columns, beams or joists only upon approval of the Architect.
- M. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- N. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- O. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### 3.2 INSTALLATION OF VOID FORMS AND SOIL RETAINERS

- A. Placement:
1. Place forms on smooth, level, firm, dry surface.
  2. Butt carton forms tightly end to end and side to side, seam side down.
  3. Place cover sheets on carton forms and staple.
- B. Moisture Protection:
1. Do not let carton forms become wet.
  2. Remove and replace wet cartons.
- C. Place soil retainers at edge of grade beams.

### 3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
  2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

#### 3.4 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified special inspector and independent testing agency to perform field tests and inspections and prepare test reports. Cooperate with testing agency to facilitate the execution of its duties.
- B. Inspect formwork prior to concrete placement to verify resulting element width, depth and length correspond to those indicated on formwork installation drawings and Contract Documents.
- C. Where special formed surface finish requirements are required, verify forming materials comply with requirements.
- D. Adequacy of formwork, shoring, and reshoring to support vertical and lateral loads during construction is sole responsibility of Contractor.

END OF SECTION 03100

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**SECTION 03200 - CONCRETE  
REINFORCEMENT**

**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. Reinforcing bars for cast-in-place concrete.
  - 2. Smooth bar dowels and diamond dowels and dowel baskets for concrete slab joints.
  - 3. Deformed bar anchors and headed shear connectors.
  - 4. Stud rails.
  - 5. Couplers for reinforcing bars.
  - 6. Welded wire fabric.
  - 7. Ties and supports for reinforcement.
- B. Related Sections:
  - 1. Division 01 Section "Structural Testing and Special Inspections".
  - 2. Division 03 Section "Concrete Formwork".
  - 3. Division 03 Section "Cast-In-Place Concrete".
  - 4. Division 03 Section "Unbonded Post-Tensioned Concrete".

**1.3 REFERENCES**

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
- B. ACI 301 – Specification for Structural Concrete.
- C. ACI 315 - Standards on Details and Detailing of Concrete Reinforcement.
- D. ACI 318 - Building Code Requirements for Structural Concrete.
- E. AWS D1.4 - Structural Welding Code Reinforcing Steel.
- F. CRSI - Manual of Standard Practice.
- G. CRSI - Placing Reinforcing Bars.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.



- B. Shop Drawings: Submit in accordance with ACI 315, "Standards on Details and Detailing of Concrete Reinforcement"
  - 1. Provide necessary plan, elevation and section detail placing drawings that illustrate fabrication, bending, and placement of reinforcement.
  - 2. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- C. Welding certificates – signed by contractor certifying that welders comply with requirements of Article 1.5 – "Quality Assurance."

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Minutes of Pre-Installation conference.
- B. Sustainable Design Submittal:
  - 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR4.2 (if required): For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
    - a. Include statement indicating costs for each product having recycled content.

#### 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator utilizing experienced detailers who have successfully completed CRSI's Reinforcing Bar Detailer Program.
- B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- C. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- D. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
  - 1. Review special inspection and testing and inspecting agency procedures for field quality control, steel reinforcement installation, and protection during concrete placement.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

## 1.8 EXTRA MATERIALS

### 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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

#### 2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.
- C. Deformed Bar Anchors (DBA): Standard fluxed ASTM A496 deformed bars prepared for stud welding.
  - 1. Available Manufacturers:
    - a. Erico Fastening.
    - b. Nelson Stud Welding.
- D. Headed Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
  - 1. Available Manufacturers:
    - a. Erico Fastening.
    - b. Nelson Stud Welding.
- E. Epoxy-Coated Reinforcing Bars: ASTM A 615, Grade 60, deformed bars, ASTM A 775, epoxy coated.
- F. Plain-Steel Wire: ASTM A 82, galvanized.
- G. Deformed-Steel Wire: ASTM A 496.
- H. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

#### 2.3 JOINT DOWELS

- A. Dowel Caps: Plastic material of size recommended for rod diameter.
- B. Smooth Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burr. Provide dowel ends that are sawn with round ends, not sheared with crimped ends.

- C. Smooth Dowel Support Baskets:
  - 1. Available Manufactures:
    - a. American Highway Technology.
- D. Smooth Dowel Coating: Grease or bituminous coating.
- E. Diamond Plate Dowels: Saw cut from ASTM A 36 hot rolled plate.
  - 1. Available Products:
    - a. Diamond Dowel™ by PNA, Inc.
- F. Smooth Plate Dowels and Baskets:
  - 1. Approved Manufacturers:
    - a. PNA, Inc.
- G. Epoxy-Coated Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, ASTM A 775 epoxy coated.

## 2.4 REINFORCEMENT ACCESSORIES

- A. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.
  - 1. Available Products:
    - a. 3M Scotchkote 213PC or liquid, two-part, epoxy repair coating or approved equal.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, or plastic according to CRSI's "Manual of Standard Practice," and as follows:
  - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
  - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
- C. Rebar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Chairs are to be stable and resist tipping.
  - 1. Dayton Richmond: Aztec E-Z Chair – PEZ and Tower Chair PTC.
  - 2. General Technologies, Inc.: Composite Chairs and Composite Slab-Beam Bolsters.
- D. Supports for slabs-on-grade with steel reinforcement: Use supports with sand plates or horizontal runners.
  - 1. Dayton Richmond: Aztec E-Z Chair – PEZ with E-Z Chair Sand Plate PSP.
  - 2. General Technologies, Inc.: Composite Chairs on Sand Plates.
- E. Compression Couplers: Use only where explicitly referenced on Drawings.
  - 1. Speed sleeve by Erico.
  - 2. G-Loc by Gateway Erectors.

- F. Tension Couplers: Use only where explicitly referenced on Drawings.
  - 1. Lenton Couplers by Erico.
  - 2. MRC 150 by Dayton Superior.
  - 3. No-Slip Coupler by Fox-Howlet.

## 2.5 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice" and accepted shop drawings.
- B. Do not re-bend or straighten steel reinforcement except where specifically accepted.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" and accepted shop drawings for placing reinforcement. Adjust reinforcing to avoid sleeves, blockouts and other voids in concrete.
- B. Underfloor Vapor Retarders: When chairing reinforcement on top of underfloor vapor retarders, use only supports with integral sand plates.
  - 1. Do not cut or puncture vapor retarder.
  - 2. Repair damage and reseal cuts or punctures in vapor retarder before placing concrete.
- C. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- D. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
  - 1. Weld reinforcing bars according to AWS D1.4, where indicated.
- E. Provide bar supports in sufficient number and heavy enough to carry steel they support. Place no bar more than 2 inches beyond last leg of continuous bar support. Do not use bar supports to support runways for concrete buggies, or similar loads.
  - 1. Maximum support bar spacing shall not exceed 48 inches.
  - 2. Maximum bolster spacing shall not exceed 36 inches for #4 support bar or 48 inches for #5 support bar.
- F. Bar supports on ground may be concrete block for slab depth of 7 inches or less and if positioned in staggered pattern. Provide bar chairs with sand feet where slab thickness exceeds 7 inches.
- G. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- H. Steel reinforcement partially embedded in concrete shall not be field bent, except as indicated or permitted by Structural Engineer.

- I. For walls reinforced on both faces, provide spreader bars and chairs to surfaces of forms on each side at spacings not to exceed 8 feet in either direction. For walls with single layer of reinforcing, provide chairs each side at spacings not to exceed 8 feet in either direction.
- J. Install epoxy coated reinforcing bars using either epoxy or plastic coated tie wires. Place epoxy coated steel on epoxy coated bar supports. Patch cut ends and areas of damage.
- K. Install welded wire reinforcement in longest practicable lengths. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- L. Center smooth dowel bars on joints, position dowels at center of slab depth and align perpendicular to face of joints both vertically and horizontally. Within 30 minutes before placement of adjacent concrete along doweled joints, apply dowel coating on free ends of dowels.
- M. Install diamond plate dowels in concrete slab-on-grade joints where shown. Install diamond plate dowels per manufacturer's written instructions.

### 3.2 PROTECTION AND REPAIR

- A. Install additional bar supports at locations where reinforcement position is not maintained due to collapsed chairs or construction activity from time of original placement.
- B. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

### 3.3 FIELD QUALITY CONTROL

- A. Assign individual to monitor reinforcement position during concrete placement and reposition bars that are displaced due to construction activity.
- B. Testing and Inspecting: Owner will engage a qualified special inspector and material testing agency to perform field quality control inspections and testing in accordance with Division 01 Section "Structural Tests and Inspections" and as specified herein.
- C. Submit reports of inspections and material testing as soon as practical after they are made.
- D. Inspect reinforcement in all cast-in-place concrete footings, foundation frost walls, basement walls, retaining walls, and columns, slabs on grade, and topping slabs.
- E. Verify reinforcing bar grade.
- F. Verify reinforcing bars are free of dirt, excessive rust and damage.

- G. Verify reinforcing bars are adequately tied, chaired and supported to prevent displacement during concrete placement.
- H. Verify proper clear distances between bars and to surfaces of concrete.
- I. Verify reinforcing bar size and placement.
- J. Verify bar laps for proper length and stagger and bar bends for minimum diameter, slope and length.
- K. Verify mechanical splices are placed in accordance with Contract Documents and reviewed shop drawings.
- L. Verify epoxy coating is present at locations noted on the Contract Documents; include tie wires, chairs, bolsters, etc. Verify coating damage is repaired in accordance with the Contract Documents.
- M. Verify installation of anchor rods, embedded plates and angles are placed in accordance with the Contract Documents.
- N. Correct work that does not comply with specified requirements prior to scheduling concrete placement.
- O. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

END OF SECTION 03200

**NEW PASSENGER TERMINAL  
DULUTH INTERNATIONAL AIRPORT  
DULUTH, MINNESOTA**

**SECTION 03300 – CAST-IN-PLACE  
CONCRETE**

**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 specifies cast-in place concrete, vapor retarder, concrete materials, mixture design, placement procedures, finishes and all related accessories, for the following:
  - 1. Footings.
  - 2. Foundation walls and piers.
  - 3. Slabs-on-grade.
  - 4. Columns.
  - 5. Concrete toppings.
  - 6. Base slabs.
  - 7. Miscellaneous concrete items.
  - 8. Placement of embedded items provided by other trades
- B. Related Requirements:
  - 1. Division 01 Section "Structural Tests and Special Inspections".
  - 2. Division 03 Section "Concrete Formwork".
  - 3. Division 03 Section "Concrete Reinforcement".
  - 4. Division 03 Section "Concrete Topping".
  - 5. Division 04 Section "Unit Masonry" for wedge type inserts and dovetail slots.
  - 6. Division 05 Sections for items cast into concrete.
  - 7. Division 31 Section "Earth Moving".

**1.3 REFERENCES**

- A. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
- B. ACI 214 - Recommended Practice for Evaluation of Strength Test Results of Concrete.
- C. ACI 223 – Standard Practice for the Use of Shrinkage Compensation Concrete.
- D. ACI 301 - Specifications for Structural Concrete for Buildings.
- E. ACI 302 – Guide for Concrete Floor and Slab Construction.
- F. ACI 304 - Guide for Measuring, Mixing, Transporting and Placing Concrete.
- G. ACI 305 - Hot Weather Concreting.

- H. ACI 306 - Cold Weather Concreting.
- I. ACI 308 – Standard Practice for Curing Concrete.
- J. ACI 309 - Guide for Consolidation of Concrete.
- K. ACI 318 - Building Code Requirements for Structural Concrete.
- L. ASTM E 1155 – Standard Test Method for Determining  $F_F$  Floor Flatness and  $F_L$  Floor Levelness Numbers.

#### 1.4 DEFINITIONS

- A. Floor Flatness Number,  $F_F$ , measures floor curvature or flatness per ASTM E 1155.
- B. Floor Levelness Number,  $F_L$ , measures floor inclination from a horizontal plane per ASTM E 1155.
  - 1. Floor Levelness, ( $F_L$ ), tolerances only apply to nonsloping slabs-on-grade and suspended slabs shored at time of testing. Floor Levelness tolerances shall not apply to slabs placed on unshored form surfaces, shored surfaces after removal of shores, or pitched slab surfaces per ACI 302.
- C. Overall  $F_F/F_L$  numbers represent minimum values acceptable for all combined local floor test sections representing the specified floor finish area per ACI 302.
- D. Local  $F_F/F_L$  test areas shall be defined as follows per ACI 302.
  - 1. Areas bounded by construction or control joints for slabs-on-grade.
  - 2. Areas bounded by columns and/or wall lines for elevated structural slabs. No less than one-half bay size.
- E. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. Form-release agents
  - 2. Concrete Admixtures.
  - 3. Curing Materials.
  - 4. Joint Fillers.
  - 5. Waterstops.
  - 6. Floor and Slab Treatments.
  - 7. Bonding Agents.
  - 8. Adhesives.
  - 9. Repair Materials
- B. Concrete Mix Designs: Each concrete mix design submittal shall contain the following information:

CAST-IN-PLACE CONCRETE  
 BID PACKAGE 2C WAYFINDING SIGNAGE REBID  
 & HAZARDOUS MATERIALS ABATEMENT  
 ISSUE FOR BID  
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1. Mix Number (which will correspond to mix ticket on trucks delivered to site).
2. Application for which concrete is designed (i.e. – footings, slabs, etc...)
3. Applicable mix performance criteria including:
  - a. Final Design strength at 28 days.
  - b. Unit Weight.
  - c. Air Content.
  - d. Slump (with water only and after addition of WRA and/or HRWRA).
  - e. For shrinkage compensating concrete, provide results of restrained prism expansion tests, ASTM C878, with mix design.
4. Applicable mix ingredients including quantities, ASTM designations, and sources for:
  - a. Cementitious materials.
  - b. Aggregate source, geological type, size, and shape.
    - 1) Include total gradation for combined coarse and fine aggregates for mixes specified to contain Well Graded Aggregate.
    - 2) Included calculated Coarseness Factor and Workability Factor for mixes specifying limits on these values.
  - c. Water.
    - 1) Indicate amount of mixing water to be withheld for later addition at Project site.
  - d. Water cementitious materials ratio, w/cm.
  - e. Admixtures.
  - f. Fibers, color pigments, and other additions.
5. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Proposed construction joint and saw-cut contraction joint locations for slabs-on-grade.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Submittal Schedule for all action submittal items.
- B. Manufacturer's Instructions for each type of product indicated:
  1. Curing and Sealing Compounds.
  2. Joint Fillers.
  3. Waterstops.
  4. Floor and Slab Treatments.
  5. Bonding Agents.
  6. Adhesives.
  7. Repair Materials.
- C. Preconstruction Material Test Reports:
  1. Cementitious Materials.
  2. Compressive strength results of trial batches or historical test data, in accordance with ACI 318 Chapter 5, indicating following:
    - a. Specified compressive strength,  $f'_c$ .
    - b. Average compressive strength,  $f'_{cr}$ .
    - c. Number of consecutive tests.
    - d. Overall standard deviation.

- e. Overall coefficient of variation.
- f. Minimum moving average of three consecutive strength tests.
- 3. Aggregate gradation, specific gravity, and absorption.
- 4. Aggregate potential alkali-silica reactivity (ASR) for concrete in exterior, corrosive, or wet environments in accordance with ASTM C 289.

D. Minutes of Pre-Installation conference.

E. Sustainable Design Submittals:

- 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR 4.2 if required: For products having recycled content, documentation indicating weights, costs, and percentages by weight of postconsumer and preconsumer recycled content.
  - a. Include statement indicating material weights and costs for each product having recycled content.
  - b. Design Mixtures for Credit ID 1.1: For each concrete mixture containing recycled pozzolanic or cementitious materials as a replacement for portland cement and for equivalent concrete mixtures that do not contain portland cement replacements.
- 2. LEED Credit: Product Data for Credit MR 5.1 and Credit MR 5.2 if required: For products having Regional content (Extracted, and processed or manufactured within 500 miles of site), documentation indicating total weights, costs and percentages by weight of regional content.
  - a. Include statement indicating material weights, and costs for each product having regional content.

F. Construction Test Reports:

- 1. Concrete tests.
- 2. Floor tolerance measurement.
- 3. Industrial floor joint filler inspection.

## 1.7 CLOSEOUT SUBMITTALS

- A. Floor Correction Agreement: Submit written floor slab extended correction period agreement in duplicate within ten days after date of Substantial Completion.
- B. Maintenance Contracts:
  - 1. Curing and Sealing Compounds.
  - 2. Floor and Slab Treatments.
- C. Operation and Maintenance Data:
  - 1. Curing and Sealing Compounds.
  - 2. Floor and Slab Treatments.
- D. Bonds.
- E. Warranty Documentation.
- F. Record Documentation.
- G. Sustainable Design Closeout Documentation.

## 1.8 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. **Testing Agency Qualifications:** An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- D. **Source Limitations:** Obtain materials from same source throughout Work.
- E. **Mockups:** Construct mockups as directed by the Architect to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
  - 1. **Exposed Concrete Panel Samples:** Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship for review and acceptance by Architect and Owner.
    - a. Build panel to size and in the location as directed by the Architect.
    - b. Approved mockups may become part of the completed Work and shall remain exposed to view for duration of work as basis for quality of final construction.
    - c. Sample mockups not selected for incorporation shall be demolished and removed from site.
- F. Contractor shall assign a qualified staff member to perform quality control on their own work in the field on a daily basis, for each day work is performed. The Contractor's quality control staff shall review their own work for compliance with contract documents before the Contractor notifies the design team of readiness for required inspections, tests and observations to be provided by the Owner's Representatives.
- G. **Pre-Installation Conference:** Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination" and Division 01 Section "Structural Tests and Special Inspections".
  - 1. Review installer qualifications, methods, scheduling and testing procedures before work is started.
  - 2. Review special inspection and testing and inspecting agency procedures for field quality control, steel reinforcement installation, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, vapor-retarder installation, anchor rod and anchorage device installation tolerances, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

3. Authorized representatives of concrete supplier, industrial floor supplier and installer, floor finisher, testing and inspection agency, admixture supplier, steel fiber reinforcement supplier, Engineer, Owner and Construction Manager.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.
- B. Joint Filler, Joint Sealers and Curing Materials: Deliver in original factory packaging and unopened containers and protect from damage and contamination.

#### 1.10 SITE CONDITIONS

- A. Provide total building enclosure including weather tight roof and walls before placing interior concrete slabs.
- B. During installation of interior slabs on grade, close openings in exterior walls and roofs enclosing areas.
- C. Provide minimum interior temperature 50 degrees F during installation and curing.
- D. Vent heaters or combustion equipment to outside.

### 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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

#### 2.2 CONCRETE MATERIALS

- A. Cementitious and Pozzolanic Materials: Use the following materials, of the same type, brand, and source for each required type of concrete and on which selection of concrete proportions was based:
  1. Portland Cement: ASTM C 150, Type 1 or Type I/II.
  2. Fly Ash: ASTM C 618, Class C or F, and as specified herein.
    - a. Available Alkalis, as  $\text{Na}_2\text{O}$  equivalent: 1.5% maximum
    - b. Loss On Ignition (LOI): 1% maximum
    - c. Calcium Oxide Limit (CaO): 20% maximum
  3. Microsilica: ASTM C 1240, amorphous silica.
  4. Replacement Ratio: Portland cement shall be replaced on an equal mass (not weight) basis. Material replacements shall be expressed as a percent, by mass, of the total cementitious materials content, with proportions selected for 28 day

compressive strengths equal to those specified. The change in volume resulting from the substitutions shall be determined and an adjustment in both coarse and fine aggregate proportions shall be determined in order to ensure a unit volume.

- a. Fly Ash replacement shall not exceed 30% for Class C, 20% for Class F, or as specified for a particular mix design.
- b. Microsilica replacement shall not exceed 10%.
- c. Maximum cement replacement of concrete mixes containing pozzolan shall not exceed 40% unless specified otherwise.

B. Normal-Weight Aggregates: ASTM C 33. Do not use aggregates containing soluble salts or other substances which can cause stains on exposed surfaces. Use aggregates from one source of supply corresponding to that on which selection of concrete proportions was based.

1. Coarse Aggregate: Minimum Class Designation:
  - a. Class 3S Typical
  - b. Class 4S Exterior horizontal concrete
    - 1) Maximum absorption 1.7%
  - c. Class 5S Exterior exposed architectural concrete
    - 1) Maximum absorption 1.7%
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
3. Aggregate Gradation: Conform to ASTM C 33 and as specified herein.
  - a. Well Graded Aggregate: Provide in concrete mixes indicated with the combined coarse and fine aggregates meeting the following criteria:

Sieve Size	Top Size Aggregate		
	1 1/2"	1"	3/4"
% Retained on Sieve			
1 1/2"	0% - 8%		
1"	8% - 18%	0% - 8%	
3/4"	8% - 18%	8% - 22%	0% - 6%
1/2"	8% - 18%	8% - 22%	6% - 22%
3/8"	8% - 18%	8% - 22%	6% - 22%
No. 4	8% - 18%	8% - 22%	6% - 22%
No. 8	8% - 18%	8% - 22%	6% - 22%
No. 16	8% - 18%	8% - 22%	6% - 22%
No. 30	8% - 18%	8% - 22%	6% - 22%
No. 50	3% - 12%	3% - 12%	3% - 12%
No. 100	0% - 8%	0% - 8%	0% - 8%
No. 200	0% - 5%	0% - 5%	0% - 5%

- 1) At least 55% by weight shall be retained on or above the #4 sieve.
- 2) A maximum of two non-adjacent sieves between 1 inch and No. 50 may fall outside the prescribed limits above with a minimum of 5% retained and a maximum of 22% retained on these nonconforming sieves.
4. Aggregates for Exposed Architectural Finish Concrete: Aggregates shall be specially selected for color and size as selected by Architect.

C. Water: ASTM C 94 and potable.

## 2.3 ADMIXTURES

- A. General: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use admixtures containing calcium chloride or thiocyanates.
- B. Air-Entraining Admixture (AEA): ASTM C 260.
  - 1. Available Products:
    - a. BASF: MB AE 90 or Micro Air.
    - b. Euclid Chemical Company: Air-Mix.
    - c. General Resource Technology: Polychem AE.
    - d. Grace Construction Products: Daravair series or Darex series.
    - e. Protex Industries: Protex AES.
- C. Water-Reducing Admixture (WRA): ASTM C 494, Type A.
  - 1. Available Products:
    - a. BASF: Pozzolith 210 or Pozzolith 322 N
    - b. Euclid Chemical Company: Eucon WR-75.
    - c. General Resource Technology: Polychem 1000.
    - d. Grace Construction Products: WRDA.
- D. Mid-Range Water-Reducing Admixture (MRWRA): ASTM C 494, Type A.
  - 1. Available Products:
    - a. BASF: Polyheed 997 or Polyheed FC100.
    - b. Euclid Chemical Company: Eucon A+.
    - c. General Resource Technology: KB-1000.
    - d. Grace Construction Products: Daracem-65.
- E. Polycarboxylate High-Range Water-Reducing Admixture (HRWRA): ASTM C 494, Type F.
  - 1. Available Products:
    - a. BASF: Glenium 3000 NS, 3030 NS, or 3200 HES.
    - b. Euclid Chemical Company: Plastol 5000.
    - c. Grace Construction Products: ADVA.
- F. Whelan Gum or Methylcellulose Viscosity Modifying Admixture (VMA):
  - 1. Available Products:
    - a. BASF: Rheomac VMA 358, 362, or 450.
    - b. Euclid Chemical Company: Viscrol.
- G. Water-Reducing and Retarding Admixture: ASTM C 494, Type B and D.
  - 1. Available Products:
    - a. BASF: Pozzolith 80 or Pozzolith 200 N.
    - b. Euclid Chemical Company: Eucon Retarder-75.
    - c. General Resource Technology: Polychem R.
    - d. Grace Construction Products: Daratard 17.
- H. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E.

1. Available Products:
  - a. BASF: Pozzolith NC 534.
  - b. Euclid Chemical Company: Accelguard 80.
  - c. General Resource Technology: Polychem Super Set.
  - d. Grace Construction Products: Polarset.

I. Integral Water Repellant Admixtures:

1. Available Products:
  - a. Grace Construction Products: Darapel
  - b. Xypex Chemical Corporation: Admix C-1000 or C-2000.

- J. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures effectively containing chloride ions (more than 0.05 percent) are not permitted.

## 2.4 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

1. Available Products:
  - a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
  - b. Concrete Sealants Inc.; Conseal CS-231.
  - c. Greenstreak; Swellstop.
  - d. Henry Company, Sealants Division; Hydro-Flex.
  - e. JP Specialties, Inc.; Earthshield Type 20.
  - f. Progress Unlimited, Inc.; Superstop.
  - g. TCMiraDRI; Mirastop.

## 2.5 MISCELLANEOUS EMBEDDED ITEMS

- A. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Plate Washers: ASTM A 36 carbon steel.
3. Washers: ASTM F 436 hardened carbon steel.

- B. Miscellaneous angles, channels, and plates: ASTM A 36.

- C. Reglets: Fabricate reglets of not less than 0.0217-inch- thick (26-ga.), galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

1. Available Manufacturers:
  - a. Gateway Building Products.
  - b. Heckman Building Products.
  - c. Hohmann-Bernard.

- D. Stair Nosings:

1. Available Products:
  - a. Wooster Products: Spectra Type WP4C.

## 2.6 CURING, CLEANING, AND SEALING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
  - 1. Available Products:
    - a. BASF: Confilm
    - b. Burke by Edoco; BurkeFilm.
    - c. ChemMasters; Spray-Film.
    - d. Conspec; Aquafilm.
    - e. Dayton Superior Corporation; Sure Film.
    - f. Euclid Chemical Company; Eucobar.
    - g. Kaufman Products, Inc.; Vapor Aid.
- B. Water Cure:
  - 1. Waterproof paper.
  - 2. Reef Industries: Transguard Economy Grade. (ASTM C 171, 20-mils thick, polypropylene sheet with nonperforated white coating.)
  - 3. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
  - 4. Dayton Bag and Burlap: Burlene.
  - 5. Reef Industries: Transguard 4000; 42-mil thick, fiber mat with polyethylene sheet backing.
- C. Water: ASTM C 94 and potable.
- D. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A, minimum 25 percent total solids.
  - 1. Available Products:
    - a. Burke by Edoco; Cureseal 1315.
    - b. ChemMasters; Spray-Cure & Seal Plus.
    - c. Dayton Superior Corporation; Day-Chem Cure and Seal (J-22UV).
    - d. Euclid Chemical Company; Super Diamond Clear.
    - e. L&M Construction Chemicals, Inc.; Lumiseal Plus.
    - f. Meadows, W. R., Inc.; CS-309/30.
- E. Concrete Floor Cleaner and Stripper:
  - 1. Available Products:
    - a. Burke by Edoco; Burke Klean.
    - b. Dayton Superior Corporation; Citrus Peel (J-48).
    - c. Euclid Chemical Company; Euco Clean & Strip.
    - d. Kaufman Products, Inc.; K Pro CD.
    - e. L&M Construction Chemicals, Inc.; Citrex.
- F. Penetrating Liquid Densifier and Sealer: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.
  - 1. Available Products:
    - a. Burke by Edoco; Titan Hard.
    - b. ChemMasters; Chemisil Plus.



- c. Curecrete Distribution Inc.; Ashford Formula.
- d. Dayton Superior Corporation; Day-Chem Sure Hard.
- e. Euclid Chemical Company; Euco Diamond Hard.
- f. Kaufman Products, Inc.; SureHard.
- g. L&M Construction Chemicals, Inc.; Seal Hard.

## 2.7 JOINT MATERIALS

- A. Equipment Control joint saw:
  - 1. Available Products:
    - a. Soff-Cut International; "Soff-Cut System," early-entry dry-cut saw with Skid Plate.
- B. Expansion Joint Material: ASTM D 1751, asphalt-saturated cellulosic fiber.
  - 1. Available Manufacturers:
    - a. W.R. Meadows.
    - b. BASF.
- C. Joint Backer Rod: Flexible, compressible, closed-cell polyethylene foam, not less than 10 psi compression deflection.
- D. Joint Filler-Industrial Slabs: Two-component, semirigid, 100 percent solids, per ASTM D 2240.
  - 1. Metzger/McGuire, MM80.
  - 2. Metzger/McGuire, SPAL-PRO RSF at freezers.
- E. Interior Joint Sealer: Mameco, Vulkem 45.
- F. Interior Bond Breaker Joint: 30 pound asphalt felt, unperforated.

## 2.8 RELATED MATERIALS

- A. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- B. Under Slab Vapor Retarder: ASTM E1745, Class A. Permeance of less than 0.01 perms after mandatory conditioning tests per ASTM E 1745 (7.1.1 – 7.1.5). Not less than 15 mils thick.
  - 1. Manufacturers and Products:
    - a. Barrier Bac, Inc..
    - b. Raven Industries.
    - c. Reef Industries, Inc..
    - d. Stego Industries.
    - e. Monaflex
    - f. Flatiron Films
  - 2. Accessories:
    - a. Seam tape: High density polyethylene tape with pressure sensitive adhesive, minimum 4 inches wide.
    - b. Pipe boots: Constructed from vapor barrier membrane and seam tape.

## 2.9 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
  - 4. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
  - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

## 2.10 CONCRETE MIXING

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, with exceptions specified herein, and ASTM C 1116 where fibers are used, and furnish batch ticket information.
  - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- C. Admixtures: Use approved admixtures according to manufacturer's written instructions.
  - 1. Use chemical admixtures in concrete, as required, for placement, workability, durability, and controlled set time.
- D. Air Content: Do not allow air content of hard-troweled finished floors to exceed 3 percent.
- E. Concrete Slump Limits: Measured according to ASTM C 143 at point of placement.
  - 1. 4 inches without water reducing admixtures
  - 2. 5 inches after addition of WRA or MWRA.

3. 7 inches after addition of HRWRA.
4. A tolerance of up to one inch above indicated maximum will be allowed for one batch in any five consecutive batches tested.
5. If the maximum water-cement ratio is not exceeded, concrete arriving at the jobsite within 60 minutes of the initial batching that has a slump less than the maximum allowed may have water added when accepted by the project inspector.
6. Water reducing admixtures will not be incorporated in combination with shrinkage compensating concrete unless approved by the Engineer.
7. Water reducing admixtures may be added to increase the slump when water can not be added and additional slump is necessary for workability when accepted by the project inspector.
8. Water shall not be added to the mix after any supplemental water reducing admixtures have been dosed into the mixer.

## 2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 56 days (min), $f'_c$	4000 psi
Maximum Cementitious Content	520 lb/cy
Maximum water/cementitious materials ratio, w/cm	0.50
Cementitious Materials Portland Cement, Type I or Type I/II Supplementary Cementitious Materials	50%-100% 0%-50%
Top Size Aggregate	1-1/2 inch

- B. Foundation Walls and Piers: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), $f'_c$	4000 psi
Maximum Cementitious Content	520 lb/cy
Maximum water/cementitious materials ratio, w/cm	0.45
Cementitious Materials Portland Cement, Type I or Type I/II Supplementary Cementitious Materials	60%-100% 0%-40%
Top Size Aggregate	1-1/2 inch
Air Content (at point of placement) at un-insulated exterior foundation walls	5.5% ( $\pm 1.5\%$ )

- C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), $f'_c$	4000 psi
Maximum Cementitious Content	520 lbs/yd <sup>3</sup>

Maximum water/cementitious materials ratio, w/cm	0.44
Cementitious Materials Portland Cement, Type I or Type I/II Fly Ash, Class C or F	70%-100% 0% - 30%
Maximum Top Size Aggregate	1-1/2 inch
Aggregate Gradation	Well Graded
Coarseness Factor	52 - 70
Workability Factor	32 - 40
Air Content (at point of placement) for slabs exposed to freezing and thawing	5.5% ( $\pm$ 1.5%)

- D. Suspended Slabs-On-Metal Deck: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), $f'_c$	4000 psi
Equilibrium Unit Weight	150 lbs/ft <sup>3</sup> ( $\pm$ 3 lbs/ft <sup>3</sup> )
Cementitious Materials Content	520 lbs/yd <sup>3</sup>
Maximum water/cementitious materials ratio, w/cm	0.44
Cementitious Materials Portland Cement, Type I or Type I/II Fly Ash, Class C or F	70%-80% 20% - 30%
Top Size Aggregate	1.5 inch
Coarseness Factor	52-70
Workability Factor	32-40
Aggregate Gradation	Well Graded
Air Content (at point of placement)	3% maximum
Strux 90/40 Synthetic Fiber Reinforcement	As indicated on drawings

- E. Concrete Topping Slabs: Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), $f'_c$	3000 psi
Maximum Cementitious Content	564 lbs/yd <sup>3</sup>
Maximum water/cementitious materials ratio, w/cm	0.42
Cementitious Materials Portland Cement, Type I or Type I/II Fly Ash, Class C or F	70%-100% 0% - 30%
Minimum Top Size Aggregate	1/2 inch
Aggregate Gradation	Well Graded

- F. Miscellaneous Concrete Items: Concrete stair pan fill, curbs, housekeeping pads, etc. Proportion normal-weight concrete mixture as follows:

Item	Requirements
Compressive Strength at 28 days (min), $f'_c$	3000 psi
Maximum water/cementitious materials ratio, w/cm	0.45
Cementitious Materials Portland Cement, Type I or Type I/II Supplementary Cementitious Materials	60%-100% 0%-40%
Minimum Top Size Aggregate	1/2 inch

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Work shall conform to ACI 117 and ACI 301, except as modified by requirements of these Contract Documents.

### 3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
  2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
  3. Install wedge inserts for masonry shelf angle supports and sleeves for pipe and conduit.

### 3.3 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect and Engineer.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
  2. Form joints with keyways and/or dowels as detailed. Embed keys at least 1-1/2 inches into concrete.
  3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows where not specifically shown on Drawings:
1. Exterior Slabs:
    - a. Spacing shall not exceed 24 times slab thickness; 10 feet on center, maximum.
    - b. Short: long side ratio shall not be less than 3:4.
  2. Interior Slabs:
    - a. As indicated on drawings.
  3. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  4. Sawed Joints: Form contraction joints with early-entry dry-cut power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
    - a. Install cuts 0 to 2 hours after final finishing and prior to final set.
    - b. Install joint protector at saw-cut intersections prior to cross cut.
  5. Provide cleanly cut, straight joints in toppings over joints in base slab.
  6. Do not saw cut slabs on metal deck.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install expansion joint material at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend expansion joint material full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
  2. Terminate full-width expansion joint material not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
  3. Install expansion joint material in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

### 3.4 WATERSTOPS

- A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

### 3.5 INSTALLING UNDER SLAB VAPOR RETARDER

- A. Install according to membrane manufacturer's current published instructions and ASTM E1643.
- B. Install over level granular base and under reinforcing and slabs on grade.
- C. Lap over footings and seal to foundation walls.

- D. Overlap membrane joints minimum 6 inches and seal continuously with seam tape.
- E. Seal penetrations and pipes with pipe boot fashioned from membrane and sealed with seam tape.
- F. Repair damaged membrane with patches of membrane overlapping damage minimum 6 inches and sealing completely with seam tape.

### 3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
  - 1. Do not add water to concrete after adding water-reducing admixtures to mixture.
- C. Clean forms, reinforcing and accessories and lubricate forms prior to placing concrete.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
  - 4. Do not insert vibrators to bottom of slabs-on-grade with underfloor vapor retarders to avoid damaging this membrane.
  - 5. Do not allow concrete to drop freely more than 4 feet.
  - 6. Use approved chutes equipped with suitable hoppers for placing where required.
  - 7. Place at rate that concrete is always plastic and flows readily into every space.
  - 8. Place beams, girders and haunches monolithically with floor system.
  - 9. Wait until concrete in columns and walls is no longer plastic before casting beams, girders or slabs supported by them.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Before concrete slabs on grade are placed, verify that granular base is level and compacted.
  - 2. Sprinkle base to eliminate suction of water from concrete.
  - 3. Allow no freestanding water.

4. Place interior slabs only after permanent walls and roof enclose slab area.
5. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
6. Maintain reinforcement in position on chairs during concrete placement.
7. Do not insert vibrators to bottom of slabs-on-grade with underfloor vapor retarders to avoid damaging this membrane.
8. Screed slab surfaces with a straightedge and strike off to correct elevations.
9. Slope surfaces uniformly to drains where required.
10. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Concrete Finish Topping:

1. Prior to placing topping, remove laitance and loose particles of sand and dirt.
2. Remove oil and grease spots by washing with 10 percent solution of muriatic acid or strong washing soda.
3. After cleaning, hose down with pressure hose and keep base slab wet for at least 12 hours.

G. Do not use concrete that has partially hardened or been contaminated by foreign materials, nor concrete that has been retempered or remixed after initial set.

H. Before depositing new concrete on or against concrete that has set at construction joints, clean, wet and apply bonding agent to existing surfaces. Tighten forms prior to resuming pouring.

I. Exercise care to prevent splashing of forms or reinforcing with concrete above level of concrete being placed.

J. Clean reinforcement projecting above or out of concrete immediately after completion of particular unit of pour.

K. Do not place concrete under adverse weather conditions unless adequate protection is provided. Refer to ACI 301, for weather restrictions and placing temperatures.

### 3.7 COLD WEATHER CONCRETING

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.



4. Ensure minimum temperatures are maintained for the duration of the curing period in accordance with ACI 306.1.
5. Concrete shall be allowed to dry for at least 12 hours before removing temperature protection for water cured or moisture retention cured concrete.

### 3.8 HOT WEATHER CONCRETING

- A. Hot-Weather Placement: Comply with ACI 301 and as follows:
  1. When high temperature, measured on jobsite at concrete placement area, is expected to rise above 90 deg F, maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. When temperature of steel reinforcement, embeds, subgrade, or forms, is greater than 120 degrees F, fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
  3. Protect concrete from wind and direct sunlight to avoid rapid drying.
  4. Apply evaporation retarder to unformed concrete surfaces if the air temperature exceeds 80 degrees F, the wind speed exceeds 10 mph, or the relative humidity is less than 40%. Apply according to manufacturer's written instructions immediately after placing and screeding.
  5. Apply moisture retaining covers or wet cure in accordance with concrete curing and protection methods as specified.

### 3.9 FINISHING FLOORS AND SLABS

- A. Finish bare concrete floors (adjacent to floors with other surfacing) so concrete surface is level with other finishes, unless otherwise noted.
- B. At areas to receive floor covering, grind smooth joints between slabs on grade and structural slabs and between existing and new surfaces to eliminate unevenness and to provide smooth, level surface across joints.
- C. Wetting the concrete surface during finishing operations is prohibited.
- D. Power floating with troweling machines equipped with normal trowel blades is prohibited.
- E. Use caution when finishing lightweight concrete slabs to maintain trowel blades at shallow angle as possible during final finishing operations.
  1. Do not provide a tight steel trowel finish to lightweight concrete slabs.
- F. Protect finished surfaces from damage. Keep free of abrasive materials.
- G. In areas where water will be present (interior and exterior) place and finish slabs so areas will drain and water will not stand in puddles. Conform to slopes shown. At structural slabs, verify elevations of drains to insure drains will be at low points. Where elevations and slopes are not indicated, generally slope floors 1/8 inch per foot uniformly to drains, unless otherwise directed by Architect.

- H. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-foot-long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4-inch.
- I. Apply slab finish to Floor Profile Number tolerances listed unless specifically noted otherwise on Drawings, according to ASTM E 1155 "Standard Test Method for Determining  $F_F$  Floor Flatness and  $F_L$  Floor Levelness Numbers" for randomly trafficked floor surfaces.
  - 1. Refer to ACI 302, Chapter 8 and Table 8.15.3, for recommended typical procedures to attain specified Floor Profile Numbers.
- J. General Finishing Requirements: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces as appropriate to attain slab finish specified.
  - 1. Utilize wet-screed guides, dry-screed guides, and/or edge forms for initial strikeoff set with optical or laser instruments as appropriate to attain specified Floor Profile Number. Check elevation after initial strikeoff and repeat as necessary.
  - 2. Smooth and restraighen surface using 8 to 10 foot wide bull float, darby, or modified highway straightedge.
    - a. Apply in two directions at 45 degree angle to strip for Overall Floor Flatness,  $F_F$ 30 or greater.
  - 3. Wait until bleed water sheen has disappeared and concrete can sustain finishing operations employed without digging in or disrupting the levelness of the surface.
  - 4. Float surface with one or more passes using a power float (float shoe blades or pans) or by hand floating if area is small or inaccessible to power driven floats. Restraighen, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
- K. CONC FIN-1: Light Trowel Finish.
  - 1. Follow General Finishing Requirements for initial procedures.
  - 2. Restraighen surface if required following paste-generating float passes using 10-foot wide highway straightedge.
  - 3. Consolidate concrete surface, uniform in texture and appearance, with one to two passes using power trowel. Hand trowel areas inaccessible by power trowel.
- L. CONC FIN-2: Medium Trowel Finish.
  - 1. Follow General Finishing Requirements for initial procedures.
  - 2. Restraighen surface if required following paste-generating float passes using 10-foot wide highway straightedge. Apply in two directions at 45 degree angle to strip. Use supplementary material to fill low spots.
  - 3. Consolidate concrete surface, uniform in texture and appearance, with two to three passes using power trowel. Hand trowel areas inaccessible by power trowel.
- M. CONC FIN-3: Trowel and Fine Broom Finish.
  - 1. Follow General Finishing Requirements for initial procedures.
  - 2. Consolidate concrete surface, with one pass using a power trowel.
  - 3. Slightly scarify surface with soft bristled broom while concrete is still plastic.

## N. CONC FIN-4: Broom Finish.

1. Surfaces of concrete mixes with silica fume and/or calcium nitrite must be kept moist (not wet) during finishing operations to promote proper texturing. Pressure foggers with a reach capable of covering the entire surface can aid finishing operations.
2. Follow General Finishing Requirements, steps 1 through 3, for initial procedures.
3. Scarify surface with a transverse scored texture using a medium bristled broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
4. Finish Tolerance: Surface shall not vary by more than  $\pm 1/2$  inch anywhere from elevation noted on Drawings.
5. Finish all concrete slabs to proper elevations to insure that all surface moisture will drain freely, and that no puddles exist. Contractor must bear cost of any corrections to provide positive drainage and repairing poorly finished surface areas.

## O. CONC FIN-5: Slip-Resistive Aggregate Finish.

1. Apply at rates recommended by the manufacturer, but not less than 25 pounds per 100 square feet.
2. Verify all procedures noted below are in compliance with manufacturer's written instructions. Notify Architect of any discrepancies requiring resolution.
3. Follow General Finishing Requirements, steps 1 through 3, for initial procedures.
4. Break the surface using a power trowel with float shoes or attached pan.
5. Evenly distribute approximately two-thirds of the specified amount of non-slip aggregate with mechanical spreader.
6. After applied material has absorbed moisture, float surface using hand wooden floats. Take care not to tear through into the underlying concrete.
7. Apply remaining one-third of dry-shake hardener. Tamp aggregate flush with surface, but do not force below surface. Float surface in a like manner.
8. If needed, trowel until the desired surface finish is achieved.
9. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

## P. Coordinate final slab texture requirements with Division 9 flooring installer for proper adhesion of final flooring materials.

## Q. Summary Slab Finish Schedule:

SLAB USE	SLAB FINISH	OVERALL F <sub>F</sub> /F <sub>L</sub>	LOCAL F <sub>F</sub> /F <sub>L</sub>
Carpet; raised access floor; or base slabs below acoustic concrete topping slabs	CONC FIN-1 Light Trowel Finish	F <sub>F</sub> 25/F <sub>L</sub> 20	F <sub>F</sub> 17/F <sub>L</sub> 15
Thin set resilient flooring; paint; or other thin film-finish coating system	CONC FIN-2 Medium Trowel Finish	F <sub>F</sub> 30/F <sub>L</sub> 25	F <sub>F</sub> 24/F <sub>L</sub> 15
Thin set ceramic or quarry tile; stone flooring; epoxy terrazzo	CONC FIN-3 Trowel and Fine Broom Fin-	F <sub>F</sub> 18/F <sub>L</sub> 15	F <sub>F</sub> 15/F <sub>L</sub> 10

SLAB USE	SLAB FINISH	OVERALL $F_F/F_L$	LOCAL $F_F/F_L$
	ish		
Parking ramps; exterior concrete pavement (Ramp > 7%)	CONC FIN-4 Broom Finish (Rake Finish)	$F_F18/F_L15$	$F_F15/F_L10$
Egress stair exposed concrete treads and landings; where shown on Drawings	CONC FIN-5 Slip-Resistive Aggregate Finish	$F_F25/F_L20$	$F_F17/F_L15$

R. Measurement of Floor Tolerance:

1. Frequency: For industrial slabs, conduct floor tolerance measurements for each day's slab placement.
  - a. Report deficient areas to Architect to determine repair procedures appropriate for final required finish.
  - b. Make appropriate adjustments to construction procedures prior to next slab placement when previous slab placement is deficient.
2. Frequency: Conduct floor tolerance or measurements within 72 hours of final finishing operations and prior to removal of forms on elevated slabs for each slab placement.
3. Frequency: Conduct floor tolerance or measurements only if slab appears to be out of tolerance.
4. Floor slab tolerances provided for localized areas shall apply to sections maximum one bay in length and minimum one-half bay.
5. Conduct measurement of floor tolerance for  $F_F100/F_L75$  areas by floor consultant utilizing Face Floor Profileograph, or other system approved by Architect.
6. Conduct measurement of floor tolerance for other slab areas utilizing Dip Stick Floor Profiler.

### 3.10 FINISHING FORMED SURFACES

- A. CONC FIN-20: Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- B. CONC FIN-21: Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
  1. Apply to Smooth-Formed Finish as-cast concrete where indicated.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### 3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces. Before final troweling of exposed treads and landings, apply dampened non-slip shake at a minimum rate of ¼ pound over square foot of surface.

### 3.12 CONCRETE PROTECTING AND CURING

- A. General: Concrete shall be maintained above 50-degrees F and in a moist condition for at least the first seven days after placement. Provide curing and protection immediately after placement in accordance with ACI 301 using materials as specified herein.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if the air temperature exceeds 80 degrees F, the wind speed exceeds 10 mph, or the relative humidity is less than 40% before and during finishing operations as measured at the Project site. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Wet Curing: Keep surfaces continuously wet for not less than three days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.

- c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
    - d. Protect surface from rapid loss of moisture upon termination of wet curing by covering with moisture-retaining covers for the remainder of the curing period.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    - a. After curing period has elapsed, completely remove curing compound without damaging concrete surfaces using concrete floor cleaner and stripper recommended by curing compound manufacturer.
  - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
- F. Wet cure or use moisture-retaining covers on all concrete surfaces for first 24 hours, minimum.
- 1. Continue curing in this manner for as long as Hot Weather Concreting conditions persist.
  - 2. Industrial slabs shall be water cured for entire curing period.
- G. Curing Compounds or Curing and Sealing Compounds shall not be used on concrete surfaces to receive adhered coverings or Penetrating Liquid Densifier and Sealer without prior manufacturer certification that it will not interfere with bonding of floor covering and warranties of flooring installer are validated.
- H. Moisture Condition of Slabs – Following placement of concrete and climatization of building, check to see that any specified tests for moisture emission have been made and a written report submitted prior to floor covering or coating installation.
- 3.13 PENETRATING LIQUID DENSIFIER AND SEALER
- A. Penetrating Liquid Densifier and Sealer: Prepare, apply, and finish Penetrating Liquid Densifier and Sealer according to manufacturer's written instructions at concrete floors to remain exposed to view.
- 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
  - 2. Do not apply to concrete that is less than 28 days old unless treatment also functions as a curing aid.

3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Protect finish surface during remainder of construction. Repair immediately any staining of finish concrete surfaces by methods recommended by manufacturer.
- C. Dry buff finish floor surfaces per manufacturer's written instructions to achieve final gloss appearance of liquid densifier and sealer just prior to substantial completion after majority of heavy construction and wet work activities have been completed

### 3.14 JOINT FILLING

- A. Arrange for on-site supervision by manufacturer's personnel.
- B. Coordinate with Owner that adequate protection or spatial separation is provided to ensure there is not contamination of Owner's stored product during joint filling.
- C. Prepare, clean, and install joint filler according to manufacturer's written instructions.
  1. Defer joint filling until concrete has cured for 30 to 90 days and space has assumed its normal operating temperature. Do not fill joints until construction traffic has permanently ceased.
- D. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry. Clean inside wall of joints to bare concrete.
- E. Mix filler thoroughly with power equipment according to manufacturer's published instructions.
- F. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.
- G. Protect joint completely from traffic for 8 hours and from vehicular traffic for 24 hours.
- H. Touch Up:
  1. Within one year after Substantial Completion, touch up joints with additional material and correct for normal joint movement according to manufacturer's published directions.
  2. Coordinate schedule for joint touch up with Owner.
  3. Touch up joints during Owner's non-working hours as required by Owner.
  4. Coordinate with Owner and Architect to ensure there is no contamination of Owner's stored product.

### 3.15 JOINT SEALING

- A. When concrete has cured 30 to 90 days, and space has assumed its normal operating temperature, rake out loose debris and clean joint with compressed air.

- B. Install backer rod and sealant according to manufacturer's published recommendations.
- C. Protect joint completely from traffic for 24 hours.

### 3.16 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval and in accordance with ACI 301. Repair methods for defects affecting the concrete's structural performance shall be closely coordinated between Contractor and Engineer.
- B. Patching Mortar: Submit proposed patching materials for Architect's review and approval.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  - 2. After concrete has cured at least 14 days, correct high areas by grinding.
  - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.



5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.17 FIELD QUALITY CONTROL

- A. The Owner will engage a qualified testing and inspection agency to provide special inspection and testing services and prepare reports in accordance with Division 01 Section Structural Tests and Special Inspections", and with IBC 2006 Chapter 17 as adopted by the 2007 MSBC, and the CASE/Mn Guideline for Special Structural Inspection and Testing, and other items which in the professional judgement of the Structural Engineer of Record, are critical to the integrity of the building structure.
- B. Contractor will cooperate with and assist testing agency in obtaining representative concrete samples as concrete is placed for determining slump and air entrainment and casting test cylinders.
1. Provide suitable space on site for storage for field condition test cylinders.
  2. If testing agency is not available, cast compression test cylinders as concrete is placed, determine and record slump of concrete, determine and record air content of concrete and submit cylinders and information to the testing agency.
- C. Inspections:
1. Verification of use of required design mixture.
  2. Concrete placement, including conveying and depositing.
  3. Curing procedures and maintenance of curing temperature.
  4. Verification of concrete strength before removal of shores and forms from beams and slabs.

- D. Concrete Tests (Technical 1): Testing of composite samples of fresh concrete obtained according to ASTM C 172 - Practice for Sampling Freshly Mixed Concrete, ASTM C 31 - Practice for Making and Curing Concrete Test Specimens in the Field, and ASTM C 39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens. Evaluation and acceptance of concrete shall be in accordance with ACI 318 and according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture where less than 50 yd<sup>3</sup> is placed, plus one additional set for each additional 100 yd<sup>3</sup> or fraction thereof.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  2. Slump: ASTM C 143; one test at point of discharge for each composite sample.
    - a. Perform additional tests when concrete consistency appears to change.
    - b. For industrial slabs, slump each truck until slump stabilization is reached then decrease slump frequency to one test per 25 cubic yards.
  3. Air Content: When air content is specified, perform test in accordance with ASTM C 231, pressure method, for normal-weight concrete and ASTM C 173, volumetric method, for structural lightweight concrete.
    - a. Where placement is by pump, air content shall be measured at location of placement.
    - b. For concrete exposed to freezing and thawing, concrete from each truck shall be tested and concrete not meeting specified percentages shall not be placed.
    - c. For interior concrete not exposed to freezing and thawing, such as lightweight concrete on metal decking, perform one test for each set of test cylinders.
    - d. Concrete used in performing air content test shall not be used in fabricating test specimens
  4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
  5. Unit Weight: ASTM C 567, equilibrium unit weight of structural lightweight concrete; one test for each composite sample.
  6. Compression Test Specimens: ASTM C 31.
    - a. Cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
    - b. Cast and field cure one cylinder specimen for each composite sample.
      - 1) Store field-cured cylinders as near as possible to location of concrete represented by sample and give cylinder, insofar as practicable, same protection and curing as adjacent concrete.
    - c. If additional specimens are required to verify early strength of concrete, contractor must pay for additional testing.
  7. Compressive-Strength Tests: ASTM C 39.
    - a. Test one cylinder specimen at 7 days for information, and remaining two cylinder specimens at 28 days for acceptance, plus one cylinder to be held until 90 days in the event that the 28 day compressive strengths are not met.

- b. Deliver field-cured specimens to laboratory at 28 days and test to verify adequacy of curing and protection in field.
  - c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing when requested by the Owner's Representative(Technical 1):
  - 1. Measurements shall be made prior to removal of forms and shores at elevated structural slabs.
  - 2. The Contractor shall be notified immediately after the measurements of any section are complete and a written report of the results shall be submitted within 72 hours after finishing operations are complete.
  - 3. Report deficient areas to Architect to determine repair procedures appropriate for final required finish.

### 3.18 EVALUATION OF TEST RESULTS

- A. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- B. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- C. Test results shall be reported in writing to Architect, concrete supplier, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- E. Additional Tests: Testing and inspecting agency shall make additional tests of concrete at the expense of the Contractor when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

- G. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.
- H. Fill core holes with concrete specified for location.

END OF SECTION 03300

**NEW PASSENGER TERMINAL  
DULUTH INTERNATIONAL AIRPORT  
DULUTH, MINNESOTA**

**SECTION 05120 – STRUCTURAL STEEL  
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. Structural steel framing members and all related accessories such as structural embeds, connections, bolts, welds, fasteners, threaded rods, headed studs, including fabrication, erection and all related work and accessories.
  - 2. Grouting for base plates, seats, and bearing areas.
  - 3. Connections and other performance specified items, including related design by contractor's Qualified Professional Engineer.
  - 4. Temporary bracing and shoring, including related design by contractor's specialty structural engineer.
  - 5. Shop applied finishes and coatings, including preparation, primers, special paint systems or galvanizing on steel exposed to exterior or aggressive environments, and bitumastic coating on steel below grade in soil.
  - 6. The work covered by this Section shall include all labor, material, equipment, permits, engineering and other services necessary for the fabrication and installation of structural steel and related work, complete, in accordance with the drawings and as specified herein.
- B. Related Requirements:
  - 1. Division 01 – Structural Testing and Special Inspections.
  - 2. Division 01 – Submittal Procedures
  - 3. Division 03 – Cast-In-Place Concrete.

**1.3 REFERENCES**

- A. AISC Specification for Design, Fabrication, and Erection of Structural Steel for Buildings.
- B. AISC Code of Standard Practice for Steel Buildings and Bridges.
- C. AISC Specification for the Design of Steel Hollow Structural Sections.
- D. AWS D1.1 – Structural Welding Code.
- E. RCSC Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.
- F. ASTM Standards in Building Codes.
- G. Steel Structures Painting Council (SSPC) – PS7.01.

#### 1.4 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.
- B. The terms "for record" and "submit for record" in this specification are defined as Contractor submittals that do not require a response.

#### 1.5 CONNECTION DESIGN PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections, moment connections, axial connections, splice connections, and brace frame tension/compression connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand service loads indicated and comply with other information and restrictions indicated.
  - 1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction, Thirteenth Edition Allowable Strength Design." Connection concepts for non-fully detailed connections show only the minimum requirements to convey design intent.
  - 2. Engineering Responsibility: Fabricator's responsibilities include using a Qualified Professional Engineer to prepare structural analysis data for all structural-steel connections that are not completely detailed on the Contract Documents.
    - a. The contractor shall design and provide any stiffener plates, doubler plates, reinforcing plates, etc. and their connections that may be required to develop and/or transfer the forces and/or connection design criteria called for in the Contract Documents.
    - b. Design connections to withstand the combined effects of shears, axial forces, moments and torques and as required by applicable code(s) and the Contract Documents.
    - c. All non-shear forces shown on the drawings are to be assumed reversible unless noted otherwise, and must be checked for both directions. If no transfer/pass-through forces are shown on the Contract Documents, then the most critical combinations of member forces and directions shall be assumed for the connection design.
    - d. All welded connections must utilize pre-qualified joints or joints that have been qualified by AWS D1.1, Section 2.
    - e. Comply with all connection notes on drawings in conjunction with these specifications.
    - f. The connection design calculation submittals shall meet the following criteria:
      - 1. Use a logical numbering system for connections without repeating labels. Cloud all changes to resubmitted calculations.
      - 2. Provide sketches for the results of each calculation, with all the pertinent dimensions to the calculation shown.
      - 3. For repetitive connections a spreadsheet summary may be used, but provide all pertinent input and resulting values plus an example long-hand calculation.
      - 4. Provide drawings/sketches showing the overall locations of the connections that are keyed/referenced to each connection calculation.
      - 5. Provide calculation checks for all forces shown on the drawings. All AISC code requirements apply. "OK by inspection" is not permitted.

## 1.6 SUBMITTALS – PART A (FOR REVIEW)

- A. Product Data: For each type of product indicated.
- B. Typical Connection Design Submittal: For each classification of connections (shear, axial, moment, truss and braced frame), submit a proposed typical connection and the supporting calculations for review prior to commencing substantial connection design.
- C. Provide placement plan and details for shear studs on all composite steel framing.
- D. Shop Drawings and related submittals: Show complete information for fabrication and erection of structural steel components.
  - 1. Submit shop drawings under provisions of Division 1 Section "Submittal Procedures." Phase submittals to match sequence of actual construction to avoid delay of work.
  - 2. Include overall floor plans with piece marks labeled and erection detail cuts.
  - 3. Include full height elevations where appropriate for elements such as brace frames.
  - 4. Include details of cuts, connections, splices, camber, holes, and other pertinent erection data.
  - 5. Include embedment, anchor bolt and erection drawings.
  - 6. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
  - 7. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
  - 8. List paint manufacturer's name and paint number where painting is required.
  - 9. Indicate items to be galvanized or coated where required.
  - 10. Connection design calculations: Submit connection design calculations and location references indicators at the same time that the shop drawings for the related connections are submitted. These shop drawings will be rejected without the following:
    - a. Complete connection calculations.
    - b. References of connection label and required loads on the shop drawings.
    - c. Signed letter from the Connection Engineer that they have already reviewed and incorporated their comments into the submitted shop drawings. This review shall be for all connections that are required to be designed by the Contractor's Engineer.
  - 11. Submittal Process and Review:
    - a. Submittal of shop and erection drawings and other submittals by the General Contractor shall constitute General Contractor's representation that the General Contractor has verified all quantities, dimensions, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each drawing with other drawings and other trades. The General Contractor shall place their shop drawing stamp on all submittals confirming the above.
    - b. The Contractor shall submit to the Design Team two (2) black-line prints and one (1) electronic copy (pdf) for shop drawing review.
    - c. The Contractor shall allow at least ten (10) working days between receipt and release by the Design Team for the review of shop and erection drawings, other than connection design calculations, which shall be allowed fifteen (15) working days. The size of the submittals is limited to that which is agreed upon during the submittal schedule required below.

- d. Resubmittals: Completely address previous comments prior to resubmitting a drawing. Resubmit only those drawings that require resubmittal. All modifications or revisions to submittals, shop drawings, connection design calculations and erection drawings must be clouded, with an appropriate revision number clearly indicated.
  - e. The Contractor shall deliver to the Design Team at the completion of the job two (2) electronic versions of the final as-built shop drawings on a CD-ROM or other media acceptable to the Design Team.
  - f. The review of connection design and the review and approval of shop and erection drawings shall be for general conformance with the design intent of the work and with the information given in the Contract Documents only and will not in any way relieve the Contractor or the Contractor's Engineer from their responsibilities stated herein.
12. Substitution Request:
- a. Requests for any departure from Contract Documents must be submitted in writing by the Contractor and accepted in writing by the Design Team, prior to receipt of submittals.
  - b. Such substitutions or modifications, if acceptable to the Design Team, shall be coordinated and incorporated in the work at the sole expense of the Contractor.
  - c. Compensation for Additional Services: Should additional work by the Design Team, such as design, drafting, meetings and/or visits be required, which are necessitated for the review and/or incorporation of the Contractor-requested substitution, including indirect effects on other portions of the work, the Contractor is responsible for paying for additional work at the standard billing rates plus out-of-pocket expenses incurred at cost + 10%.
  - d. Contractor is responsible for means and methods and any impacts on other portions of the work that may arise from this substitution.

#### 1.7 SUBMITTALS – PART B (FOR RECORD)

- A. Submittal Schedule for all Part A submittal items.
- B. Welding certificates for all welders that will perform work for this project..
- C. Welding Procedures: Submit for record written welding procedures for all joints not prequalified by Section 2 of AWS D1.1. Submit all welding and qualification procedures to the Testing Agency for Approval before submitting to Design Team.
- D. Qualification Data for the Fabricator, Erector and Connection Engineer
- E. Submittal Letter: The Contractor shall submit for record a letter from the Contractor's Engineer supervising the preparation of connection designs on shop and erection drawings. A letter shall be submitted along with the first submission of Connection design calculations. It shall be signed and sealed by the Contractor's Engineer, and shall include the following:

"All connection design calculations for this project will be designed by me, or by qualified personnel under my direct supervision, to resist the loads and reactions indicated on the Contract Documents, except those connections which are completely designed on the Contract Documents."



- F. Preconstruction Survey: Submit for record. For all steel construction, before steel erection commences, perform and submit a complete survey for position and alignment at all points where construction by other trades will support steel elements, including but not limited to pockets, embedded plates, anchor rods and base plates.
- G. Source quality-control test reports.
- H. Minutes of Pre-Installation conference.
- I. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
  - 1. Structural steel including chemical and physical properties.
  - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
  - 3. Direct-tension indicators.
  - 4. Tension-control, high-strength bolt-nut-washer assemblies.
- J. Sustainable Design Submittals:
  - 1. LEED Credit: Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
    - a. Include statement indicating costs for each product having recycled content.

#### 1.8 CLOSEOUT SUBMITTALS

- A. Record Documentation.
- B. Sustainable Design Closeout Documentation.

#### 1.9 QUALITY ASSURANCE

- a. Fabricator Qualifications; A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC Certified Plant, Category STD. Fabricator shall be experienced in the preparation of shop drawings using intergrated three-dimensional modeling software parametrically linking all major structural piece marks and overall building framing model.
- b. Installer (erector) Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE (minimum).
- c. Fabricator's/Contractor's Qualified Professional Engineer/Specialty Structural Engineer Qualifications: Qualified Professional Engineer(s), licensed in the State of Minnesota, with 10 years of experience being in responsible charge to work of this nature. The proposed engineer(s) shall be subject to approval of the Design Team.
- d. Comply with applicable provisions of the following specifications and documents:
  - 1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
  - 2. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" or "Load and Resistance Factor Design Specification for Structural Steel Buildings."
  - 3. AISC's "Specification for the Design of Steel Hollow Structural Sections."

4. AISC's "Specification for Allowable Stress Design of Single-Angle Members" or "Specification for Load and Resistance Factor Design of Single-Angle Members."
  5. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- e. Contractor shall assign a qualified staff member to perform quality control on their own work in the field on a daily basis, for each day work is performed. The Contractor's quality control staff shall review their own work for compliance with contract documents before the Contractor notifies the design team or others, of readiness for required inspections, tests and observations to be provided by the Owner's Representatives.
  - f. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
  - g. Pre-Design/Detailing Meeting: Prior to starting connection design and detailing, the Fabricator shall hold a meeting to verify all connection design assumptions and procedures and shop drawing preparation and submittal procedures. The Contractor shall prepare an agenda and require responsible representatives of every party who is concerned with the connection design and detailing to attend this meeting. The Contractor shall distribute meeting minutes to all parties within 5 working days of the meeting.
  - h. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination" and Division 01 – "Structural Tests and Special Inspections".

#### 1.10 TEMPORARY SUPPORT OF STRUCTURAL STEEL FRAME

- A. The structure as shown on the Contract Documents is designed to withstand the design loads only when all structural elements are installed and fully connected. The Contractor shall be responsible for the analysis of all components and assemblies for stresses and displacements that may be imposed by fabrication, shipping, handling, erection, temporary conditions, construction loads, etc. The analysis of such shall be performed by the Contractor's Engineer.

#### 1.11 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
- B. Store fasteners in a protected place. Bolts and nuts that become dry or rusty before use shall not be allowed.
- C. Store welding electrodes in hermetically sealed containers. Electrodes exposed to atmosphere for periods greater than those permitted shall be redried in accordance with AWS D1.1.
- D. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

## 1.12 OBSERVATIONS BY DESIGN TEAM

- A. Review: The Design Team will observe the construction for general compliance with the provisions of the Contract Documents during various phases of construction.
- B. Compensation for Additional Services: Should additional work by the design team such as design, drafting, meetings and/or visits be required which are necessitated by failure of the Contractor to perform the work in accordance with the Contract Documents, the Contractor is responsible for paying for additional work performed at standard billing rates plus out-of-pocket expenses incurred at cost + 10%. Additional costs for testing and inspection by the Owner shall also be compensated by the Contractor.

## 1.13 COORDINATION

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.
- B. Provide structural steel substrate to receive sprayed fire-resistive materials free of paint, lubricants, oils, dirt, or other contaminants which would significantly impair adhesion of sprayed materials.

## 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. Contractor may submit alternative product for review and approval by the design team.

### 2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992, Grade 50
- B. Channels, Angles: ASTM A 36
- C. Plate and Bar: ASTM A 36 or ASTM A 572 (Fy = 50 ksi) where indicated on drawings
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing
- E. Steel Pipe: ASTM A53, Type E or S, Grade B.
- F. Welding Electrodes: E 70 XX, minimum. Comply with AWS requirements.

### 2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A325 or A490, heavy hex steel structural bolts; All bolts shall be new, not re-used.
  - 1. Finish: Plain – Typical. Mechanically deposited zinc coating, ASTM B 695, Class 50 - exposed to weather.

- B. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type.
  - 1. Finish: Plain – Typical. Mechanically deposited zinc coating, ASTM B 695, Class 50 - exposed to weather.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
  - 1. Finish: Plain – Typical. Mechanically deposited zinc coating, ASTM B 695, Class 50 – exposed to weather
  - 2. Available Products:
    - a. LeJeune Tension Control Bolts.
    - b. Bethlehem Load Indicator Bolts.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
- E. Anchor Rods: ASTM F 1554, Grade as indicated on General Structural Notes and Contract Drawings, straight.
  - 1. Nuts: ASTM A 563 heavy hex carbon steel.
  - 2. Plate Washers: ASTM A 36 carbon steel.
  - 3. Washers: ASTM F 436 hardened carbon steel.
  - 4. Finish: Plain, unless noted otherwise on Contract Drawings.
- F. Threaded Rods: ASTM A 36, unless noted otherwise on Contract Drawings.
  - 1. Nuts: ASTM A 563 heavy hex carbon steel.
  - 2. Washers: ASTM A 36 carbon steel.
  - 3. Finish: Plain.
- G. Clevises and Turnbuckles: ASTM A108, Grade 1035, cold-finished carbon steel.

## 2.4 SHOP COATINGS

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer. Color to be fabricator's standard.
- B. Galvanizing Repair Paint: ASTM A780.
- C. Bituminous Protection Coating: Carboline, Bitumastic 50

## 2.5 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.  $f'_c = 4000$  psi minimum at 24 hours.
  - 1. Available Products:
    - a. Five Star Products:
      - 1. Five Star Grout
    - b. Master Builders: Embeco.
    - c. Sonneborn Chemrex Inc.: SonogROUT 10K.

## 2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings."
  - 1. Camber structural-steel members where indicated.
  - 2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
  - 3. Mark and match-mark materials for field assembly.
  - 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- D. Cleaning: Clean and prepare steel surfaces that are to remain unpainted and/or not exposed to view or exterior conditions according to SSPC-SP 2 - "Hand Tool Cleaning". For interior steel exposed to view, clean and prepare per SSPC-SP 6 - "Commercial Blast Cleaning". For Exterior steel that is not galvanized, prepare to SSPC-SP-6. For members to be hot Dipped Galvanized, prepare to SSPC-SP-3, "Power Tool Cleaning".
- E. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

## 2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type:
    - a. Typical shear connections: Snug Tightened.
    - b. Moment connections: Slip Critical.
    - c. Tension/Compression Connections: Slip Critical.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
  - 1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

## 2.8 SHOP PRIMING

- A. Structural steel to be unpainted unless noted otherwise on the architectural drawings.
- B. For all steel noted as painted on the architectural drawings, shop prime steel surfaces except the following:
  1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  2. Surfaces to be field welded.
  3. Surfaces to be high-strength bolted with slip-critical connections.
  4. Surfaces to receive sprayed fire-resistive materials.
  5. Galvanized surfaces.
  6. Surfaces supporting concrete slabs, composite metal deck or shear connectors.
- C. Surface Preparation: Clean surfaces per the requirements in Section 2.6
- D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  1. Apply two coats of shop paint to inaccessible surfaces after assembly or erection.

## 2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
  1. Galvanize items indicated in Contract Documents.
  2. Fill vent holes and grind smooth after galvanizing.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify elevations of concrete bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated. See Section 1.10.

### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges".
- B. Base Plates: Clean concrete bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base plates. Clean bottom surface of base plates.
  - 1. Set base plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Weld plate washers to top of base plate.
  - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base plate before packing with grout.
  - 4. Promptly pack grout solidly between bearing surfaces and base plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions. The top flanges of the beams receiving stud shear connectors shall be free of any substances that might interfere with the welding operations. During welding the steel decking panels shall be free of detrimental substances and rest tightly upon the top flange of the beam.
- I. No trades may field cut or alter structural members without specific approval of the Structural Engineer. Submit dimensioned plan and detail sketch of proposed modification under cover of a "Request for Information" (RFI) or cloud proposed changes on shop drawings.

### 3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type:

- a. Typical shear connections: Snug Tightened.
  - b. Moment connections: Slip Critical or fully pretensioned.
  - c. Tension/Compression Connections: Slip Critical or fully pretensioned.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
  - 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
  - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
  - 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
  - 4. Verify that weld sizes, fabrication sequence, and equipment used for AESS will limit distortions to allowable tolerances.
    - a. Grind butt welds flush.
    - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.
- C. Tension Control Devices:
  - 1. Install using electric power wrench as recommended by bolt manufacturer.
  - 2. Tighten until splined end of bolt is sheared off.
- D. Shear Connectors:
  - 1. Do not weld when the temperature is below 0 degrees F.
  - 2. Remove standing water in deck ribs so that water is not trapped between beams and deck during welding.
  - 3. Ensure that surfaces of steel beams to which studs are to be welded are dry and free of paint, dirt and debris and that deck bottom is in firm contact with beam.
  - 4. Install studs after steel framing and metal decking are in place.
  - 5. Use automatic welding equipment powered to weld studs satisfactorily under site conditions.
  - 6. Prior to starting each day's operations, weld at least two shear studs to determine proper generator control unit and stud welder settings.
  - 7. Test that studs are capable of being bent 45 degrees from vertical without weld failure.
  - 8. Weld additional trial shear studs at request of Independent Testing Lab.

### 3.5 FIELD QUALITY CONTROL

- A. The Owner will engage a qualified testing and inspection agency to provide special inspection and testing services and prepare reports in accordance with Division 1, Section "Structural Tests and Special Inspections", and IBC Chapter 17 as adopted by the current Minnesota State Building Code, and the CASE/Mn Guideline for Special Structural Inspection and Testing, and other items which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure.
- B. Special Inspection and Testing Criteria. Refer to Division 1, Section "Structural Tests and Special Inspections" for standard requirements and definitions.
  - 1. Special Testing and Inspection Requirements
    - a. High Strength Bolting (Field Installed).
      - 1) General (Technical II)



- a) Visually inspect mating surfaces and bolt type for all slip-critical bolted connections for general conformance with the contract documents prior to bolting.
  - b) Determine the requirements for bolts, nuts, washers, paint and installation/tightening standards are met.
  - c) Observe calibration procedures when such procedures are required in the contract documents and verify that selected procedure is used to tighten bolts.
- 2) Slip Critical Bolts and Tension Bolts (Technical II)
  - a) Test bolt tightening in 10% of all bolts. Test a minimum of two bolts in each connection. Verify that all plies of connected elements have been brought into contact, at 100% of connection. Verify all tips are removed from "twist-off" bolts.
- 3) Bearing Bolts (Technical II)
  - a) Visually inspect to conform all plies of connected elements have been brought into contact, at 100% of connections. (Applies only to bolts designed for values not requiring exclusion of threads from failure plane, all other bolts require testing as for tension bolts.)
- 4) Standard
  - a) Test High Strength bolted connections per R.C.S.C. Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
- b. Welding (Field)
  - 1) Fillet Welds (Technical II)
    - a) Visually inspect 100% of all fillet welds for size, length and quality per AWS D1.1.
  - 2) Partial Penetration Welds (Technical II)
    - a) Test 100% of all partial penetration welds exceeding 5/16 inch, using Ultrasonic Tester per AWS D1.1. Test 25% of all partial penetration welds less than 5/16 inch, using Magnetic Particle Testing per ASTM E109, performed on root pass on finished weld.
  - 3) Full Penetration Welds (Technical II)
    - a) Test 100% of all full penetration welds exceeding 5/16 inch, using Ultrasonic Tester per AWS D1.1. Test 25% of all full penetration welds less than 5/16 inch, using Magnetic Particle Testing per ASTM E109, performed on root pass on finished weld.
  - 4) Stud Shear Connector Welds (Technical I)
    - a) Visually inspect 100% of installed studs for full 360 degree flash. Test all questionable studs, not showing full 360 degree flash by bending studs 15 degrees from vertical, away from weld discontinuity, per AWS D1.1. All ceramic welding ferrules shall be removed by contractor. Randomly test all other studs by bending to 15 degrees from vertical as noted:
      - Studs welded through deck: 15%
      - Studs welded to bare steel: 5%
 Alternatively, sound 100% of installed studs, for full penetration weld, using an 8 lb. Maul. Test questionable studs as noted above. Welding ferrules need not be removed.
  - 5) Deck Welds and Fasteners (Technical I)

- a) Visually inspect size, location, length and burn through for 100% of puddle welds on metal deck designed as a structural element, per AWS D1.3.
      - b) Visually inspect sidelap fasteners to meet spacing and size specified.
    - 6) Welding of Reinforcing Bars (Technical II)
      - a) Be continuously present during welding and visually inspect 100% of all reinforcing bar welds as the welding is performed, per AWS D1.4. Verify proper joint preparation is provided and proper electrodes are used and properly store and dried.
  - c. Mechanical Fasteners (Misc.)
    - 1) Fasteners (Technical I)
      - a) Visually inspect specified size, spacing, embedment, and location of expansion bolts and adhesive bonded bolts in connections shown on the structural drawings.
  - d. Structural Configuration
    - 1) Submittals (Structural I)
      - a) Verify mill test reports and other submitted documentation for compliance with contract documents.
    - 2) Materials (Technical I)
      - a) Verify materials delivered to site comply with contract documents and approved shop drawings. Materials include bolts, electrodes, mechanical fasteners and deck gauge.
    - 3) Detail Compatibility (Structural I) On a periodic basis:
      - a) Review project documents affecting integrity of the structure, including contract documents and pertinent submittals (approved shop drawings)
      - b) Visit site, at intervals appropriate to the stage of construction, to perform review of the structure and visually confirm general compliance with the project documents.
      - c) Inspect the following to verify member orientation, configuration, type and size comply with details indicated on the contract documents and approved shop drawings:
        - Bracing and stiffening members.
        - Proper applications of joint details at connections for structural members.
        - Other work critical to the integrity of the building structure.
  - e. General (Technical I)
    - 1) Verify that all mill certificates and welder certifications comply with the requirements set forth in this specification.
2. Conventional Testing and Inspection Requirements
- a. High Strength Bolting
    - 1) Bolt Material Test (Technical II)
      - a) Test a minimum of two bolts of each ASTM class specified, for bolt hardness and tensile properties.
    - 2) Fabrication and Erection Tolerances (Owner's Construction Manager)
      - a) Verify in-place structure satisfies specified tolerances.
- C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

### 3.6 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, and abutting structural steel.
  - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
  - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 05120

**NEW PASSENGER TERMINAL  
DULUTH INTERNATIONAL AIRPORT  
DULUTH, MINNESOTA**

**SECTION 05500 – METAL  
FABRICATIONS**

**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. Section Includes:
  - 1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
- B. Related Sections:
  - 1. Division 10 Section 10435, "Roadway Signage."

**1.3 ACTION SUBMITTALS**

- A. Product Data: For the following:
  - 1. Paint products.
  - 2. Grout
- B. LEED Submittals:
  - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- C. Shop Drawings: Show fabrication and installation details for metal fabrications.
  - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.

**1.5 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel."

## 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

## PART 2 - PRODUCTS

### 2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrication exposed to view in the complete Work, provide materials without seam marks, roller marks, rolled trade names or blemishes

### 2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- D. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
  - 1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm).
  - 2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; 0.0677 inch (1.7 mm) minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
- E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/1 47M, unless otherwise indicated.

### 2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicates; with nuts, ASTM A 563; and, where indicated, flat washers.
  - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- D. Eyebolts: ASTM A 489.
- E. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

- F. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).
- G. Wood Screws: Flat head, ASME B18.6.1.
- H. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
- I. Lock Washers: Helical, spring type, ASME B17.21.1 (ASME B18.21.2M).
- J. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six (6) times the load imposed when installed in unit masonry and four (4) times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- K. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 194M), Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- L. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

## 2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 09 painting Sections and Division 09 Section "High-Performance Coatings."
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- D. Non-shrink, Non-metallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- E. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum twenty-eight (28) day compressive strength of 3000 psi (20 MPa).

## 2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to the greatest extent possible. 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.

- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces with straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and method 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 no roughness shows after finishing.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- F. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- G. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- H. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
  - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6 inch (150 mm) embedment and 2 inch (50 mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

## 2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
  - 1. Fabricate units from slotted channel framing where indicated.
  - 2. Furnish inserts for units installed after concrete is placed.
- A. Galvanize miscellaneous framing and supports where indicated.
- B. Prime miscellaneous framing and supports with primer specified in Division 09 Section "Painting."

## 2.9 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

## 2.10 STEEL AND IRON FINISHES

- A. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 2. Shop prime with primers specified in Division 09 Section, "Painting."
- B. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
  - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3 "Commercial Blast Cleaning."
  - 3. Items Indicated to Receive Primers Specified in Division 09 Section "High-Performance Coatings:" SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- C. Shop Priming: Apply shop primer to comply with SSOPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment and elevation; with edges and surfaces level, plumb, true and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitation. Do not weld, cut or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 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 no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws and other connectors.

### 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

### 3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erections, clean field welds, bolted connections and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting and to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  1. Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections and abraded areas and repair galvanizing to comply with ASTM A 780. Apply Galvanizing Repair Compound in accordance with manufacturer's recommendations.
  1. Apply by brush or spray to provide a minimum 1.5 mil (0.04 mm) dry film thickness.

END OF SECTION 05500

**NEW PASSENGER TERMINAL  
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**SECTION 09900 - PAINTING**

**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 surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.
  - 1. Surface preparation, and finish coats specified in this section are in addition to surface treatment specified under other sections. This contractor to clean and prep for finish coats; only finish coats included in
  - 2. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
- B. Paint exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
  - 1. Painting includes field-painting exposed bare and concealed pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, miscellaneous metals, hollow metal doors and frames and similar items.
- D. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
  - 1. Prefinished or factory-finished items not to be painted include (but are not limited to) acoustic materials, architectural woodwork and casework, elevator entrance doors and frames, finished mechanical and electrical equipment, light fixtures, switchgear, and distribution cabinets.
  - 2. Concealed surfaces not to be painted include wall or ceiling surfaces in generally inaccessible areas such as furred areas, elevator shafts and pipe spaces.

- a. Finished metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and brass are not to be painted, unless otherwise indicated.
- 3. Operating parts not to be painted include moving parts of operating equipment, such as valve and damper operators, linkages, sensing devices, motor and fan shafts, and sprinkler heads.
- 4. Labels: Do not paint over Underwriters Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

### 1.3 ACTION SUBMITTALS

- A. Product data for each paint system specified, including block fillers and primers.
  - 1. Provide the manufacturer's technical information including label analysis and instructions for handling, storage, and application of each material proposed for use.
  - 2. List each material and cross-reference the specific coating, finish system, and application. Identify each material by the manufacturer's catalog number and general classification.
  - 3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
- B. LEED Submittals:
  - 1. Product Data for Credit EQ 4.2: For paints and coatings, including printed statement of VOC content.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
  - 2. Step coats on Samples to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.
- D. Manufacturer's Instructions: Submit manufacturer's instructions including technical data sheets, material safety data sheets, mixing instructions, application requirements, special procedures, and conditions requiring special attention.
- E. Product List: For each product indicated, include the following:
  - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
  - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
  - 3. VOC content.
- F. Mock-Ups: Prior to application of the exterior work, prepare a mock-up for the finish and application required to verify selection made under sample submittals

and to demonstrate aesthetic effects as well as qualities of materials and execution. Prepare mock-up to comply with the following requirements, using materials indicated for final unit of work. Locate mock-ups on site in location as directed by the Architect. Demonstrate the proposed range of aesthetic effects and workmanship to be expected in the completed work. Obtain the Architect's acceptance of mock-up before start of final unit of work.

1. Retain and maintain mock-up during construction in undisturbed condition as a standard for judging completed unit of work.

### 1.3 QUALITY ASSURANCE

- A. **Applicator Qualifications:** Engage an experienced applicator who has completed painting system applications similar in material and extent to those indicated for the Project that have resulted in a construction record of successful in-service performance.
- B. **Single-Source Responsibility:** Provide primers and undercoat paint produced by the same manufacturer as the finish coats.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
  1. Product name or title of material.
  2. Product description (generic classification or binder type).
  3. Manufacturer's stock number and date of manufacture.
  4. Contents by volume, for pigment and vehicle constituents.
  5. Thinning instructions.
  6. Application instructions.
  7. Color name and number.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
  1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

### 1.5 JOB CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F and 90 degrees F.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F and 95 degrees F.

- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.
  - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of the following:
  - 1. Benjamin Moore and Co.
  - 2. Edison Coatings, Inc.
  - 3. Glidden Professional division of Azko Nobel Paints, LLC.
  - 4. Keim Mineral Coatings of America, Inc.
  - 5. M.A.B. Paints.
  - 6. Pratt & Lambert.
  - 7. Sherwin-Williams Company.
  - 8. Silicote USA LLC.

### 2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility:
  - 1. Provide block fillers, primers, finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.
  - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 1. Flat Paints and Coatings: 50 g/L.
  - 2. Nonflat Paints and Coatings: 150 g/L.
  - 3. Dry-Fog Coatings: 400 g/L.
  - 4. Primers, Sealers, and Undercoaters: 200 g/L.
  - 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
  - 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
  - 7. Pretreatment Wash Primers: 420 g/L.
  - 8. Floor Coatings: 100 g/L.
  - 9. Shellacs, Clear: 730 g/L.
  - 10. Shellacs, Pigmented: 550 g/L.

- C. Material Quality: Provide the manufacturer's best-quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
  - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish the manufacturer's material data and certificates of performance for proposed substitutions.
- D. Colors: Provide color selections made by the Architect from the manufacturer's full range of standard colors.
- E. No lead or mercury is permitted in any coating used on this project.

## 2.4 PRIMERS

- A. Primers: Provide the manufacturer's recommended factory-formulated coating material that is compatible with the other specified system components indicated in the painting schedules included at the end of this specification section.

## 2.3 UNDERCOAT MATERIALS

- A. Undercoat Materials: Provide the manufacturer's recommended factory-formulated coating material that is compatible with the other specified system components indicated in the painting schedules included at the end of this specification section.

## 2.4 FINISH PAINT MATERIAL

- A. Finish Paint: Provide the manufacturer's recommended factory-formulated coating material that is equivalent to the specified finish paint material indicated in the painting schedules included at the end of this specification section.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and conditions under which painting will be performed for compliance with paint application requirements. Notify Owner and Architect in writing of conditions detrimental to proper and timely completion of the work. Surfaces receiving paint must be thoroughly dry before paint is applied.
  - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected.
  - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total system for various substrates. On request,

furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

### 3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items, if necessary, to completely paint the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease prior to cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to the manufacturer's instructions for each particular substrate condition and as specified.
  1. Provide barrier coats over incompatible primers or remove and reprime. Notify Architect in writing about anticipated problems using the specified finish-coat material with substrates primed by others.
  2. Cementitious Materials: Prepare concrete, concrete block and cement plaster surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen, as required, to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
    - a. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
    - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
    - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
  3. Ferrous Metals: Clean ungalvanized ferrous metal surfaces that have not been shop-coated and previously painted metal surfaces; remove oil, grease, dirt, loose mill scale, rust and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council (SSPC).

- a. Blast steel surfaces clean as recommended by the paint system manufacturer and according to requirements of SSPC specification SSPC-SP 10.
  - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
  - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.
  - d. On previously painted surfaces, remove existing paint and smooth edges sufficient to obtain a uniform surface upon repainting.
4. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Materials Preparation: Carefully mix and prepare paint materials according to manufacturer's directions.
- 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue. Store materials not in actual use in tightly covered containers.
  - 2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
  - 3. Use only thinners approved by the paint manufacturer and only within recommended limits.

### 3.3 APPLICATION

- A. General: Apply paint according to manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
  - B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
- 1. Paint colors, surface treatments, and finishes are to match or blend with existing adjacent surfaces.
  - 2. Provide finish coats that are compatible with primers used.
  - 3. The number of coats and the film thickness required are the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce a smooth even surface according to the manufacturer's directions.
  - 4. Apply additional coats if undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.



5. The term exposed surfaces includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
  6. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  7. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
  8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
  9. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.
  10. Sand lightly between each succeeding enamel or varnish coat.
  11. Omit primer on metal surfaces that have been shop-primed and touch-up painted, unless otherwise indicated.
- C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- D. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to the manufacturer's directions.
1. Brushes: Use brushes best suited for the material applied.
  2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
  3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- E. Minimum Coating Thickness: Apply materials no thinner than the manufacturers recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- F. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces.
- G. Mechanical items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers, and supports, including exposed, uninsulated piping.
  2. Heat exchangers.
  3. Tanks.

4. Ductwork.
5. Insulation.
6. Supports.
7. Motors and mechanical equipment.
8. Accessory items.

H. Electrical items to be painted include, but are not limited to, the following:

1. Conduit and fittings.
2. Switchgear (if not factory finished).

I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime-coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with specified requirements.

### 3.4 CLEANING

A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

### 3.5 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.6 EXTERIOR PAINT SCHEDULE

- A. General: Provide the following paint systems for the various substrates indicated.
- B. Concrete: System based on the products of Keim Mineral Coatings of America, Inc.
  - 1. Concrete Cleaner: Silicic acid based cleaner diluted with water. Basis of Design: "KEIM Concrete Cleaner".
  - 2. Water Repellent: Solvent-free silane based water repellent with 100% active ingredients. Basis of Design: "KEIM Silan 100".
  - 3. Silicate Stain, Base Coat: Sol silicate based mineral stain with less than 1g/l VOC. ASTM E 96 Vapor Permeability – 77 perms, ASTM G 154 Accelerated Weathering – no fading, cracking, peeling, ASTM E 514 62-MPH Wind-Driven Rain Test – no water penetration. Basis of Design: "KEIM Concretal Lasur".
  - 4. Silicate Stain, Top Coat: Sol silicate based mineral stain with less than 1g/l VOC. ASTM E 96 Vapor Permeability – 77 perms, ASTM G 154 Accelerated Weathering – no fading, cracking, peeling, ASTM E 514 62-MPH Wind-Driven Rain Test – no water penetration. Basis of Design: "KEIM Concretal Lasur".
  - 5. Dilution for Silicate Stain: Sol silicate dilution designed for the sol silicate stain system. Less than 1g/l VOC. Basis of Design: "KEIM Concretal Dilution"

### 3.7 INTERIOR PAINT SCHEDULE

- A. General: Provide the following paint systems for the various substrates, as indicated.
- B. Gypsum Drywall Partitions: System based on the products of Glidden Professional Division of AzkoNobel Paints.
  - 1. Satin / Eggshell Acrylic Latex: Latex primer and two satin / eggshell latex based acrylic enamel finish coats.
    - a. Primer: 1030 ULTRA-HIDE PVA Interior Primer Sealer.
    - b. Finish: 1412 ULTRA-HIDE Acrylic Latex Eggshell Enamel.
    - c. Gloss Range: Satin / Eggshell finish shall have gloss range of 20-30 percent specular light reflection when tested in accordance with ASTM D523. Designation may be satin with some manufacturers.
  - 2. Epoxy Coating: Primer and two gloss epoxy polyamide finish coats.
    - a. Primer: 3210 ULTRA-HIDE Aquacrylic GRIPPER Stain Killer Primer Sealer.
    - b. Finish: 4508 TRU-GLAZE Epoxy Polyamide Gloss Epoxy.
- C. Concrete Masonry: System based on the products of Glidden Professional Division of Azko Nobel Paints.
  - 1. Satin / Eggshell Acrylic Latex: Acrylic latex filler coat and two satin / eggshell latex based acrylic enamel finish coats.

- a. Filler: 3010 ULTRA-HIDE Acrylic Latex Block Filler.
  - b. Finish: 1412 ULTRA-HIDE Acrylic Latex Eggshell Enamel.
- 2. Epoxy Coating: 100% acrylic block filler and two gloss epoxy polyamide finish coats.
  - a. Filler: 4000 BLOXFIL Heavy Duty Acrylic Block Filler.
  - b. Finish: 4508 TRU-GLAZE Epoxy Polyamide Gloss Epoxy.
- D. Concrete: System based on the products of Keim Mineral Coatings of America, Inc.
  - 1. Concrete Cleaner: Silicic acid based cleaner diluted with water. Basis of Design: "KEIM Concrete Cleaner".
  - 2. Water Repellent: Solvent-free silane based water repellent with 100% active ingredients. Basis of Design: "KEIM Silan 100".
  - 3. Silicate Stain, Base Coat: Sol silicate based mineral stain with less than 1g/l VOC. ASTM E 96 Vapor Permeability – 77 perms, ASTM G 154 Accelerated Weathering – no fading, cracking, peeling, ASTM E 514 62-MPH Wind-Driven Rain Test – no water penetration. Basis of Design: "KEIM Concretal Lasur".
  - 4. Silicate Stain, Top Coat: Sol silicate based mineral stain with less than 1g/l VOC. ASTM E 96 Vapor Permeability – 77 perms, ASTM G 154 Accelerated Weathering – no fading, cracking, peeling, ASTM E 514 62-MPH Wind-Driven Rain Test – no water penetration. Basis of Design: "KEIM Concretal Lasur".
  - 5. Dilution for Silicate Stain: Sol silicate dilution designed for the sol silicate stain system. Less than 1g/l VOC. Basis of Design: "KEIM Concretal Dilution"
- E. Steel, Galvanized or Non-galvanized:
  - 1. Primer coat - recommended by the finish coat manufacturer.
  - 2. Second and third coats – semi-gloss latex paint, 100% acrylic, non-blocking, pencil hardness of H or harder per ASTM D 3363:
    - a. "Pitt-Tech 474 Series" (PPG)
    - b. "M29 DTM" (Moore)
    - c. "Pro Classic Waterborne B31 Series" (S-W)
- F. Aluminum:
  - 1. Primer coat - recommended by the finish coat manufacturer.
  - 2. Second and third coats – flat latex paint, 100% acrylic, non-blocking, pencil hardness of H or harder per ASTM D 3363:
    - a. "Pitt-Tech 712 Series" (PPG)
    - b. "M29 DTM" (Moore)
    - c. "Pro Classic Waterborne B31 Series" (S-W)

END OF SECTION 09900

**NEW PASSENGER TERMINAL  
DULUTH INTERNATIONAL AIRPORT  
DULUTH, MINNESOTA**

**SECTION 10435 – EXTERIOR  
SIGNAGE**

**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. Exterior Wayfinding Roadway Signs.
2. Roadway Sign Support Structures and Foundations.
3. Electrical work and lighting for illuminated signs.
4. Regulatory Signage.
5. Banners.
  - a. Two-sided printing, one color ink on colored fabric.
  - b. Quantity: Sixty (60)

B. Related Requirements:

1. Section 01500 "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
2. Section 02220 "Building Earthwork"
3. Section 03200 "Concrete Reinforcement"
4. Section 03300 "Cast-in-Place Concrete"
5. Section 05120 "Structural Steel"
6. Section 9900 "Painting"
7. Division 16 - Electrical

- C. The Drawings show design intent are not intended to cover every detail of materials, parts, construction, mounting or installation. Furnish all required engineering, materials, parts, construction, mounting, and installation necessary to complete the entire work, whether or not said details are shown or specified, at no additional cost to the Project.

- D. These contract documents are for design intent compliance and should only be used as a guide to produce the finished size, appearance, and function shown. Nothing contained in these contract documents shall be construed as a design for any engineered element.

- E. The Manufacturer shall provide all required structural and electrical engineering drawings. Drawings shall be stamped and signed by the respective structural and electrical engineers currently registered in the State of Minnesota.

EXTERIOR SIGNAGE  
BID PACKAGE 2C WAYFINDING SIGNAGE REBID  
& HAZARDOUS MATERIALS ABATEMENT  
ISSUE FOR BID  
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- F. All applicable national, state and local codes, ordinances and safety standards shall take precedence over these contract documents and it shall be the responsibility of the Manufacturer or his Subcontractor(s) to make certain that these codes, ordinances and safety standards are in compliance.

### 1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

### 1.4 REFERENCES

- A. U.S. Access Board's "Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines", 2004 Edition.
- B. Federal Aviation Administration Advisory Circular 150/5360-12E "Airport Signing and Graphics".
- C. AASHTO (American Association of State Highway and Transportation Officials) "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 5th Edition", with 2010 and 2011 Interim Revisions.
- D. Minnesota Department of Transportation's "2011 Standard Signs Summary"
- E. Minnesota Department of Transportation's "Minnesota Manual on Uniform Traffic Control Devices", 2011 Edition.
- F. U.S. Department of Transportation's "Manual on Uniform Traffic Control Devices", 2009 Edition.

### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Include fabrication and installation details.
  - 2. Show sign mounting heights and accessories.
  - 3. Provide location plans for all signs.
  - 4. Show message list, typestyles, graphic elements, and scaled graphic layouts for each sign at least one/eighth full size.
- C. Samples:
  - 1. Materials:
    - a. Aluminum sheet, with specified finishes, 12" x 12".
    - b. Sign face color samples on specified material, 4" x 4".
    - c. Paint sample for finish of sign structures, 4" x 4"..
    - d. Stone facing, three (3) samples with specified finish, 8" x 8".
    - e. Banner fabric, three (3) samples, 12"x12".

2. Wayfinding Signs:
  - a. One (1) full-size field sample of Sign Type E.2. When approved, sign may be installed.
  - b. One (1) full-size field sample of Sign Type E.5. When approved, sign may be installed.
3. Regulatory Signs: One (1) full-size field sample of each of the following sign types:
  - a. R1-1
  - b. R3-2
  - c. R5-1A
  - d. R7-C
  - e. R7-108
  - f. R7-201
  - g. R8-3
4. Stone Veneer: Three (3) samples, 2 inches thick, 8 inches square in size, indicating complete range of color and texture.
5. Banners: One (1) full-sized sample.
- D. Stone Veneer Mockup: Build mockup to demonstrate aesthetic effects and to set quality standards for materials and execution.
  1. Build mockups approximately **72 inches** long by **48 inches** high by full thickness, including face and backup wythes and accessories.
- E. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.
- F. Delegated-Design Submittal:
  1. Include complete structural drawings and supporting calculations signed and sealed by a qualified structural engineer licensed in the State of Minnesota.
  2. Include complete electrical drawings for roadway sign lighting signed and sealed by a qualified professional engineer licensed in the State of Minnesota.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Manufacturer and Installer.

## 1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

## 1.8 COORDINATION

- A. Coordinate sign installations with shop drawings and Manufacturer's data for other construction components that may affect or may be affected by the work.

## 1.9 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5 years experience performing the Work required by this section on successful in-service Projects similar in size and scope to this Project.
- B. Installer Qualifications: Manufacturer of products or an entity that employs installers and supervisors who are trained and approved by manufacturer.
- C. Sole Suppliers: Sign products of similar types shall be supplied by one manufacturer.

## 1.10 DELIVERY, STORAGE AND HANDLING.

- A. Signs and materials shall be delivered to the Project tagged or labeled bearing Manufacturer's name with material or sign identification number and installation location as shown on the Drawings. Signs and materials shall be stored in strict accordance with the Manufacturer's written directions.
  - 1. Finished surfaces shall be adequately protected during all phases of the Work to prevent damage by scratches, stains, discoloration, or other causes. Damage to any surface during fabrication, handling, shipment, storage, and erection shall be remedied by the Contractor at his own expense.

## 1.11 WARRANTY

- A. Special Warranty: 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 finishes beyond normal weathering.
    - b. Deterioration of embedded graphic image.
    - c. Separation or delamination of sheet materials and components.
  - 2. Warranty Period: Five years from date of Substantial Completion.



## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer licensed in the State of Minnesota to design sign structures and anchorage for sign types E.1, E.2 and E.3.
- B. Loads: Signs shall withstand loads across the total sign area equivalent to 100 miles per hour in any direction:
- C. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- D. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "ADA-ABA Accessibility Guidelines for Buildings and Facilities" for signs.
- E. Color, finish, material and process shall match for all work.

### 2.2 SIGNS

- 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:
  - 1. Cummings Signs.
  - 2. Lakehead Sign Co.
  - 3. National Signs.
  - 4. Nordquist Sign Company, Inc.
  - 5. Poblocki Sign Company, LLC.
  - 6. Sign Source
  - 7. Summit Signs.
  - 8. Todd Signs.
  - 9. Western Remac Inc.
  - 10. White Way Signs.
- B. Wayfinding Signs: Provide smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
  - 1. Solid-Sheet Sign and Back: Aluminum sheet with finish specified in "Surface Finish" Subparagraph below and as indicated.
  - 2. Graphics: Characters and symbols die cut from 3- to 3.5-mil thick, weather-resistant reflective pressure-sensitive vinyl film with release liner on the back and carrier film on the front for on-site alignment and application. Manufacturer to produce all pressure-sensitive vinyl graphics on digitally controlled cutting equipment

3. Sign-Panel Perimeter: Finish edges smooth.
    - a. Edge Condition: Square cut.
    - b. Corner Condition in Elevation: Rounded.
  4. Surface Finish:
    - a. Baked-Enamel or Powder-Coat Finish protected by a clear coat in colors matching Architect's samples.
  5. Flatness Tolerance: Sign panel shall remain flat under installed conditions as indicated and within a tolerance of plus or minus 1/4 inch measured diagonally from corner to corner.
- C. Regulatory Signs: Provide smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
1. Solid-Sheet Sign and Back: Aluminum sheet, 0.080 inch minimum thickness.
  2. Sign-Panel Perimeter: Finish edges smooth.
    - a. Edge Condition: Square cut.
    - b. Corner Condition in Elevation: Rounded.
  3. Flatness Tolerance: Sign panel shall remain flat under installed conditions as indicated and within a tolerance of plus or minus 1/4 inch measured diagonally from corner to corner.
  4. Unless otherwise indicated, provide in accordance with U.S. Department of Transportation's "Manual on Uniform Traffic Control Devices", 2009 Edition, and Minnesota Department of Transportation's "Minnesota Manual on Uniform Traffic Control Devices", 2011 Edition.

## 2.3 WAYFINDING SIGN AND SIGN SUPPORT MATERIALS

- A. Structural Steel Hollow Structural Sections: ASTM A 500, Grade B.
- B. Aluminum Sheet and Plate: ASTM B 209 alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Aluminum Extrusions: ASTM B 221 alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- D. Aluminum Pipe: ASTM B 429 alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- E. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated and suitable for exterior applications.

- F. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.
- G. Stone Veneer: Natural or Cast Sandstone
  - 1. Color and Texture: Provide units with fine texture and red-brown color resembling Lake Superior Sandstone on local buildings as identified by Architect.
  - 2. Cast Stone Manufacturers: Subject to compliance with requirements, provide products produced by a Producer Member of the Cast Stone Institute, manufactured in accordance with the Cast Stone Institute Technical Manual standards.
  - 3. Source Limitations: Obtain stone, if natural, from single quarry or, if cast, a single manufacturer. Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.
  - 4. Veneer Anchors: Stainless Steel Wire, ASTM A 580, Type 316.

## 2.4 REGULATORY SIGN SUPPORT MATERIALS

- A. Posts: Galvanized Steel Pipe, ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
- B. Bases: For installation on pavement: Cast iron, either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/1 47M

## 2.5 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
  - 1. Furnish nonferrous-metal or stainless-steel devices unless otherwise indicated.
  - 2. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
    - b. Fastener Heads: For nonstructural connections, use flathead screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

## 2.6 FABRICATION

- A. General: Provide sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
  2. Form assemblies and joints exposed to weather to resist water penetration and retention.
  3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
  4. Provide rebates, lugs, and brackets necessary to assemble components. Drill and tap for required fasteners.
- B. Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.
- C. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated.

## 2.7 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

## 2.8 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

## 2.9 BANNERS

- A. Fabric: 100% Woven acrylic "Sunbrella" fabric, as manufactured and recommended for its intended use by Glen Raven, Inc., Glen Raven, NC, or equal.
  - 1. Weight: 9.25 oz/sq. yd.
  - 2. Color: As selected by Architect from manufacturer's standard colors.
- B. Ink: Use Inks specifically formulated for fabric.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements and other conditions affecting performance of signage work.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Verify banner arm conditions in field prior to fabrication.

### 3.2 INSTALLATION

- A. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
- B. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- C. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

### 3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10435

EXTERIOR SIGNAGE  
BID PACKAGE 2C WAYFINDING SIGNAGE REBID  
& HAZARDOUS MATERIALS ABATEMENT  
ISSUE FOR BID  
10435 - 9

**NEW PASSENGER TERMINAL  
DULUTH INTERNATIONAL AIRPORT  
DULUTH, MINNESOTA**

**SECTION 16050 - BASIC ELECTRICAL  
MATERIALS AND METHODS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 16.

**1.2 SUMMARY**

- A. This Section includes general requirements for electrical installations. These requirements are applicable to all Division 16 work. The following requirements are included in this Section to expand the requirements specified in Division 1:
  - 1. Submittals.
  - 2. Coordination drawings.
  - 3. Record documents.
  - 4. Maintenance manuals.
  - 5. Rough-ins.
  - 6. Electrical installations.
  - 7. Cutting and patching.
  - 8. Codes, Permits and Inspections.
  - 9. Separation of Work Between Trades.
  - 10. Definitions and Interpretations.
  - 11. Energy Conservation Rebate Programs.

**1.3 SUSTAINABLE DESIGN**

- A. Sustainable Design Intent: Comply with project requirements intended to achieve a Certified Rating, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council.
- B. LEED Certification Documentation: Submit documentation from the manufacturer highlighting LEED requirements for materials and products of this Section.

- C. Comply with the requirements of Division 1 Section "LEED REQUIREMENTS".
- D. Construction Waste Management: Comply with the requirements of Division 1, Section "Construction Waste Management", for removal and disposal of construction debris and waste.

#### 1.4 SUBMITTALS

- A. General: Follow the procedures specified in Division 1 Section "SUBMITTALS."
- B. Additional copies may be required by individual sections of these Specifications.

#### 1.5 COORDINATION DRAWINGS

- A. Prepare coordination drawings in accordance with Division 1 to a scale of 1/4"=1'-0" (1:50) or larger; detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components in all electric rooms including 1<sup>st</sup> floor main electrical room, 2<sup>nd</sup> floor electrical room and 3<sup>rd</sup> floor electrical room. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
  - 1. Indicate the proposed locations of major raceway systems, equipment, and materials. Include the following:
    - (a) Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
    - (b) Exterior wall and foundation penetrations.
    - (c) Fire-rated wall and floor penetrations.
    - (d) Equipment connections and support details.
    - (e) Sizes and location of required concrete pads and bases.
  - 2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
  - 3. Prepare floor plans, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

B. Project Coordination Drawings

1. This Trade shall add to Coordination Drawings prepared by the HVAC Contractor showing all of the electrical work (equipment, conduit, etc.) to be installed as part of the work of this section of the specifications.
2. Requirements for vibration isolation and seismic restraints shall be shown on the coordination drawings by each trade.
3. This Trade after showing all of the electrical work shall forward the completed electronic AutoCAD files to the General Contractor/Construction Manager.
4. The Electrical Contractor shall attend a series of meetings arranged by the General Contractor/Construction Manager to resolve any real or apparent interferences or conflicts with the work of the other Contractors.
5. The Electrical Contractor shall then make adjustments to his work on the Coordination Drawings to resolve any real or apparent interferences or conflicts.
6. After any real or apparent interferences and conflicts have been incorporated into the Coordination Drawings, the Electrical Contractor shall "sign-off" the final Coordination Drawings.
7. The Electrical Contractor shall not install any of this work prior to "sign-off" of final Coordination Drawings. If the electrical work proceeds prior to sign-off of Coordination Drawings, any change to the electrical work to correct the interferences and conflicts which result will be made by the Electrical Contractor at no additional cost to the project.

1.6 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in Division 1. In addition to the requirements specified in Division 1, comply with the following:
1. A complete set of "as-built" or record electric drawings shall be made up and delivered to the Architect.
  2. The drawings shall show:-
    - (a) All electric work installed exactly in accordance with the original design.
    - (b) All electric work installed as a modification or addition to the original design.



- (c) The dimensional information necessary to delineate the exact location of all circuitry and wiring runs (other than lighting and appliance branch circuitry and small control, signal and communications runs) which are so buried or concealed as to be untraceable by inspection through the regular means of access established for inspection and maintenance.
  - (d) The numbering information necessary to correlate all electrical energy consuming items (or outlets for same) to the panel or switchboard circuits from which they are supplied.
- 3. The drawings shall be produced using AutoCAD software. The design drawing files will be made available should it be determined that such files would serve as suitable backgrounds for the "as-built" drawings. These documents remain the property of Cosentini Associates and may be used for no other purpose without expressed, written consent. The contractor shall assume all liabilities resulting from unauthorized use or modifications to the drawings.
- 4. "As-built" information shall be submitted as follows:
  - (a) CADD drawing files on CD-R in AutoCAD format.
  - (b) One (1) set of reproducible drawings.
  - (c) Two (2) sets of blueprints.
- 5. The quantity of design drawings which are made available shall in no way be interpreted as setting a limit to the number of drawings necessary to show the required "as-built" information.
- 6. Progress prints of record drawings shall be submitted monthly during the construction period for Architect's approval.

## 1.7 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Division 1. In addition to the requirements specified in Division 1, include the following information for major equipment items such as engine generator set(s), UPS equipment, alarm system(s), communications systems, transformers, busways, switchgear, switchboards, panelboards, automatic transfer switches, lighting fixtures, and other items as specified elsewhere.
  - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed operating procedures include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

#### 1.9 CODES, PERMITS AND INSPECTIONS

- A. All work shall meet or exceed the latest requirements of all national, state, county, municipal, and other authorities exercising jurisdiction over electrical construction work and the project.
- B. All required permits and inspection certificates shall be obtained, paid for, and made available at the completion of the work.
- C. Any portion of the work which is not subject to the requirements of an electric code published by a specific authority having jurisdiction shall be governed by the National Electrical Code and other applicable sections of the National Fire Code, as published by the National Fire Protection Association.
- D. Equipment, material, layout and installation provided as part of the electrical work shall conform to the requirements of all agencies having jurisdiction. Include as part of the electrical work all required filings and submissions for approval. Equipment furnished separate from - but installed as part of - the electrical work, which does not have all necessary approvals, shall not be installed until approvals are obtained by the parties furnishing the equipment.
- E. Installation procedures, methods and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Administration (OSHA).
- F. All equipment furnished as part of the electrical work shall comply with the latest editions of all applicable state and municipal "energy codes." Provide certification from the equipment suppliers for all energy-consuming equipment that the equipment fully complies with these codes. Equipment submissions will not be accepted for review unless accompanied by such certification in writing.

## 1.10 GUARANTEES AND CERTIFICATIONS

- A. All work shall be guaranteed to be free from defects. Any defective materials or workmanship as well as damage to the work of all trades resulting from same shall be replaced or repaired as directed for the duration of stipulated guaranteed periods.
- B. The duration of guarantee periods following the date of beneficial use of the system shall be one year. Beneficial use is defined as operation of the system to obtain its intended use.
- C. The date of acceptance shall be the date of the final payment for the work or the date of a formal notice of acceptance, whichever is earlier.
- D. Non-durable items such as electric lamps, shall be replaced up to the date of acceptance, such that they shall have had no more than 100 hours use prior to this date.
- E. Certification shall be submitted attesting to the fact that specified performance criteria are met by all items of electrical equipment for which such certifications is required.

## 1.11 SEPARATION OF WORK BETWEEN TRADES

- A. The specifications for the overall construction delineate various items of work under separate trade headings. The list below sets forth this delineation to the extent that it affects the electric work.
- B. In the absence of more detailed information, the list shall be taken as a specific instruction to the electrical trade to include the work assigned to it.
- C. Indications that any trade is to perform an item of work means that it is to perform the work for its own accommodation only, except as specifically noted otherwise.

Oth = Other than electrical or mechanical.

Plb = Plumbing

FP = Fire Protection

Htg = Heating, Ventilating & Air Conditioning

Elec = Electrical.

f = Furnished.

i = Installed.

p = Provided (furnished and installed).

Item	Oth	Plb	FP	Htg	Elec	Note
Motors for mechanical equipment.		p	p	p		
Motor controllers for: Htg Plb FP		f  f	  f	f  	i  i	Specifications and drawings delineate exceptions.  Includes motor control centers if applicable.
Motor control devices for: Htg Plb FP		 p  	  p	p  		Specifications and drawings delineate exceptions.  Control devices for mounting within controller are provided integral with controller.
Power wiring for motors: Htg Plb FP					p p	
Control wiring for motor controllers: Htg Plb FP				p  	 p p	Specifications and drawings delineate exceptions.
Temporary light and power.	p					See General conditions specifications.  To accommodate all trades.
Temporary water.	p					

Item	Oth	Plb	FP	Htg	Elec	Note
Temporary heat.	p					
Temporary toilets.	p					
Hoisting.					p	
Rigging.					p	
Bracing and dunnage for safe rigging.					p	
Cutting, chasing and patching.	p					Cost where due to late installation or improper coordination of work is the responsibility of the electric.
Framed slots and openings in walls, decks and slabs.	p					Coordination drawings are required from the electric.
Sleeves through non-waterproof slabs, decks and walls.					p	Includes drilling of holes when required.
Sleeves through waterproof slabs, decks and walls.					p	Includes drilling of holes for other than field poured concrete.
Waterproof sealing of sleeves through waterproof slabs, decks and walls.					p	
Fireproof sealing (fire-stopping) excess opening spaces in slabs, decks and fire-rated walls.					p	
Excavation and backfill inside buildings.	p					
Excavation and backfill outside buildings.					p	
Concrete encasement of conduits.					p	Red coloring for concrete encasing primary voltage runs included in electric.

Item	Oth	Plb	FP	Htg	Elec	Note
Electric manholes and handholes.					p	Furnishing of covers, associated frames and other hardware included in electric.
Fastenings.					p	
Supports.					p	
Flashing of electric conduits through roof (pitch pockets).	p					
Concrete foundations, pads and bases inside buildings.	p					Furnishing of anchors and vibration mounts included in the electric.
Concrete foundations, pads and bases outside buildings.					p	Furnishing of anchors and vibration mounts included in the electric.
Concrete lined trenches in building foundation.	p					
Field touch-up painting of damaged shop coats.					p	
Field rustproof painting of supporting steel members, frames and racks.					p	
Finish painting of exposed work.	p					Red coloring of exposed fire protection alarm systems circuitry included in electric.  Red and white striping of exposed primary voltage runs included in electric.
Finished wall and ceiling access doors, panels and supporting frames.	i				f	Supplying list of locations where required included in electric.
Permanent catwalks to equipment.	p					Supplying list of locations where required included in electric.

Item	Oth	Plb	FP	Htg	Elec	Note
Permanent ladders to equipment.	p					Supplying list of locations where required included in electric.
Opening frames for ceiling recessed lighting fixtures and other electrical items.					p	
Luminous ceilings.	p					Lamp strips and lamps included in electric.
Electric duct heaters (heaters installed in air ducts).				p		Line and control connections included in electric.
Electric heaters with integral fans, (unit heaters, cabinet heaters, fan coil units and the like.)				p		Line and control connections included in electric.
Electric radiators (baseboard, sill line and convector type heaters).					p	
Electric water heaters.		p				Line and control connections included in electric.
Electric boilers.				p		Line and control connections included in electric.
Through wall sleeve type air conditioning and electric heating units.					p	
Electric heater cables for radiant space heating.					p	
Electric heater cables for snow melting.					p	
Electric heater cables for mechanical system pipe tracing.					p	
Electric power consuming items and controls for same not referred to above.	p	p	p	p		Line and control connections to equipment included in electric.

Item	Oth	Plb	FP	Htg	Elec	Note
Rubbish removal.					p	Removal of the shipping and packing materials of electrical items is included in the electric regardless by whom the items are furnished.
Special tools for maintenance of equipment furnished as part of electric work.					f	

- D. Include in the electrical work all necessary supervision and the issuing of all coordination information to any other trades who are supplying work to accommodate the electrical installations.
- E. For items of equipment which are to be installed but not purchased as part of the electrical work, the electrical work shall include:
1. The coordination of their delivery.
  2. Their unloading from delivery trucks driven in to any point on the property line at grade level.
  3. Their safe handling and field storage up to the time of permanent placement in the project.
  4. The correction of any damage, defacement or corrosion to which they may have been subjected.
  5. Their field make-up and internal wiring as may be necessary for their proper operation.
  6. Their mounting in place including the purchase and installation of all dunnage, supporting members, and fastenings necessary to adapt them to architectural and structural conditions.
  7. Their connection to building wiring including the purchase and installation of all "crown boxes" or other type of termination junction boxes necessary to adapt and connect them to this wiring. Included also shall be the purchase and installation of any substitute lugs or other wiring terminations as may be necessary to adapt their terminals to the building wiring as called for and to the connection methods set forth in these specifications.
- F. Items of equipment which are installed but not purchased as part of the electrical work shall be carefully examined upon delivery to the project. Claims that any of



these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the electric work will be considered only if presented in writing within one week of the date of delivery to the project of the items in question. The electric work includes all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

## 1.12 DEFINITIONS AND INTERPRETATIONS

- A. As used in the drawings and specifications for electrical work, certain non-technical words shall be understood to have specific meanings as follows regardless of indications to the contrary in the General Conditions or other documents governing the electric work.

"Furnish" -- Purchase and deliver to the project site complete with every necessary appurtenance and support, all as part of the electrical work. Purchasing shall include payment of all sales taxes and other surcharges as may be required to assure that purchased items are free of all liens, claims or encumbrances. Payment of sales taxes is, however, specifically excluded.

"Install" -- Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project, all as part of the electrical work.

"Provide" -- "Furnish" and "install."

"New" -- Manufactured within the past two years and never before used.

Regardless of their usage in codes or other industry standards, certain words as used in the drawings or specifications for the electrical work, shall be understood to have the specific meanings ascribed to them in the following list:-

"Circuitry" -- Any electric work (not limited to light and power distribution) which consists of wires, cables, raceways, and/or specialty wiring method assemblies taken all together complete with associated junction boxes, pull boxes, outlet boxes, joints, couplings, splices and connections except where limited to a lesser meaning by specific description.

"Wiring" -- Same as Circuitry.

"Circuit" -- Any specific run of circuitry.

"Branch Circuit" -- Any light and power distribution system circuit which, at its load end, is directly connected to one or more electrical energy consuming items with no overcurrent protection devices interposed, other than (where required) those protecting the energy consuming items from overloading or overheating.

"Appliance Panel" -- Any panel, used in a light and power distribution system, containing single pole and/or multipole branches rated in various sizes.

"Lighting Panel" -- Any panel used in a light and power distribution system, having all (or the majority) of its branches single pole and rated the same.

"Lighting and Appliance Branch Circuitry" -- All or any portion of branch circuits outgoing from a lighting or appliance panel.

"Feeder" -- Any item of light and power circuitry used in a distribution system which is not lighting and appliance branch circuitry.

"Main Feeder" -- Any feeder which, at its supply end, is connected through its own overcurrent protection (and switching) device, and none other, directly to a main service or a main service overcurrent protection (and switching) device.

"Branch Feeder" -- A feeder, other than a main feeder, which complies with the definition of a branch circuit.

"Submain Feeder" -- Any feeder which is neither a main feeder nor a branch feeder.

"Distribution Panel" -- Any panel, used in a light and power distribution system, containing only multi-pole branches and with all (or the majority) of its branches used for feeders supplying other panels.

"Power Panel" -- Same as distribution panel, except with all (or the majority) of its branches used for feeders which do not supply other panels.

"Motor Power Circuit" -- Any circuit which operates nominally at 100 volts or more, and which carries electrical input energy to a motor.

"Motor Control Circuit" (used in conjunction with a motor for which a magnetic starter is supplied) -- Any circuit (other than a motor power circuit), which operates nominally at 100 volts or more, and which carries current intended for directing or indicating the performance of a motor starter.

"Motor Control Circuit" (used in conjunction with a motor for which a manual starter is supplied) -- Any circuit containing an extension of power circuit wires, other than those constituting the direct connection between source of supply, starter and motor.

"Motor Control Actuating Device" -- Any device which performs a switching function in a motor control circuit (pushbuttons, automatic contacting devices, etc.).

"Motor Control Actuated Device" -- Any device which functions in response to voltage received from a motor control circuit (pilot lights, solenoids, etc.)

"Package Unit" -- An item of equipment having one or more motors or other electric

energy consuming elements integrally factory mounted on a single base, complete with all associated control devices and interconnecting wiring.

"Low Voltage" -- Below 50 volts.

"Process Control System" -- An overall control and/or logging system of a low voltage, electronic or pneumatic type available as a fully installed "package" from specialty manufacturers (commonly referred to as a "Temperature Control System" or an "Automatic Control System" or a "Building Management System" where used in conjunction with air conditioning).

"Grade Slab" -- A building floor slab which is in contact with or directly over grade (earth).

"Building Confines" -- The extent of a building, as defined by the outside surfaces of its peripheral walls, the top surface of its roof, and the underside surface of its grade slab.

"Distribution Switch" -- Any switch used in a light and power system other than a tumbler, toggle or specialty switch in the "wiring device" category.

"Normal Electric Work Conditions" -- Locations within building confines which are neither damp, wet nor hazardous and which are not used for air handling.

"Underground" -- Subsurface and exterior to building foundations.

"At Underside of Grade Slab" -- Under a grade slab and integrated into it.

"Below Grade Slab" -- Under a grade slab but not integrated into it.

"Standard" (as applied to wiring devices) -- Not of a separately designated individual type.

"Raceway" -- Any pipe, duct, extended enclosure, or conduit (as specified for a particular system) which is used to contain wires, and which is of such nature as to require that the wires be installed by a "pulling in" procedure.

"Specialty Cast-in-Floor Raceway" -- Underfloor duct, cellular deck and the like.

"Concealed" (as applied to circuitry) -- Covered completely by building materials, except for penetrations (by boxes and fittings) to a level flush with the surface as necessitated by functional or specified accessibility requirements.

"Exposed" (as applied to circuitry) -- Not covered in any way by building materials.

"Subject to Mechanical Damage" -- Exposed within seven feet of the floor in mechanical rooms, vehicular spaces, or other spaces where heavy items (over 100 pounds) are moved around or rigged as a common practice or as required for replacement purposes.

"Primary" (as applied to light and power distribution) -- Over 600 volts.

"Secondary" (as applied to light and power distribution) -- Under 600 volts.

"Assembly" -- A defined set of elements of electric work.

- B. The following shall be treated as damp or wet locations within building confines, regardless of whether or not a high ambient moisture level is found to exist:-
  - 1. Spaces where any designations indicating weatherproof (WP) or vapor-proof (VP) appear on the drawings.
  - 2. Cooling tower areas.
  - 3. Below waterproofing in slabs applied directly on grade.
  - 4. Kitchens up to a height of 18" above finished floor.
  - 5. Outside of waterproofing in foundation walls in contact with grade.
  - 6. Above waterproofing in slabs having no building above.
  - 7. Above waterproofing in fill on slabs having no building above.
  - 8. Spaces containing equipment owned and/or maintained by the electric utility company.
- C. Electric work in slabs, walls or suspended ceilings which bound on a space defined as a damp or wet location shall meet the damp or wet location requirements if it enters into, or opens into the damp or wet location in any way.
- D. Where the word "conduit" is used without specific reference to type, it shall be understood to mean "raceway".
- E. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any electrical item in the drawings and specifications for electrical work carries with it the instruction to furnish, install and connect the item as part of the electrical work regardless of whether or not this instruction is explicitly stated.

- F. It shall be understood that the specifications and drawings are complementary and are to be taken together for a complete interpretation of the work. Where there are conflicts between the drawings and specifications or within the specifications or drawings themselves, the items of higher standard shall govern.
- G. To the extent that they govern the basic work, the specifications also govern change order work if any.
- H. No exclusion from or limitation in, the symbolism used on the drawings for electrical work or the language used in the specifications for electrical work shall be interpreted as a reason for omitting the appurtenances or accessories necessary to complete any required system or item of equipment.
- I. The drawings for electrical work utilize symbols and schematic diagrams which have no dimensional significance. The work shall, therefore, be installed to fulfill the diagrammatic intent expressed on the electrical drawings, but in conformity with the dimensions indicated on the final working drawings, field layouts and shop drawings of all trades. In particular, information as to the exact size, location and electrical connection points for mechanical equipment shall be derived by reference to HVAC and Plumbing documents.
- J. Certain details appear on the drawings for electrical work which are specific with regard to the dimensioning and positioning of the work. These are intended only for general information purposes. They do not obviate field coordination for individual items of the indicated work.
- K. Information as to general construction and architectural general construction and architectural features and finishes shall be derived from structural and architectural drawings and specifications only.
- L. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.
- M. Ratings of devices, materials and equipment specified without reference to specific performance criteria shall be understood to be nominal or nameplate ratings established by means of industry standard procedures.
- N. The restriction of conductors in wires to copper, as specified elsewhere, shall be understood to also apply to all conductors (wire, cable or bus as applicable), including those provided as part of factory assembled components such as transformers, switchboards, panelboards, switchgear, overcurrent protection and switching devices. This restriction shall apply equally to all such equipment regardless of indications (or lack thereof) elsewhere to the contrary. Aluminum will not be acceptable.

## PART 2 - PRODUCTS

### 2.1 TOUCH UP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

### 2.2 ACCESS DOORS IN FINISHED CONSTRUCTION

- A. Access doors as required for operation and maintenance of concealed equipment, valves, controls, etc. will be coordinated by general contractor.
  - 1. Access doors shall be of ample size, minimum of 16 inches x 16 inches (40 cm. x 40 cm.).
- B. Furnish (confirm with GC) access doors as required for operation and maintenance of concealed equipment, valves, controls, etc., and coordinate their delivery with the installing Trade.
  - 1. Coordinate and prepare a location, size, and function schedule of access required and deliver to a representative of the installing Trade.
  - 2. Doors shall be minimum size 16 inches x 16 inches (40 cm. x 40 cm.) as manufactured by Karp Associates, Inland Steel Products "Milcor", "MIFAB" or other approved in accordance with the following schedule:

Location	Type	Catalog Number
Plaster Ceiling	Recessed Door Panel	Karp DSC-210-PL Milcor Style AP MIFAB-CAD-PL
Acoustic Tile Ceiling	Recessed Door Panel for Tile	Karp DSC-210 Milcor Style AT MIFAB-CAD
Plaster Wall	Flush Door Panel	Karp DSC-214-PL Milcor Style K MIFAB-CAD-PL-PL
Drywall	Flush Door Panel	Karp DSC-214-M Milcor Style DW MIFAB-MDW
Drywall	Recessed Door Panel	Karp-RDW-210 MIFAB-CAD-FL

Ceramic Tile Walls	Flush Door Panel	Karp DSC-214-M Milcor Style M MIFAB-UA
Masonry Wall	Flush Door Panel	Karp DSC-214-M Milcor Style M MIFAB-UA
3-Hour Rated Masonry Shaft	Flush Door Panel	Karp DSC-211-FRT MIFAB-MPFR-SD
1-1/2 Hour Rated Shaft	Flush Door Panel	Karp KRP-150-FR Milcor Fire Door Rated Access Door Panel MIFAB-MPFR

3. Doors and frames shall be given a factory prime coat of corrosion resistant paint.
4. Type shall be as approved by Architect.
5. Frames shall be welded minimum 14 gauge steel, mitered corners ground smooth with anchors.
6. Finish shall be as selected and approved by Architect.
7. Doors shall be minimum 14 gauge steel, heavy hinges flush with frame, invisible when closed.

### PART 3 - EXECUTION

#### 3.1 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

#### 3.2 ELECTRICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
  1. Coordinate electrical systems, equipment, and materials installation with other building components.
  2. Verify all dimensions by field measurements.

3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
  4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
  5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
  6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
  7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
  8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
  9. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
  10. Coordinate location of access panels or doors where outlet boxes, junction boxes, or equipment are concealed behind finished surfaces.
  11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- B. Coordinate electrical service connections to components furnished by utility companies.
1. Coordinate installation and connection of exterior underground and overhead utilities and services.
  2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- C. Locations of all devices, fixtures, and other visible components shall be as indicated on the architectural drawings. Mounting heights shall be as specified in Division 16 Section "Raceways and Boxes".



- D. Each piece of mechanical equipment located outside the building or on the roof shall be within 25 feet (7 m) of a duplex outlet. Where necessary to meet this criteria, provide duplex outlets in addition to those devices shown on the drawings. Each shall be complete with waterproof cover and integral GFI protection, and 20 ampere circuitry to the nearest 120 volt panel on the proper electric meter.

### 3.3 FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Firestopping."

### 3.4 FOUNDATIONS

- A. General
  - 1. All equipment, including but not limited to Switchgear, Switchboards, Motor control centers, Generators, Uninterruptible power supplies and battery racks, Automatic transfer switches, transformers shall be provided with foundations.
  - 2. Furnish shop drawings showing adequate concrete reinforcing steel details and templates for all concrete foundations and supports, and all required anchor bolts and other appurtenances necessary for the proper installation of this equipment. All concrete work shall be shown in detail on the shop drawings, prepared by this trade.
  - 3. Each piece of equipment shall be set on a concrete base minimum 4 inches (10 cm.) high and extending 3 inches (8 cm.) beyond the equipment in all directions. Bases shall be integrally keyed to structural slab.

### 3.5 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with Division 1 Section "Cutting and Patching." In addition to the requirements specified in Division 1, the following requirements apply:
  - 1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
    - (a) Uncover Work to provide for installation of ill-timed Work.
    - (b) Remove and replace defective Work.

- (c) Remove and replace Work not conforming to requirements of the Contract Documents.
  - (d) Upon written instructions from the Architect, uncover and restore Work to provide for Architect observation of concealed Work.
- 2. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- 3. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers.
- B. Identify for future use with a tag at each unterminated end all low voltage (audio, data, Class 2, Class 3, PLTC, fire alarm, optical fiber, communications, coaxial, and network) cables.

### 3.6 REFINISHING AND TOUCH UP PAINTING

- A. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
- B. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
- C. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
- D. Repair damage to PVC or paint finishes with matching touch up coating recommended by manufacturer.

### 3.7 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
  - 1. Cutting and patching for electrical construction.
  - 2. Touch up painting.

### 3.8 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 16050

**NEW PASSENGER TERMINAL  
DULUTH INTERNATIONAL AIRPORT  
DULUTH, MINNESOTA**

**SECTION 16060 - GROUNDING AND BONDING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.
- B. Related sections include the following:
  - 1. Division 16 Section "Conductors and Cables."
  - 2. Division 16 Section "Raceways and Boxes."
  - 3. Division 16, Section "Underground Ducts and Utility Structures."
  - 4. Division 16, Section "Lightning Protection."

**1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated.
  - 1. Ground rods, connectors, exothermic welds, ground bars, grounding conductors and other components of system.
- B. Field Test Reports: Written reports specified in Part 3.

**1.4 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by Underwriters Laboratories, Inc.
- B. Comply with UL 467.
- C. Comply with NFPA 70, as amended by state and local codes.
- D. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.
- E. Comply with applicable BICSI standards.

## F. Comply with ANSI/IEEE 142

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
1. Erico Products, Inc.
  2. Ideal Industries, Inc.
  3. Kearney.
  4. O-Z/Gedney Co.
  5. Raco, Inc.
  6. Thomas & Betts, Electrical

## 2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 16 Section "Conductors and Cables."
- B. Material: Copper
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape - alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.
- E. Grounding Electrode Conductors: Stranded cable.
- F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- G. Bare Copper Conductors: Comply with the following:
1. Solid Conductors: ASTM B 3.
  2. Assembly of Stranded Conductors: ASTM B 8.
  3. Tinned Conductors: ASTM B 33.
- H. Copper Bonding Conductors: As follows (except where otherwise indicated):
1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 0.25-inch (6.4 mm) in diameter.
  2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.

3. Bonding Jumper: Bare copper tape, braided bare copper No. 30 AWG conductors, terminated with copper ferrules; 1.625 inch (42 mm) wide and 1/16 inch (1.5 mm) thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper No. 30 AWG conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
- I. Grounding Bus: Bare, annealed copper bars of rectangular cross section, 1/4 by 2 inches (6 by 50 mm) in cross section, unless otherwise indicated; with mounting insulators.

## 2.3 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Connectors: Bolted-pressure-type connectors, or compression type.
- C. Bolted Clamps: Heavy-duty type.
- D. Pressure Connectors: High-conductivity-plated units.
- E. Main Grounding System - Welded Connections: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions for the specific types, sizes, and combinations of conductors and other items to be connected.
  1. Manufacturer: Erico "Cadweld" system.

## 2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel with high-strength steel core and electrolytic-grade copper outer sheath, molten welded to core.
  1. Size: 3/4 inch by 10 feet (19 by 3000 mm ).

# PART 3 - EXECUTION

## 3.1 APPLICATION

- A. Equipment Grounding Conductor Application: Comply with NFPA 70, as amended by state and local codes, for sizes and quantities of equipment grounding conductors except where specific types, larger sizes or more conductors are indicated.
  1. Provide equipment grounding conductors with circuit conductors for all feeders and branch circuits.

- B. Signal and Communications: For telephone, alarm, voice and data and other communication systems, provide a #4 AWG minimum green insulated copper conductor in raceway from the grounding electrode system to each service location, antenna, terminal cabinet, wiring closet and central equipment location.
- C. The ground bus of switchboards and switchgear shall be connected to the main grounding electrode by means of insulated grounding electrode conductors run in intermediate metallic conduit and sized as per Code.
- D. The neutral bar of each individually enclosed service switch shall be bonded to its enclosure on the line side of a removable link (included therein), and connected to the main grounding electrode by means of insulated grounding electrode conductors run in intermediate metallic conduit and sized as per Code.
- E. The emergency generator system neutral shall be grounded by means of a connection from the [neutral bar in the generator main circuit breaker enclosure to the main grounding electrode by means of an insulated grounding electrode conductor run in intermediate conduit and sized as per Code. Include a bonding connection from the neutral to the equipment enclosure.
- F. The Uninterruptible Power Source (UPS) system neutral shall be grounded by means of a connection from the neutral bar in the UPS main circuit breaker enclosure to the main grounding electrode by means of an insulated grounding electrode conductor run in intermediate conduit and sized as per Code. Include a bonding connection from the neutral to the equipment enclosure.
- G. The main grounding electrode shall be an accessible point on the nearest metallic main water service pipe. Connection shall be made on the street side of the main valve utilizing a ground clamp of a type specifically manufactured for the purpose. Bonding jumpers shall be provided around the water meters (if provided) and around insulating joints and/or sections, utilizing conductors sized as per Code and run in IMC. Bond the structural steel to the grounding electrode system.
- H. The water pipe ground shall be supplemented by an additional "made" electrode consisting of buried ground rods, and provided in sufficient quantity so as to have a measured resistance to ground of not more than 5 ohms. Establish a bonding connection from the "made" electrode consisting of green insulated conductors run in IMC and sized as per Code.
- I. Bond the reinforcing bars in concrete to the nearest grounding electrode. Where reinforcing bars are installed in building foundations and footings protect the bonding conductor during construction. Arrange for inspection by the authority having jurisdiction prior to placement of concrete.
- J. The neutral of secondary winding of each low voltage (i.e., less than 600 volts) transformer shall be grounded to the grounding electrode as specified hereinafter by means of an insulated grounding conductor sized as per Code and run in IMC. The neutral of each transformer shall be bonded to the transformer enclosure by means of an insulated conductor sized as per code. If not factory installed the jumper shall be field installed within the transformer enclosure.

- K. At each secondary voltage to secondary voltage transformer, bond the metallic water piping system to the transformer neutral at the nearest available location utilizing conductors sized equal to the grounding electrode conductor and run in conduit.
- L. The grounding electrode for each low voltage (both windings 600 volts or less) transformer shall be the main water service pipe entering the building taken at a point on the street side of its main valve. Utilize a common ground clamp on the main water pipe, with means for connecting the multiple separate grounding conductors from the various transformers. In lieu of multiple separate grounding conductors, multiple connection to a "ground bus cable" may be utilized. The ground bus cable shall consist of a 500 MCM green coded insulated copper conductor run in 1-1/2 inch (DN 41) threaded steel conduit from the street side of the main water service valve, throughout the building to all dry type transformer locations requiring grounding. The ground bus cable shall be connected to the main water pipe by means of a ground clamp of a type specifically manufactured for the purpose. At each transformer location, establish a "grounding electrode" connection point by arranging a break in the "ground bus cable" conduit exposing the cable for not more than a twelve inch length. Ends of conduit at the break shall be equipped with bushings. The connection shall be made by means of an irreversible compression connector listed for the purpose or an exothermic weld.
- M. Include a properly sized green insulated grounding conductor within the conduit for each feeder supplying a panel containing an isolated ground bus (i.e., insulated from ground). Increase indicated conduit size if necessary to accommodate this conductor. Connect to the neutral grounding facility for feeders originating at the service entry point or at 480-120/208 volt stepdown transformers as applicable.
- N. Bond metallic conduits containing grounding electrode conductors and main bonding conductors to the ground bus service enclosure and/or grounding electrode at both ends of each run utilizing grounding bushings and jumpers. Bonding jumpers shall be sized equal to the grounding electrode conductors.
- O. Provide grounding bonds for all metallic conduits of the light and power system which terminate at (or in pits below) distribution equipment for which a ground bus is specified. Accomplish this by equipping the conduits with bushings of the grounding type connected individually to the ground bus.
- P. Provide supplementary ground bonding to maintain continuity of the equipment and raceway grounding system as follows:
  - 1. Bonding jumpers shall be applied where wiring devices (receptacles and switches) are not equipped with approved self-grounding features. Include any necessary field modifications for termination of the bonding jumpers so as to insure grounding continuity.
  - 2. Bonding jumpers shall be applied to insure that grounding continuity does not depend solely on the supporting screws fastening metallic enclosures together.
  - 3. Include any necessary field modifications for termination of the bonding jumpers so as to insure grounding continuity.

- Q. Provide grounding of raised metallic floors used to contain wiring to computers and/or other equipment. Where the floor system is of a type that is specifically designed by the manufacturer to maintain ground continuity through its metallic structural support system, the grounding may be accomplished by means of no fewer than (8) bonding connections spaced equally about the perimeter but in no case more than 100 feet (30 m) apart. Utilize #8 AWG green insulated copper conductors for the connection of the bonding locations to the ground bus in the panel serving the equipment and the service ground point. If the raised floor is to be used as an air handling plenum, the insulation shall be of a fluoropolymer type suitable for use in plenums without raceway. If the floor system is not designed to maintain ground continuity through the metallic structural support system, alternating support pedestals in each direction must be connected to the bonding conductors.
- R. Provide a ground connection for each 100 feet (30 m) of run of cable tray, and for each isolated run of less than 100 feet (30 m), by means of a #6 AWG green coded insulated copper conductor run in 3/4 inch (DN 21) conduit. The grounding electrode for each run of cable tray requiring same shall consist of a cadweld connection to adjacent structural steel at a point where only fireproofing and not structural concrete is applied to it or the nearest cold water pipe if steel is not available. Utilize ground clamps of a type specifically manufactured for the purpose.
- S. Provide supplementary ground bonding for each motor control center (MCC) as follows:
1. Provide equipment grounding conductors as required to insure that all sections (including attached integral or field installed pullboxes) are bonded together by means of these conductors and by means of the MCC ground bus (if a ground bus is included in the MCC).
  2. Provide grounding bushings and jumpers as required to insure that all conduits and any contained equipment grounding conductors are bonded to the enclosure grounding conductors (or ground bus).
- T. Where specifically noted on the drawings, or described hereinbefore in this Section, include insulated equipment and raceway grounding conductors run within the raceways. Where insulated equipment grounding conductors required for feeders have not been included in the quantities of conductors indicated on the drawings, incorporate such conductors in accordance with the electrical code. Adjust conduit sizing if required.
- U. Common Ground Bonding With Lightning Protection System: Bond electric power system ground directly to lightning protection system grounding conductor at closest point to electric service grounding electrode. Use bonding conductor sized same as system ground conductor and installed in conduit.
- V. Grounding Underground Distribution System Components complies with IEEE C2 grounding requirements and the following. Provide additional grounding if required to comply with Utility Company standards.



1. **Grounding Manholes and Handholes:** Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, non-shrink grout.
2. **Grounding Connections to Manhole Components:** Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.
3. **Pad-Mounted Transformers and Switches:** Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with pad mounted equipment by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

### 3.2 INSTALLATION

- A. **General:** Ground electrical systems and equipment according to NFPA 70, as amended by state and local codes, except where Drawings or Specifications exceed such requirements.
- B. **Grounding Rods:** Locate a minimum of 1-rod length from each other and at least the same distance from any other grounding electrode.
  1. Drive until tops are 2 inches (50 mm) below finished floor or final grade, except as otherwise indicated.
  2. Interconnect with grounding-electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make these connections without damaging copper coating or exposing steel.
- C. **Grounding Conductors:** Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- D. **Underground Grounding Conductors:** Use bare copper wire. Bury at least 24 inches (600 mm) below grade.

- E. Metal Water Service Pipe: Provide insulated copper grounding conductors, sized as indicated, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding-clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Provide a grounding jumper with the same size conductor across dielectric fittings. Bond grounding-conductor conduit to conductor at each end.
- F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding-clamp connectors.
- G. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

### 3.3 CONNECTIONS

- A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.
- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

- G. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage an independent electrical testing organization to perform tests described below.
- B. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal.. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the fall-of-potential method according to IEEE 81.
- C. Maximum grounding resistance shall be less than or equal to 5 ohms.
- D. Excessive Ground Resistance: Where resistance to ground exceeds specified values, provide additional grounding to achieve required results.
- E. Report: Prepare test reports, certified by the testing organization, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results.
- F. Field Test Reports: Submit written test reports to include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

END OF SECTION 16060

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**SECTION 16075 - ELECTRICAL IDENTIFICATION**

**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 electrical identification materials and devices required to comply with ANSI C2, NFPA 70 - as amended by state and local codes, OSHA standards, and the requirements of the authorities having jurisdiction. All power distribution equipment shall be labeled.

**1.3 SUBMITTALS**

- A. Product Data: For each electrical identification product indicated.
- B. Schedule of Nomenclature: An index of electrical equipment and system components used in identification signs and labels.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

**1.4 QUALITY ASSURANCE**

- A. Comply with NFPA 70, as amended by state and local codes.
- B. Comply with ANSI A13.1 and NFPA 70 for color-coding.
- C. Comply with ANSI Z535-2, Z535-4, and NFPA 70E.
- D. Comply with ANSI C2.
- E. Comply with 29 CFR 1910.145

**1.5 COORDINATION**

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 RACEWAY AND CABLE LABELS

- A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
  - 1. Color: Black letters on orange field.
  - 2. Legend: Indicates voltage and service.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, **2 inches (50 mm)** long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; **2 inches (50 mm)** wide; compounded for outdoor use.

### 2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than **3 mils (0.08 mm)** thick by **1 to 2 inches (25 to 50 mm)** wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- C. Aluminum Wraparound Marker Labels: Cut from **0.014-inch- (0.35-mm-)** thick aluminum sheet, with stamped, or embossed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.
- D. Metal Tags: Brass or aluminum, **2 by 2 by 0.05 inch (50 by 50 by 1.3 mm)**, with stamped legend, punched for use with self-locking nylon tie fastener.
- E. Write-On Tags: Polyester tag, **0.015 inch (0.38 mm)** thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

## 2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
  1. Not less than **6 inches (150 mm)** wide by **4 mils (0.102 mm)** thick.
  2. Compounded for permanent direct-burial service.
  3. Embedded continuous metallic strip or core.
  4. Printed legend shall indicate type of underground line.

## 2.4 WARNING LABELS, NAMEPLATES AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Engraved Plastic Warning Labels, Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum **1/16 inch (1.6 mm)** thick for signs up to **20 sq. in. (129 sq. cm)** and **1/8 inch (3.2 mm)** thick for larger sizes.
  1. Engraved legend with black letters on white face.
  2. Punched or drilled for mechanical fasteners.
- C. Baked-Enamel Warning Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for the application. **1/4-inch (6.4-mm)** grommets in corners for mounting. Nominal size, **7 by 10 inches (180 by 250 mm)**.
- D. Exterior, Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with **0.0396-inch (1-mm)** galvanized-steel backing; and with colors, legend, and size required for application. **1/4-inch (6.4-mm)** grommets in corners for mounting. Nominal size, **10 by 14 inches (250 by 360 mm)**.
- E. Warning label and sign shall include, but are not limited to, the following legends:
  1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR **48 INCHES (1200 MM)**.". Adjust clearance dimensions as required for system voltage and equipment configuration.
  3. Arc Flash Warning: "POTENTIAL ARC FLASH HAZARD - APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT AND TOOLS REQUIRED WHEN WORKING ON THIS EQUIPMENT."

- F. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

## 2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
1. Minimum Width: 3/16 inch (5 mm).
  2. Tensile Strength: 50 lb (22.3 kg) minimum.
  3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
  4. Color: Black, except where used for color-coding.
- B. Paint: Formulated for the type of surface and intended use.
1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.
  2. Primer for Concrete Masonry Units: Heavy-duty concrete masonry unit block filler.
  3. Primer for Concrete: Exterior concrete and masonry primer.
  4. Enamel: Exterior semigloss acrylic enamel.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands or with snap-around, color-coding bands:
1. Fire Alarm System: Red.
  2. Telecommunication System: Green and yellow.
  3. Control Wiring: Green and red.
- B. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use aluminum wraparound marker labels or non-ferrous metal tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

- C. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use aluminum wraparound marker labels. Identify each ungrounded conductor according to source and circuit number.
- D. Ground fault interrupter outlets: Identify receptacles supplied by ground fault interrupter circuit breakers or by upstream ground fault interrupter receptacles. Use engraved letters on device plate.
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Warning Labels for Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
  - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
    - (a) Power transfer switches.
    - (b) Controls with external control power connections.
  - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
  - 3. Switchboards, Panelboards, Equipment Control Panels, Meter Socket Enclosures, and Motor Control Centers: Labeled to warn of potential electric arc flash hazards. The label shall be located so as to be clearly visible before examination, adjustment, servicing, or maintenance of the equipment.



I. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum **3/8-inch- (10-mm-)** high letters for emergency instructions at equipment used for power transfer or for load shedding.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

- (a) Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with **1/2-inch- (13-mm-)** high letters on **1-1/2-inch- (38-mm-)** high label; where 2 lines of text are required, use labels **2 inches (50 mm)** high.
- (b) Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

- (a) Panelboards, electrical cabinets, and enclosures.
- (b) Access doors and panels for concealed electrical items.
- (c) Electrical switchgear and switchboards.
- (d) Transformers.
- (e) Emergency system boxes and enclosures.
- (f) Motor-control centers.
- (g) Disconnect switches.
- (h) Enclosed circuit breakers.
- (i) Motor starters.
- (j) Push-button stations.

- (k) Power transfer equipment.
- (l) Contactors.
- (m) Remote-controlled switches, dimmer modules, and control devices.
- (n) Battery racks.
- (o) Power-generating units.
- (p) Voice and data cable terminal equipment.
- (q) Master clock and program equipment.
- (r) Intercommunication and call system stations.
- (s) Television/audio components, racks, and controls.
- (t) Fire-alarm control panel and annunciators.
- (u) Monitoring and control equipment.
- (v) Uninterruptible power supply equipment.
- (w) Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

### 3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Attach signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- E. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- F. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
  - 1. Color shall be factory applied the entire length of conductors, except the following field-applied color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:

- (a) Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of **6 inches (150 mm)** from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use **1-inch- (25-mm-)** wide tape in colors specified. Locate tape bands to avoid obscuring cable identification markings.
  - (b) Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting **3 inches (76 mm)** from the terminal and spaced **3 inches (76 mm)** apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length. Locate bands to avoid obscuring cable identification markings.
- 2. Colors for 208/120-V Circuits:
  - (a) Phase A: Black.
  - (b) Phase B: Red.
  - (c) Phase C: Blue.
- 3. Colors for 480/277-V Circuits:
  - (a) Phase A: Brown.
  - (b) Phase B: Orange.
  - (c) Phase C: Yellow.
- G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at **6 to 8 inches (150 to 200 mm)** below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds **16 inches (400 mm)** overall.
- I. Painted Identification: Install painted identification according to manufacturer's written instructions and as follows:
  - 1. Clean surfaces of dust, loose material, and oily films before painting.
  - 2. Prime surfaces using type of primer specified for surface.

END OF SECTION 16075

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**SECTION 16080 - ELECTRICAL TESTING**

**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 general requirements for electrical field testing and inspecting. Detailed requirements are specified in each Section containing components that require testing. General requirements include the following:
  - 1. Coordination requirements for testing and inspecting
  - 2. Reporting requirements for testing and inspecting.

**1.3 QUALITY ASSURANCE**

- A. As specified in each Section containing electrical testing requirements.

**PART 2 - PRODUCTS**

NOT USED

**PART 3 - EXECUTION**

**3.1 GENERAL TESTS AND INSPECTIONS**

- A. Where no specific requirements are given, provide testing in accordance with the latest version of the InterNational Testing Association (NETA) Acceptance Testing Specification for Electric Power Distribution Equipment and Systems.
- B. Where tests are specified to be performed by an independent testing agency, prepare systems, equipment, and components for tests and inspections, and perform preliminary tests to ensure that systems, equipment, and components are ready for independent agency testing. Include the following minimum preparations as appropriate:
  - 1. Perform insulation-resistance tests.
  - 2. Perform continuity tests.
  - 3. Perform rotation test (for motors to be tested).

4. Provide a stable source of single-phase, 208/120-V electrical power for test instrumentation at each test location.
- C. Test and Inspection Reports: In addition to requirements specified elsewhere, report the following:
1. Manufacturer's written testing and inspecting instructions.
  2. Calibration and adjustment settings of adjustable and interchangeable devices involved in tests.
  3. Tabulation of expected measurement results made before measurements.
  4. Tabulation of "as-found" and "as-left" measurement and observation results.

### 3.2 COMMISSIONING

- A. Provide manpower as required to assist the commissioning agent, as required in Division 1 Section "GENERAL COMMISSIONING REQUIREMENTS" and Division 1 Section "HVAC COMMISSIONING REQUIREMENTS".

END OF SECTION 16080

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**SECTION 16120 - CONDUCTORS AND CABLES**

**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 building wires and cables and associated splices, connectors, and terminations for wiring systems rated 600 volts and less.

**1.3 SUBMITTALS**

- A. Product Data: for each type of product indicated.
- B. Field Quality Control Test Reports.

**1.4 QUALITY ASSURANCE**

- A. Listing and Labeling: Provide products specified in this Section that are Underwriters Laboratories listed and labeled.
  - 1. The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.
- B. Comply with NFPA 70, as amended by state and local codes.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 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 manufacturers specified.

**2.2 CONDUCTORS AND CABLES**

- A. Available Manufacturers:
  - 1. American Insulated Wire Corp.; a Leviton Company.

2. General Cable Corporation.
  3. Senator Wire & Cable Company.
  4. Southwire Company.
  5. Belden, Division Cooper Industries.
  6. Cable & Wire Division, AT&T.
  7. Pyrotenax.
- B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
1. Conductor Material: Copper, complying with NEMA WC 5 or 7; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
  2. Conductor Insulation Types: Type THHN, THWN, XHHW complying with NEMA WC 5 or 7.
- C. Electrical Circuit Protective System Cable: Where required by code, or where indicated on the drawings, feeders and circuitry are a fire rated cable system, except where enclosed within equivalent fire rated construction indicated on the architectural drawings. Mineral-insulated, metal-sheathed cable, Type MI.

## 2.3 CONNECTORS AND SPLICES

- A. Available Manufacturers:
1. AFC Cable Systems, Inc.
  2. AMP Incorporated/Tyco International.
  3. Hubbell/Anderson.
  4. O-Z/Gedney; EGS Electrical Group LLC.
  5. 3M Company; Electrical Products Division.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## PART 3 - EXECUTION

## 3.1 WIRE AND INSULATION APPLICATIONS

- A. Utilize copper conductors with THWN, THHN or XHHW insulation, except provide THHW-2, THWN-2 or XHHW-2 insulation for conductors 1/0 and larger in "wet" locations. Conductors utilized in underground installations are UL Listed for use in wet locations. Conductors are run in raceways as described in Section 16 "Raceways and Boxes". Type THHW and THHW-2 are not utilized where excluded by conduit sizing. Type THWN are not utilized for connection to 100 percent rated overcurrent devices.
- B. Electrical circuit protective system cable is utilized for feeders and circuitry which is required to be fire rated and which is not enclosed within equivalent fire rated construction indicated on the architectural drawings.
  - 1. A one-hour rating is required for:
    - (a) Feeders for Emergency Systems except where run within space directly protected by sprinklers.
    - (b) Normal and emergency feeders to fire pump.
- C. In general, cable ampacities are based on a 60 degree C rating for cables #1 AWG and smaller and on a 75 degree C rating for larger cables. In conjunction with this, note the following:
  - 1. 75 degree C ratings may be utilized for cables #1 AWG and smaller where overcurrent protection and switching devices (OCD's), wiring devices and solidly connected equipment connected to such cables are listed and identified for use with 75 degree C rated conductors. (Note that these specifications require all OCD's - regardless of ampere rating to be suitable for use with 75 degree C rated conductors).
  - 2. Increase indicated cable (and raceway) sizing as required for circuitry where conductors #1 AWG and smaller will connect directly to solidly connected utilization equipment whose load current will exceed the 60 degree C rating of the cable, and for which manufacturer's approval for cable terminations is less than 75 degrees C, or to receptacles whose ampere rating exceeds the 60 degree C rating of the connected cables unless such receptacles are listed for use with 75 degree C rated conductors. Note that accessible intermediate tap boxes may be utilized adjacent to 60 degree C rated terminations to allow conductor "upsizing" locally so as to comply with such termination requirements.
- D. For low voltage systems where circuits are power limited in accordance with Class 2 or Class 3 requirements (as defined in Article 725 of the National Electrical Code) utilize cables having characteristics as follows:



1. Cables are of a fluoropolymer type having adequate fire-resistant and low-smoke producing characteristics and are U.L. listed for plenum use (Type CL2P for Class 2 circuits, type CL3P or CMP for Class 3 circuits), except that where run in conduit, they may be U.L. type CL3, or where run in cable trays they are U.L. type CMP.
- E. For low voltage systems whose circuits are not power limited Class 2 or Class 3 (in accordance with the requirements of Article 725 of the National Electrical Code), and which are not telecommunications circuitry (in accordance with Article 800 thereof), utilize copper conductors having TFN insulation for sizes #16 AWG and smaller, and type THHN or THWN for sizes #14 AWG and larger. Wires are run in electric metallic tubing.
- F. Low voltage circuits intended for the distribution of voice or data utilize communications cables (complying with requirements of Article 800 of the National Electrical Code) having characteristics as follows:
1. Cables are of a fluoropolymer type having adequate fire-resistant and low-smoke producing characteristics and are U.L. listed for plenum use (Type CMP), except that where run in conduit, they may be U.L. type CM.
  2. Refer to Division 16, Section "Fire Protective Alarm System" for fire alarm system wiring.

### 3.2 INSTALLATION

- A. Conceal cables in finished walls, ceilings and floors unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- E. Support cables according to Division 16 Section "Basic Electrical Materials and Methods."
- F. Seal around cables penetrating fire-rated elements according to Division 7 Section "Through-Penetration Firestop Systems."
- G. Identify wires and cables according to Division 16 Section "Electrical Identification" and Division 16 Section "Supporting Devices".

### 3.3 CONNECTIONS:

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Maintain all splices and joints in removable cover boxes or cabinets where they may be easily inspected.
- D. Locate each completed conductor splice or joint in the outlet box, junction box, or pull box containing it, so that it is accessible from the removal cover side of the box.
- E. Join solid conductors #8 AWG and smaller by securely twisting them together and soldering, or by using insulated coiled steel spring "wire nut" type connectors. Exclude "wire nuts" employing non-expandable springs. Terminate conductors #8 AWG and smaller by means of a neat and fast holding application of the conductors directly to the binding screws or terminals of the equipment or devices to be connected. Terminals and connectors are U.L. approved specifically for the application.
- F. Join, tap and terminate stranded conductors #6 AWG and larger by means of solder sleeves, taps and lugs with applied solder or by means of pressure indent type connectors, or mechanical connectors utilizing ball tipped set screws. Apply pressure indent type connectors, utilizing tools manufactured specifically for the purpose and having features preventing their release until the full pressure has been exerted on the lug or connector. Factory installed equipment or device terminals are of types UL approved specifically for the application.
- G. Except where wire nuts are used, build up insulation over conductor joints to a value equal both in thickness and dielectric strength to that of the factory applied conductor insulation. Insulation of conductor taps and joints are by means of half-lapped layers of rubber tape, with an outer layer of friction tape; by means of half-lapped layers of approved plastic electric insulating tape; or by means of split insulating casings manufactured specifically to insulate the particular connector and conductor, and fastened with stainless steel or non-metallic snaps or clips.
- H. Exclude splicing procedures for neutral conductors in lighting and appliance branch circuitry which utilize device terminals as the splicing points.
- I. Exclude joints or terminations utilizing solder in any conductors used for grounding or bonding purposes.
- J. Exclude all but solder or pressure indent type joints in conductors used for signaling or communications purposes.

### 3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both wall surfaces.
- F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 7 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 7 Section "Through-Penetration Firestop Systems."
- K. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.

### 3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.6 FIREPROOFING WIRES AND CABLES:

- A. Beyond the termination of raceways, apply fireproofing over the unprotected insulation and/or splices of the following:-
  - 1. All service feeder cables ahead of main service overcurrent protection devices within all the pits, cable chambers or pull boxes they pass through and elsewhere where they are not enclosed in raceways.
  - 2. Fire pump feeder cables wherever they extend beyond the termination of raceways.
  - 3. All feeder wires and cables emanating from different secondary service connections or both normal and emergency supplies which, due to indications on the drawings or unavoidable field conditions are forced to enter the same unbarriered compartment of a cable chamber, cable pit, pull box or junction box.
- B. Fireproofing of wires and cables is by means of a half-lapped layer of Scotch 77 fire and arc-proofing tape. The wrapped tape is secured by a band consisting of two layers of glass cloth electrical tape. Fireproofing is extended up into raceways. Fireproofing is applied in an overall manner to raceway groupings of conductors.

### 3.7 INSTALLATION OF CIRCUITRY FOR MISCELLANEOUS LOW VOLTAGE SYSTEMS:

- A. Comply with requirements described in applicable subsections of this Section. In particular, note the following circuitry requirements for low voltage systems:
  - 1. Wiring for miscellaneous low voltage systems may be run without conduit - subject to the approval of the local authorities - except where prohibited by other sections of these specifications or by indications on the drawings.
  - 2. Where conduit is required, it is steel electric metallic tubing (EMT), except that it is galvanized intermediate steel conduit where located within 8 feet (2.4 m) of the floor in mechanical spaces (or is otherwise exposed to mechanical damage), or is intended for embedment in concrete.
  - 3. Wires and cables have characteristics - in compliance with Articles 725 and/or 800 (as applicable) of the National Electrical Code - as described elsewhere in the specifications or drawings for this project, and are U.L. listed in accordance therewith.
  - 4. Where wires and cables are permitted to be run without conduit, they are independently supported from the building structure or ceiling suspension systems at intervals not exceeding four feet on center, utilizing cable supports specifically approved for the purpose. Wires and cables do not rest on or depend on support from suspended ceiling media (tiles, lath, plaster, as well as splines, runners or bars in the plane of the ceiling), nor are they supported from pipes, ducts or conduits. Where cables are bundled together, separate bundles are provided separately for each type of cabling and separately for each independent system. Bundling and/or supporting ties are of a type suitable for use in a ceiling air handling plenum regardless of whether or not installed in a plenum.

5. Cables are tagged or labeled at each termination point and in each intermediate junction box, pull box or cabinet through which they pass.
6. Comply with applicable requirements for locating and routing circuitry, for installing circuitry, and for fire-stopping as described in other sub-section of this Section.

### 3.8 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
  1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
  2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
- B. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 2 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
  1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
  2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  3. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
  1. Test procedures used.
  2. Test results that comply with requirements.
  3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 16120

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**SECTION 16422 - SELECTION OF OVERCURRENT  
DEVICES**

**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 all overcurrent protective devices (OCPD's) (OCD's) required for the project. It defines the type of OCPD required for each individually mounted device, panelboard, switchboard, switchgear and miscellaneous device required.
- B. Related Sections: The following Sections requirements relate to this Section:
  - 1. Division 16, Section "Enclosed Switches and Circuit Breakers."
  - 2. Division 16, Section "Panelboards."
  - 3. Division 16, Section "Switchboards."
  - 4. Division 16, Section "Switchgear."

**1.3 SUBMITTALS**

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specifications Section.
- B. Descriptive data defining how the required short circuit ratings will be met by the equipment furnished under the Related Sections described above. System shall be fully rated.
- C. In advance of, or in conjunction with, the submission of shop drawings for approval, provide data defining in detail how the required coordination and short circuit current ratings specified elsewhere in these specifications are achieved with the equipment being furnished under the listed Related Sections. The data shall, in narrative or graphic fashion, fully define how the various devices, individually, or in combination, comply with the "fully rated" short circuit current requirements. Include certifications from the manufacturer as to the UL approvals for these ratings for all proposed equipment. Short circuit and coordination study shall include recommended device settings. In particular, demonstrate selective coordination of overcurrent devices used for Emergency Systems and Legally Required Standby Systems.
- D. Arc flash study indicating arc flash hazard at each piece of distribution equipment.

## 1.4 QUALITY ASSURANCE

- A. Comply with NFPA 70 as amended by state and local codes.
- B. Listing and Labeling: Products - as described with the Related Sections above - shall be Underwriters Laboratories listed and labeled as defined in NFPA 70 Article 100.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Refer to Related Sections listed hereinbefore for general product requirements.
- B. Short circuit current ratings, and the manufacturer's labels attesting to these ratings (based on U.L. listings), will be required for overcurrent protection devices, where they are individually mounted and for the equipment assemblies when they are incorporated in panels, switchboards, switchgear, etc. Such ratings shall be in accordance with the following:-
  - 1. In order to insure that they are at least equal to the available fault current, minimum ratings have been specified herein for the individual overcurrent device types, and in the pertinent sections for panelboards, switchboards, switchgear and other assemblies or devices. .
- C. All overcurrent protection and switching devices shall be U.L. listed as suitable for the termination of 75 degree C conductors, sized in accordance with their 75 degree C ampacity ratings. Devices shall be specifically identified accordingly and shall bear the designation "60 / 75 degree C" or "75 degree C", regardless of whether incorporated in panelboards, switchboards or other assemblies or whether individually mounted.

### 2.2 APPLICATION

- A. Overcurrent protective devices (OCD'S) shall be provided as described hereinafter.
- B. OCD's shall be of the current limiting circuit breaker type (CLCB) except as noted hereinafter.
- C. Branch circuit breakers in 277/480 (265/460) volt lighting or appliance panels shall be of the standard molded case type.
- D. Main and branch circuit breakers in 120/208 volt panelboards of all types shall be of the standard molded case type.
- E. Individually mounted overcurrent protection and switching devices shall be as follows:
  - 1. For use on 277/480 (265/460) volt circuits, they shall be of the CLCB molded case breaker type.

2. For use on 120/208 volt circuits, they shall be of the standard molded case circuit breaker type.
- F. Emergency Systems and Legally Required Standby Systems: Overcurrent devices shall be selected such that all overcurrent devices in the distribution system are selectively coordinated.
1. Overcurrent devices for Emergency Systems and Legally Required Standby Systems shall be switch and fuse type. Devices up to and including 800 amperes shall be quick-make, quick-break type switches with cartridge fuses. Devices over 800 amperes shall be bolted pressure type switches with cartridge fuses. This requirement includes all overcurrent devices providing utility service to the transfer switches, providing generator power to the transfer switches, and on the load side of transfer switches - including branch circuit overcurrent protection.
  2. Short circuit rating of panelboards and devices shall be as required to provide a fully rated system.

## 2.3 CURRENT LIMITING CIRCUIT BREAKERS

- A. Where intended for mounting in main switchboards, switchgear or as individually mounted service switches they shall be of the 100 percent rated (i.e., capable of carrying 100 percent of their rating continuously), fixed (stationary) mounted and drawout mounted air frame type, with current limiting fuses accessibly mounted in the line side bus connections to each pole of the breakers. They shall be as follows:
1. Their circuit breaker elements shall consist of quick-make quick-break mechanically trip free air immersed circuit breaker mechanisms arranged to operate all poles simultaneously and equipped with an adjustable solid state type overcurrent tripping device, incorporating:-
    - (a) Short time inverse current characteristic tripping in main breakers.
    - (b) Instantaneous short circuit tripping except in main breakers.
    - (c) Long time inverse current characteristic tripping for all breakers.
    - (d) Ground fault tripping. Refer to Division 16 Section entitled "Main Switchboards "Switchgear" for further information regarding features and functions. Dry contacts which close on ground fault trip shall be provided for monitoring by the BMS.
  2. Their breaker contacts shall be complete with arc quenchers in each pole, interpole barriers and latches with mechanical pushbutton trips and position indicators.
  3. They shall have shunt trip devices complete with control transformers, "line side" shunt trip control supply connections, and internal factory wiring to accessible terminals as required for the present or future extension of the trip control circuit at a 120 volt control voltage level, to remote normally open external actuating devices.



4. They shall have phase failure protection relay systems arranged to trip them open in response to a sustained voltage in any phase which is lower than 75 percent of the other phase voltages.
  5. Sizing of the current limiting fuse for each circuit shall be as selected by the manufacturer as part of the coordination study. Fuses shall be capable of safely interrupting currents of up to 200,000 amperes RMS symmetrical. Fuses shall coordinate with, and back up, the associated circuit breakers so that faults up to the safe capability of the breakers will be interrupted by the breakers, and larger faults will be interrupted by the fuse without damage to the breakers.
- B. Current limiting circuit breakers intended for use in power and/or distribution panels, or for use as individually mounted overcurrent protection devices, shall be of the molded case type. In ratings up to the maximum frame size in which they are available from the manufacturer, they shall be of the fuseless type. In larger frame sizes, they shall be of a type which incorporates an integral current limiting fuse in each pole. Current limiting molded case circuit breakers shall be as follows:
1. Their breaker elements shall consist of manually operated, quick-make, quick-break, mechanically trip free operating mechanisms for simultaneous operation of all poles, with contacts, arc interrupters and trip elements for each pole.
  2. Their breaker tripping units shall be of the adjustable solid state type incorporating long time delay and instantaneous tripping, or of the "thermal-magnetic" type having bi-metallic elements for time delay overload protection, and magnetic elements for short circuit protection.
  3. They shall be of either the fuseless type or of the type which incorporates current limiting fuses.
  4. Where of the fuseless type, they shall incorporate high speed blow-apart current limiting contacts, and shall have a short circuit interrupting capacity of at least 150,000 RMS symmetrical amperes at the specified system voltage.
  5. Where they are of the type which incorporates fuses (i.e., in frame sizes larger than 400 amps), they shall be as follows:-
    - (a) Their fuses shall be equipped with release buttons arranged to trip open the latches of their circuit breaker elements.
    - (b) Each shall have its fuses and breaker elements integrally mounted in a single overall molded phenolic plastic case.

- (c) The fuses shall be capable of safely interrupting fault currents in the order of 200,000 amperes RMS symmetrical. The current limiting fuses shall coordinate with and back up the circuit breakers they are associated with so that all fault overload currents occurring within the safe capability of the breakers shall cause the breakers to open, and all currents occurring beyond the safe capability of the breakers shall cause the fuses to open; the opening of fuses being such as to prevent damage to any circuit breaker components parts.
- C. In lieu of the air frame CLCB's specified hereinbefore for mounting in main switchboards or as individually mounted service switches, stationery molded case circuit breaker sizes may be utilized in frame sizes up to 800 amps. They shall be as follows:
  - 1. They shall be 100 percent rated.
  - 2. They shall be provided with solid state tripping devices, incorporating all of the features and characteristics specified hereinbefore for current limiting air frame circuit breakers.
  - 3. They shall in all other respects comply with the requirements specified for current limiting circuit breakers in power and/or distribution panels.

## 2.4 STANDARD MOLDED CASE CIRCUIT BREAKERS

- A. Standard molded case circuit breakers shall comply with the following:-
  - 1. They shall consist of manually operated quick-make, quick-break mechanically trip free operating mechanisms for simultaneous operation of all poles, with contacts, arc interrupters and trip elements for each pole, all enclosed in molded phenolic plastic cases.
  - 2. Their tripping units shall be of the "thermal magnetic" type having bi-metallic elements for time delay overload protection, and magnetic elements for short circuit protection.
  - 3. Where no frame sizes are indicated their interrupting capacity (in RMS symmetrical amperes) shall not be less than 14,000 amperes for use in 277/480 (265/460) volt lighting and appliance panels, nor less than 10,000 amperes for use in 120/208 volt lighting or appliance panels.
  - 4. Where frame sizes are indicated their interrupting capacity (in RMS symmetrical amperes) shall not be less than 22,000 amperes for 100 amperes and 225 amperes frame circuit breakers, nor less than 42,000 amperes for larger frame sizes.
  - 5. The minimum interrupting capacity in symmetrical RMS amperes of the circuit breakers intended for use in panelboards shall be as noted above.
  - 6. They shall be of the "bolted-in" type.
  - 7. Single pole breakers sized 20 amps or less shall be rated for switching duty.

8. Where utilized for circuits supplying HID lighting, they shall be HID rated.
9. They shall be multi-pole circuit breakers, or single-pole circuit breakers with handle ties where serving multi-wire branch circuits in relocatable partitions or systems furniture.
10. They shall be equipped with 5 milliamp sensitivity ground fault interrupting features where so indicated, and/or where they supply 120 volt, 15- and 20-ampere receptacles in bathrooms, kitchens, within 6 feet of sinks, where intended for use by vending machines, and other such code mandated locations and with 30 milliamps sensitivity G.F.I. features where they supply piping tracing cables or snow melting cables or gutter de-icing cables or HWAT cables.

## 2.5 BOLTED PRESSURE SWITCHES

### A. Select bolted pressure type distribution switches in accordance with the following:-

1. They shall have copper current-carrying elements having silver plated contact surfaces.
2. They shall have blade locks to prevent them from opening under short circuit stresses and a mechanism which produces initial contact pressure on the jaws in addition to final bolted pressure when they are closed.
3. They shall be capable of interrupting at least 12 time their rating without damage in accordance with NEMA and UL performance standards.
4. They shall have auxiliary renewable arcing contacts which "make" before and "break" after main current-carrying elements function.
5. They shall be equipped with operating mechanisms which incorporate manual closing and tripping.
6. Where used as service disconnects, they incorporate electrical tripping. Electrical tripping shall incorporate a stored energy mechanism that permits closure only after the opening mechanism has been charged. They shall be complete with control transformers, "line side" trip control supply connections, and internal factory wiring to accessible terminals as required for the present or future extension of the trip control circuit at a 120 volt control voltage level, to remote normally open external actuating devices. The trip circuit shall operate down to 55 percent of nominal voltage.
7. They shall be designed for use with Class "L" fuses.
8. They shall be 100 percent rated when mounted in an enclosure, in accordance with UL test procedures for individual mounting or for incorporation into panelboards or switchboards.
9. They shall be equipped with an Open-Fuse Trip Device arranged to trip switch open if a phase fuse opens.

## 2.6 QUICK-MAKE, QUICK-BREAK SWITCHES

- A. Select quick-make, quick-break type distribution switches in accordance with the following:-
1. They shall equal or exceed the performance required for NEMA type H.D. horsepower rated switches.
  2. They shall have arc quenchers and circuit breaker type pressure contacts.
  3. Where intended for panelboard or switchboard mounting, they shall be of the "bolted-in" type.
  4. They shall be designed for use only with Class "J" fuses up to 600 amps, and "Class L" fuses above 600 amps. Where protecting a branch circuit for emergency systems and legally required standby systems, fuses shall be current limiting type. They shall incorporate factory installed clips designed to insure the use of proper fuses. Coordinate to insure that fuses supplied for the project match these fuse gaps.
  5. Switches 400 amperes or larger shall be equipped with an Open-Fuse Trip Device arranged to trip switch open if a phase fuse opens.

## 2.7 FUSES

- A. Select fuses for use in switch and fuse type overcurrent devices in accordance with the following:
1. Regardless of the actual available fault current they shall, at full recovery voltage, be capable of safely interrupting fault currents of 200,000 amperes RMS symmetrical deliverable at the line side of the fuse.
  2. They shall be suitable for application to fuse gaps which reject other types of fusing. Coordinate with supplier(s) of all fusible switch units (in panels, switchboards, etc.) for the project to insure that fuse gaps match the specified fuse types.
  3. Except as noted hereinafter, in sizes up to 600 amps, they shall be of the Class "J" time delay type, capable of carrying 500 percent of rated current for not less than 10 seconds and UL listed as a "Class J" fuse. Fuses shall be Shawmutt Type "AJT", Bussmann Type "LPJ", or other approved. Approval is contingent on certified test data demonstrating full compliance with the following requirements:-
    - (a) Fuse shall carry 500 percent of rating for at least 10 seconds.

- (b) Fuse shall be suitable for motor feeders when applied at 150 percent of motor full load current.
- (c) Fuse selectivity with downstream fuses shall be:-
  - (1) 2:1 with "J" time delay
  - (2) 3:1 with "RK-5" time delay
  - (3) 2:1 with "RK-1" time delay
- 4. Where intended for use in motor starters (individual, or in motor control centers) they shall be of the dual element time delay type, UL listed as "Class RK-5", and capable of carrying 500 percent of rating for at least 10 seconds. Utilize "Class RK-1" time delay fuses where required to insure coordination with upstream fuses.
- 5. Where protecting a branch circuit fuses shall be current limiting type.
- 6. Except as noted hereinafter, in sizes over 600 amps, they shall be of the current limiting type, UL listed as "Class L".
- 7. Where protecting a feeder or tap supplying a single large motor or transformer, fuses in the range of 800 to 2000 amps shall have special "Class L" time delay characteristics equal to Shawmutt Type "A4BT" or Bussmann Type "KRP-C" fuses.

## 2.8 GROUND FAULT TRIPPING

- A. Provide ground fault tripping for each individually mounted service switch over 800 amps and for each main switchboard device and each switchgear device.

## 2.9 ELEVATOR POWER/DISTRIBUTION PANELS

- A. Branch units in power/distribution panels supplying elevators shall be of the quick-make, quick-break distribution switch type with time delay fuses.
  - 1. Where serving as the in-sight disconnect for a hydraulic elevator, they shall incorporate an auxiliary dry contact.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Comply with the requirements of Division 16 Sections "Enclosed Switches and Circuit Breakers," "Fuses," "Panelboards," "Switchboards" and "Switchgear".

- B. Submit recommended settings for all adjustable or interchangeable overcurrent and ground fault tripping devices. Include a complete short circuit and coordination study to demonstrate that the recommended device settings will provide a completely coordinated system based on the available fault currents. Full coordination of all devices used for Emergency Systems and Legally Required Standby Systems is required. Include all work required in the field to verify that factory settings are as recommended, and to field set device whose settings are not as recommended.

END OF SECTION 16422

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**SECTION 16424 - FEEDERS AND BRANCH  
CIRCUITRY**

**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 basic requirements for the installation of light and power feeders and circuitry run at less than 600 volts.
- B. Related Sections: The following sections contain requirements that relate to this Section:
  - 1. Division 16, Section "Raceways and Boxes."
  - 2. Division 16, Section "Conductors and Cables."
  - 3. Division 16, Section "Panelboards."

**1.3 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Circuited up "as-built" drawings and panel directories as called for in the Division 16 related sections.

**1.4 QUALITY ASSURANCE**

- A. Comply with NFPA 70, as amended by state and local codes.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Products shall be as specified in the Division 16 related sections.

**PART 3 - EXECUTION**

**3.1 INSTALLATION OF FEEDERS**

- A. Feeder connections shall be in the phase rotation which establishes proper operation for all equipment supplied.

- B. Feeders consisting of multiple cables and raceways shall be arranged such that each raceway of the feeder contains one cable for each phase leg (and one neutral cable if any).
- C. Each individual tap off a feeder which consists of multiple cables per phase (and neutral if any) shall be arranged so that all of the cables of a phase leg (and neutral if any) of the feeder are connected to the corresponding phase leg (and neutral if any) of the individual tap.
- D. Indications of conductor sizing for three phase and three phase/four wire feeders shall, unless otherwise noted on the drawings, be understood as follows:
  - 1. (3) equally sized conductors represents a three phase feeder.
  - 2. (4) equally sized conductors represents a three phase/4 wire feeder with 100% neutral.
  - 3. (3) equally sized conductors plus (1) smaller conductor represents a three phase/three wire feeder plus ground wire.
  - 4. (4) equally sized conductors plus (1) smaller conductor represents a three phase/four wire feeder plus ground wire).
  - 5. (3) equally sized conductors plus (1) larger conductor or (2) equally sized conductors represents a three phase/4 wire feeder with neutral oversized to accommodate "harmonic-rich loads."
  - 6. (3) equally sized conductors plus (1) larger conductor or (2) equally sized conductors and one smaller conductor represents a three phase/four wire feeder with neutral oversized to accommodate "harmonic-rich" loads plus a ground wire.

### 3.2 INSTALLATION OF LIGHTING AND APPLIANCE BRANCH CIRCUITRY

- A. Circuitry indicated without sizing shall be understood to be lighting and appliance branch circuitry protected at 20 amps or less.
- B. Conform all lighting and appliance branch circuitry (regardless of whether protected above or below 20 amps) to the following:-
  - 1. Except as noted below, circuitry shall be multi-wire utilizing common neutrals arranged so that no neutral conductor acts as a common wire for more than one circuit conductor connected to the same phase leg of the supply system.
    - (a) Common neutrals shall not be utilized for circuitry runs emanating from panel branches having ground fault interrupting features regardless of any indication to the contrary on the floor plans.
    - (b) Common neutrals shall not be utilized for circuitry runs containing more than (6) 120 volt receptacle circuits within a single raceway (conduit, underfloor duct).



2. Conductors used as common neutrals for multiple (2 or 3) 120 volt branch circuits protected at 20 amps or less shall be #10 AWG where such circuits supply receptacles which are dedicated to - or may be utilized for - "harmonic-rich" loads such as personal computers, computer terminals, word processors, printers and the like. Accordingly, common neutrals supplying receptacles shall be understood to be #10 AWG under the following conditions:
    - (a) Wherever so indicated (by note or otherwise) on the drawings.
    - (b) Throughout all office areas, computer rooms or other data processing spaces and laboratories.
  3. Branch circuitry supplying relay controlled lighting fixtures shall be understood to include all necessary interconnections between the control panels containing the relays and the associated lighting or appliance panels.
  4. Under no condition shall any local switch break a neutral conductor.
  5. At any location where lighting and appliance branch circuitry is extended from a flush mounted panelboard to a suspended ceiling immediately above, at least four 1-inch empty conduits shall be included (in addition to those required for active circuitry) to permit future wiring escape from the panelboard. The empty conduits shall extend up from the panel and shall terminate in a threaded conduit cap immediately after turning out into the hung ceiling space.
  6. Raceway sizes shall conform to standard maximum permissible occupancy requirements except where these are exceeded by other requirements specified elsewhere.
  7. Two and three pole branches in panels shall be used respectively for individual single phase load items connected line to line and individual three phase load items. Where circuitry indications require the use of 2-pole and/or 3-pole branch breakers which have not been scheduled, provide in the panelboards the required multi-pole breakers in lieu of the equivalent number of single pole branch breakers. Required quantities of single, two and three pole branch breakers shall be confirmed prior to ordering panels.
- C. Conform lighting and appliance branch circuitry, indicated as being protected at 20 amps or less, to the following:-
1. 120 volt circuitry shall be supplied from 20 amp panel branches except as indicated otherwise.
  2. 277 (265) volt circuitry shall be supplied from 20 amp panel branches except as indicated otherwise.
  3. Except as specified below, minimum conductor size shall be #12 AWG.

4. Common neutrals shall not be utilized for circuitry runs containing more than (6) 120 volt receptacle circuits within a single raceway (conduit, cellular deck, underfloor duct]) except as noted below.
5. For circuitry run in underfloor raceway systems (cellular deck, underfloor duct), comply with the following:
  - (a) Utilize #10 AWG phase leg conductors and #8 AWG neutral conductors for runs contained in branch cells or ducts (i.e., cells or ducts intended for the direct supplying of receptacles or other outlets from after-set inserts or pre-set inserts mounted on them).
  - (b) Utilize #8 AWG conductors for home run circuitry contained in main runs (i.e., trench headers, junction headers or header ducts).
  - (c) Common neutrals shall be utilized for all circuitry contained in main runs and branch runs. Neutral conductors shall be tapped and reduced in insert outlet boxes to #10 or #12 AWG for direct connection to receptacles.
6. Conductors for 120 volt circuitry extending in excess of 75 feet, from the point of supply, to the first outlet shall be #10 AWG (minimum) copper to the first outlet. Increase beyond #10 AWG if required for compliance with code-mandated voltage drop restrictions.
7. Conductors for 277 (265) volt circuitry extending in excess of 150 feet, from the point of supply, to the first outlet shall be #10 AWG (minimum) copper to the first outlet. Increase beyond #10 AWG if required for compliance with code-mandated voltage drop restrictions.
8. Conductors used in runs consisting of more than six wires (exclusive of grounding conductors) in a single raceway shall be #10 AWG copper minimum. Increase beyond #10 AWG as required to comply with code-mandated derating factors, and as specified hereinbefore.
9. Circuits supplying receptacles which are not of the ground fault circuit interrupting type, and are located as noted below, shall be connected to panel branches that are equipped with ground fault interrupting features:
  - (a) Receptacles located in bathrooms. Bathrooms shall be defined as spaces containing a basin plus a toilet, tub or shower.
  - (b) Receptacles located within 6 feet of any sink and intended to serve counter top surfaces.
  - (c) Receptacles in commercial and institutional kitchens.
  - (d) All receptacles mounted on building exterior surfaces.
  - (e) All receptacles mounted in garages.
  - (f) All receptacles mounted in elevator machine rooms, machinery spaces and pits.

10. Circuits supplying pipe tracing cable, snow melting cable, gutter melting cable and HWAT cable shall be connected to panel branches equipped with 30 ma interrupting features for equipment protection.

D. Where circuitry has not been delineated for lighting fixtures, receptacles, switches and miscellaneous items intended for protection at 20 amps, such items shall be provided with circuitry conforming to the requirements listed below. Prior to installation of circuitry, submit for review floor plans showing circuit numbers, home runs, and interconnecting circuitry for all such items.

1. When circuiting up recessed ceiling lighting fixtures, connect fixtures on the basis of more than one fixture to a single outlet box, in an approved manner, as required to insure that circuits will not be unnecessarily lightly loaded due to mandated, restrictions on the maximum number of outlets per circuit. Except with special permission, unnecessarily light loading shall be understood to mean, less than 1000 volt amps (VA) on a 120 volt circuit and less than 3200 VA on a 277 volt circuit.
2. The total load on a circuit shall be computed by ascribing volt-amps to individual items on the basis of the following:-

<u>ITEM</u>	<u>VOLT-AMPS (VA)</u>
Any lighting fixture.	Input volt-amps as per lighting fixture schedule.
Any outlet with no specific wattage or circuiting instruction indicated.	180 volt amperes
Any outlet (other than for resistance heating) with wattage indicated.	1.15 x Indicated wattage
Any resistance heating outlet with wattage indicated.	1.0 x Indicated wattage
Any fractional HP motor with HP indicated.	2500 x Indicated HP
Any outlet with amps indicated.	120 x Indicated amps

3. Not more than 1300 total VA shall be applied to any 15 amp, 120 volt panel branch circuit nor more than 1450 VA to any 20 amp, 120 volt branch circuit. Not more than 4000 VA shall be applied to any 277 (265) panel branch circuit.
4. A separate 20 amp panel branch circuit supplying no other outlets shall be used for each outlet indicated as an "individual appliance circuit" or "heavy duty" outlet.

5. Lighting fixture shall be connected to 20 amp panel branch circuits. Solidly connected equipment less than 1300 VA shall be connected to 15 amp panel branch circuits except as indicated or noted herein.
6. Lighting fixtures and receptacles shall not be connected to the same branch circuit.
7. Any installed lighting and appliance branch circuitry, found (as a result of unnecessarily light loading of conductors) to make excessive use of panel branches, shall be rearranged.
8. Circuits shall be balanced on phases at their supply point as evenly as possible.
9. The final arrangement of lighting and appliance branch circuitry shall be fully delineated on the record, or "as-built" drawings called for elsewhere.

END OF SECTION 16424

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**SECTION 16442 - PANELBOARDS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of 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. Lighting and appliance branch circuit panelboards.
  - 2. Power and distribution panelboards.
- B. Related Sections include the following:
  - 1. Division 16 "Selection of Overcurrent Devices" for overcurrent protection program.
  - 2. Division 16 Section "Fuses".
  - 3. Division 16 Section "Transient Voltage Suppression" for surge protection.
  - 4. Division 16 Section "Lighting Control Panelboards Powerlink G3".

**1.3 DEFINITIONS**

- A. Overcurrent Protective Device (OCD) (OCPD): A device operative on excessive current that causes and maintains the interruption of power in the circuit it protects.

**1.4 SUBMITTALS**

- A. Product Data: For each type of panelboard, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - (a) Enclosure types and details for types other than NEMA 250, Type 1.
    - (b) Bus configuration, current, and voltage ratings.

- (c) Short-circuit current rating of panelboards and overcurrent protective devices.
  - (d) UL listing for series rating of installed devices where applicable.
  - (e) Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- C. Field Test Reports: Submit written test reports and include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- E. Operation and Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Operation and Maintenance Data," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, OCD's, components and accessories through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by Underwriters Laboratories Inc.
- C. Comply with NEMA PB 1.
- D. Comply with UL 50, 87, 486A, 869 and NEMA 250, AB1 and KS1.
- E. Comply with NFPA 70 as amended by state and local codes.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
  - 1. Ambient Temperature: Not exceeding 104 degrees F (40 degrees C).
  - 2. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Condition: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperature within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

## 1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

## 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:

1. Panelboards and Accessories:
  - (a) Eaton Corp.; Cutler-Hammer Products.
  - (b) General Electric Co.; Electrical Distribution & Control Div.
  - (c) Siemens Energy & Automation, Inc.
  - (d) Square D Co.

### 2.2 MANUFACTURED UNITS

- A. Factory tests: Dielectric test, phase to phase and phase to ground, at twice the rated voltage plus 1,000 volts (1,500 volts minimum) for one minute. Date of test and the name and title of the individual certifying the test shall be indicated on a label affixed to the equipment.
- B. Enclosures: Flush- and surface mounted cabinets. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
1. Outdoor Locations: NEMA 250, Type 3R.
  2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
  3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
- C. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- D. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

- E. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.
- F. Bus: Hard-drawn copper, 98 percent conductivity
- G. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
- H. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- I. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.
- J. Main and Neutral Lugs: Type suitable for use with conductor material.
- K. Feed-through Lugs: Type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
- L. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- M. Where wires or cables are used within panelboards to make up internal connections (factory installed or otherwise) such wire or cable shall have copper conductors only.
- N. Where indicated or as required to assure ready accessibility of top switching and overcurrent device, they shall be arranged as multiple adjacent sections. A single overall cabinet shall be supplied for the multiple adjacent sections which constitute one panel. 1/4 inch (7 mm) minimum thickness plastic barriers having adequate angle iron framing support all around shall be included between sections. The entire assembly shall be such as to include wiring gutter space for each section as if it were an individual panelboard. Common bussing shall be arranged for adjacent sections unless there is indication that the individual sections are to be separately supplied. Sub-feed lugs with full capacity cable taps to adjacent panel sections will be accepted as the bussing method.

## 2.3 POWER OR DISTRIBUTION PANELBOARDS

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.
- B. Main Overcurrent Protective Devices and Branch Overcurrent Protective Devices: as specified in Division 16, Section "Selection of Overcurrent Devices."
- C. Cabinet: width and a depth adequate for a three pole branch device equal in rating to the panel mains. In no case shall the cabinet be wider than 42 inches (106 cm) or deeper than 18 inches (46 cm).

## 2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.



- B. Doors: Concealed hinges, secured with flush latch with tumbler lock.
- C. Gutter space: adequate space for connecting to all active and spare branches.
- D. Cabinet width: not to exceed 24 inches (61 cm).
- E. Cabinet depth: not to exceed 6 inches (15 cm).

## 2.5 PANELBOARD BUSES

- A. The neutral buses of 120/208 volt panels supplying "harmonic-rich" line-to-neutral loads shall have ampacities larger than those of the phase legs in such panels in accordance with the following criteria:
  - 1. In no case shall the neutral bus ampacity of any panel supplied by a feeder with a neutral conductor which is larger than the phase conductors be less than the lesser of:
    - (a) The ampacity of the neutral conductor of the feeder supplying the panel.
    - (b) Twice the ampacity of the upstream overcurrent device protecting the feeder supplying the panel.
  - 2. The above requirements for the sizing of panel neutral buses shall override any indications on the drawings that smaller neutral buses are acceptable.
  - 3. Neutral buses shall be equipped with lugs capable of accepting single conductors (i.e., not paralleled) of an ampacity equal to the neutral bus rating (except where the neutral bus rating exceeds 400 amps).
  - 4. If required by manufacturer in order to comply with increased neutral bus sizing criteria specified above, increase phase leg bussing, as well.
  - 5. Refer to the light and power riser diagram or to other electrical drawings to determine which panels - if any - are supplied by feeders having "over-sized neutrals" and therefore require up-sizing of the panel neutral bus.
- B. A ground bus shall be provided for each panel. The ground bus shall be insulated from the panelboard cabinet.

## 2.6 OVERCURRENT PROTECTIVE DEVICES

- A. As described in Division 16 Section "Selection of Overcurrent Devices".

## 2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items as required for overcurrent protective device test, inspection, maintenance, and operation.

- B. Switch and fuse units incorporated as part of panelboards shall be equipped with factory installed rejection clips to restrict fuses to types specified in Division 16, Section "Selection of Overcurrent Devices." Modify or replace in field any incorrect fuse clips.
- C. Provide "lock-on" clips for the toggle handles of 5 percent of the branches in all lighting and appliance panels. Apply these clips to circuits supplying clocks, fan coil units and others as directed in the field.
- D. Furnish handle padlock attachments for 5 percent of the branches in lighting and appliance panels, and padlocks (with key) for 10 percent of these padlock attachments, but not less than 10 locks. Apply the padlock attachments to circuits (as directed in the field) for which the branch circuit device must be lockable in the "off" position in order to provide code-approved disconnect means.

## 2.8 PANELBOARD SHORT CIRCUIT RATINGS

- A. Panelboards and Panelettes (load centers) shall bear U.L. labels attesting to the adequacy of the equipment to withstand and interrupt short-circuit currents not less than those available at their incoming terminals. Panels shall either be fully rated or shall be series rated in conjunction with integral or remote upstream devices in compliance with Division 16 Section "Selection of Overcurrent Devices". U.L. labels shall include size and type of allowable upstream and branch circuit devices and series connected ratings.
- B. Panelboard short circuit ratings shall comply with the coordination study per specification section 16055.
- C. EMERGENCY SYSTEMS AND LEGALLY REQUIRED STANDBY SYSTEMS: Overcurrent devices shall be selected such that distribution system is selectively coordinated. Series rated devices shall not be used for distribution, regardless of any indication to the contrary. Short circuit rating of panelboards and devices shall be as required for a fully rated system. For lighting and appliance panelboards which are not available with integral main overcurrent devices, provide individually enclosed main device located adjacent to panel complete with interconnecting circuitry.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mount top of trim 74 inches (188 cm) above finished floor, unless otherwise indicated.
- C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- D. Install overcurrent protective devices and controllers.

1. Set field-adjustable switches and circuit-breaker trip ranges.
- E. Install filler plates in unused spaces.
- F. Stub four 1-inch (DN 25) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (DN 25) empty conduits into raised floor space or below slab not on grade.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

### 3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."
- B. Create a directory to indicate installed circuit loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

### 3.3 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding."
- B. Connect wiring according to Division 16 Section "Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  2. Test continuity of each circuit.
- B. Perform the following field tests and inspections and prepare test reports:
  1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
  2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
  1. Measure as directed during period of normal system loading.

2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
  4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
- D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scanning of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.
1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  2. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 CLEANING

- A. In completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 16442

**NEW PASSENGER TERMINAL  
DULUTH INTERNATIONAL AIRPORT  
DULUTH, MINNESOTA**

**SECTION 16500 - LIGHTING**

**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.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 16 Section "Basic Electrical Materials and Methods".
  - 2. Division 16 Section "Supporting Devices".
  - 3. Division 16 Section "Lighting Control Devices".
  - 4. Division 16 Section "Wiring Devices".

**1.2 SUMMARY**

- A. This Section includes interior and exterior light fixtures, emergency lighting units, exit signs, lamps, ballasts and accessories.

**1.3 SUBMITTALS**

- A. For each type of light fixture, emergency lighting unit, or exit sign specified submit data on standard features and accessories, and the following:
  - 1. Outline drawings indicating fixture dimensions.
  - 2. Catalogue cuts for proposed lamps.
  - 3. Performance data for proposed fluorescent and high intensity discharge ballasts.
  - 4. Battery and charger data for emergency lighting units.
  - 5. For air handling fixtures, submit air, thermal, and sound performance data. Provide certified results of independent laboratory tests indicating:
    - (a) Airflow as a function of pressure differential between plenum and occupied space.
    - (b) Noise criteria (NC) rating as a function of airflow.

- (c) Heat transfer rate as a function of airflow (required for heat removal fixtures only).
- B. For nonstandard fixtures, submit detailed shop drawings indicating dimensions, materials, weights, method of field installation and assembly, method of relamping and ballast access, and principal features.
- C. Submit project-specific, factory-produced shop drawings for all fluorescent pendants and continuous fluorescent wall-slots. Drawings show housing lengths, joiners, supports, endcaps, corners, and unlighted end sections, as applicable, for all unique row lengths.
- D. Submit dimming ballast compatibility certificates signed by the lighting control system manufacturer certifying that proposed dimming ballasts are compatible with proposed dimming systems.
- E. Submit samples of fixtures as directed by Architect, Engineer, or Lighting Designer. Unless otherwise noted, all samples are provided with specified lamp(s) and ballast(s), and are equipped with a cord and plug for operation at 120V.
- F. If shop drawings are submitted for a specific fixture type by a non-specified manufacturer, and approvals cannot be obtained by the third submission, then the proposed equipment will not be accepted and the specified equipment is furnished.

#### 1.4 QUALITY ASSURANCE

- A. Comply with NFPA 70 as amended by state and local codes.
- B. Electrical Components of fixtures are listed and labeled by UL where applicable.
- C. Provide fixtures and accessory components specified in this Section that are listed and labeled for their indicated use and installation conditions on Project.
  - 1. Fixtures specified for installation in damp or wet locations are listed and labeled for use in such locations.
  - 2. Fixtures specified for installation in insulated ceilings are IC-rated if insulation comes within 3 inches (76 mm) of sides of fixture housings, or within 6 inches (152 mm) of top of fixture housings.
  - 3. Fixtures specified for installation in hazardous locations conform to UL 844.
  - 4. Comply with UL 1570-1574.
- D. The Terms "Listed" and "Labeled" are used here as per the definitions in the National Electrical Code, Article 100.

## 1.5 COORDINATION

- A. For ceiling-mounted fixtures, coordinate fixtures, mounting hardware, and trim with ceiling system and other items, including work of other trades, which must be mounted on ceiling or in ceiling space.
- B. Lighting fixtures, ballasts, lamps and other components meet or exceed the requirements of all applicable federal, state, and/or municipal energy codes.
- C. Coordinate lamps and dimming ballasts with lighting control systems. Before ordering any equipment, verify with manufacturers that proposed dimming ballasts are compatible with proposed lighting controls, and that proposed lamps are compatible with proposed dimming ballasts.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, fixtures that may be incorporated into the Work include, but are not limited to, the products specified in the Light Fixture Schedule. Where three or more manufacturers are indicated for each fixture type, no other manufacturers will be considered. Where one manufacturer is indicated for each fixture type, other manufacturers will be considered only if the engineer, architect, or lighting consultant can determine that the proposed equipment is equal to the specified equipment.

### 2.2 LIGHT FIXTURES AND FIXTURE COMPONENTS, GENERAL

- A. Light fixtures and components are suitable for operation at the voltage of the building circuits to which they are connected.
- B. Light fixtures are furnished complete with all appurtenances necessary for their proper operation, installation, and support.
- C. Light fixtures conform to the following standards as applicable:
  - 1. Fluorescent Fixtures conform to UL 1570.
  - 2. Incandescent Fixtures conform to UL 1571.
  - 3. High Intensity Discharge (HID) Fixtures conform to UL 1572.
  - 4. Track-Lighting Systems conform to UL 1574.
  - 5. Exit Signs and emergency lighting fixtures shall conform to UL 924.
  - 6. Christmas-Tree and Decorative-Lighting Outfits conform to UL 588.
- D. General Construction:
  - 1. Light fixtures are constructed with joints made only by means of welded, brazed, screwed, or bolted construction methods. Soldered joints will not be permitted. No self-tapping screws, bled metal tapping methods, or rivets are employed for fastening any parts to or in any wireway or wiring chamber,

for fastening any parts which must be removed to gain access to electrical components requiring service or replacing, or for fastening any electrical component or support for same.

2. All ferrous parts and supports, other than parts manufactured of stainless steel, are completely rustproofed after fabrication, and before finish coatings are applied. Rustproofing is by means of galvanizing, bonderizing, zinc plating, or by treatment with other industry standard rust-preventing processes providing rustproofing qualities equal to the processes mentioned above.
  3. All screws, bolts, nuts and other fastening and latching hardware are cadmium or equivalent plated.
  4. All metallic cast or extruded parts are close grained, sound, and free from imperfections or discolorations. Cast or extruded parts are rigid, true to pattern, and of ample weight and thickness. Cast or extruded parts are properly fitted, filed, ground buffed, and chased to provide finished surfaces and joints free of imperfection with all details or ornamentation brought out. Finished thickness of all cast parts is not less than 1/8 inch (3 mm).
  5. Housings are constructed so that all electrical components are easily accessible and replaceable without removing housings from their mountings.
- E. Sheet metal components are fabricated of steel, except as indicated. Form and support sheet metal to prevent warping and sagging.
- F. Doors, frames, and other means of internal access operate smoothly, free from light leakage under operating conditions, and are arranged to permit relamping without use of tools, unless indicated otherwise on drawings. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.
- G. Specular, semi-specular, and laminated silver metallized film reflectors have a non-iridescent coating when used with triphosphor fluorescent lamps. Reflectors have total hemispheric reflectances equal to or greater than the following values, unless otherwise noted:
1. White surfaces: 90 percent.
  2. Specular surfaces: 87 percent.
  3. Semi-specular surfaces: 84 percent.
  4. Laminated silver metallized films: 95 percent.
- H. Lenses and diffusers are 100 percent virgin acrylic, tempered annealed glass, or cast glass unless otherwise noted. When polycarbonate lenses are specified, they have a high resistance to yellowing or brittleness due to exposure to heat or ultraviolet radiation. Polystyrene lenses are not provided under any circumstances. Lens thickness is at least 1/8 inch (3mm), unless otherwise noted.



- I. Fixture support components comply with Division 16, Section "Supporting Devices"
  - 1. Single-stem hangers are 1/2-inch (13mm) minimum diameter steel or aluminum tubing with swivel ball fitting and ceiling canopy arranged so that stems hang vertically regardless of the angle of the surface they are mounted from. Finish of stems and canopy plates are same as fixture unless otherwise noted.
  - 2. Hook hangers are only provided where specified. Hook hangers are integrated assemblies matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
  - 3. Provide pendant mounting hardware for fixture types indicated as suitable for surface or pendant mounting in accordance with instructions issued during construction or as required by job conditions.
  - 4. Wherever a fixture or its hanger canopy is applied to a surface mounted outlet box, a finishing ring (escutcheon) is utilized to conceal the outlet box.
  - 5. Unless otherwise noted, linear fluorescent pendants are provided with aircraft cable supports, with power fed through a single straight white cord at one end of each row. When multiple independent feed points are required to satisfy circuitry requirements (e.g. when a continuous pendant row has both emergency and normal sections), locate feeds at two ends of row.
- J. Lampholders are suitable for operation of the specified lamps and are set so that lamps are positioned in optically correct relation to all light fixture components. All lampholders comply with applicable requirements of ANSI C81. All fluorescent lampholders comply with UL 542.
- K. Fixtures for use in damp or wet locations are suitably gasketed to prevent the entrance of moisture.
- L. Air-handling fixtures comply with the following:
  - 1. Sound Transmission Class (STC) conform to ADC Standard AD 63.
  - 2. Supply Units are equipped with slots in one or both side trims and joined with air-diffuser boot assemblies specified in Division 15.
  - 3. Heat Removal Units provide an air path through the lamp cavity to reduce heat buildup.
  - 4. Air Return Units are equipped with slots on either side of the diffuser to allow air return through fixture into ceiling plenum.
  - 5. Static Fixtures have slots blanked, with fixture appearance matching active units.
- M. Fixtures utilizing ballasts or transformers bear identification, by means of a label on the reflector or body, of the circuit voltage at which they are intended to operate.

- N. All high intensity discharge (HID) fixtures circuited for emergency operation are equipped with auxiliary instant-on quartz systems (also known as a quartz restrike systems). Each fixture is equipped with an auxiliary quartz lamp that is automatically switched on whenever the fixtures are energized (e.g. after a temporary power interruption) and automatically switched off when the high intensity discharge lamp reaches approximately 60 percent light output. The control circuitry that switches the quartz lamp is integral to the fixture.
- O. Recessed incandescent lighting fixtures incorporate integral thermal protection. When specified in fixture schedule, provide fixtures with special wattage reduction labels for compliance with energy codes.
- P. All components of track lighting systems, including track, fittings, and fixtures, are provided by one manufacturer.
- Q. Fixtures are complete with all internal wiring and all flexible conduits, pigtails, and the like necessary for external connections. All wire utilized for connections to or between individual lamp sockets and lamp auxiliaries (i.e., wires which do not constitute "through circuit" wiring) are minimum #16 gauge, industry standard, fixture wire suitable for the temperature, current and voltage conditions to which it is subjected. Internal wiring contains a minimum number of splices. Splices in internal wiring are made with approved insulated "wire nut" type mechanical connectors, suitable for the temperature and voltage conditions to which they are subjected.
- R. Grounding-type flexible conduit is used for light fixture pigtails, and grounding type connectors are used for installing same. Include grounding conductor if upstream overcurrent device exceeds 20 amps.
- S. Fluorescent fixtures specified with integral emergency battery packs (also known as emergency ballasts) incorporate a test switch and indicator light within the fixture. Test switch and indicator light are discretely located, so that they are not visible from ordinary viewing angles, but so that they are readily accessible to maintenance personnel, as required by code. Fixtures incorporating emergency battery packs are wired so that they may be switched or dimmed as part of their assigned lighting control zone without causing the battery pack to energize the lamps.

## 2.3 BALLASTS

- A. General Requirements: Provide ballasts as indicated in the Light Fixture Schedule. If specific ballasts are not identified in the Light Fixture Schedule, provide ballasts as indicated below:
  - 1. Fixtures with T-8 linear and U-bent fluorescent lamps are provided with instant start solid-state electronic ballasts.
  - 2. Fixtures with T-5 standard and high-output linear fluorescent lamps are provided with programmed rapid start solid-state electronic ballasts.
  - 3. Fixtures with T-5 "biax" 2G11-base lamps (excluding NEMA FT40W) are provided with programmed rapid start solid-state electronic ballasts.

4. Fixtures with 40W T-5 "biax" 2G11-base lamps (NEMA FT40W) are provided with instant start solid-state electronic ballasts.
  5. Fixtures with T-4 "quad tube" and "triple tube" compact fluorescent lamps (NEMA CFQ and CFM) are provided with programmed rapid start solid-state electronic ballasts.
  6. Fixtures with T-4 "twin tube" compact fluorescent lamps rated 13W or lower (NEMA CFT13W, CFT9W, and CFT7W) are provided with preheat electromagnetic ballasts.
  7. Fixtures with HID lamps are provided with electromagnetic ballasts.
- B. Instant start electronic ballasts comply with the following:
1. Ballasts for T-8 lamps operate from a 50/60 Hz input source of 108-305 volts with no damage to the ballasts.
  2. Input current Total Harmonic Distortion (THD) does not exceed 10 percent.
  3. Power factor is 0.90 or greater.
  4. Provide 2-, 3-, or 4-lamp ballasts for multilamp fixtures wherever possible. All multilamp ballasts operate lamps in parallel, so that the loss of one or more lamps will not prevent the remaining lamps from functioning properly.
  5. Ballast factor is between 0.85 and 0.90 for normal light output ballasts, and a minimum of 1.15 for high light output ballasts. Provide normal light output ballasts unless otherwise specified.
  6. Ballasts operate lamps at a frequency of 40 kHz or greater.
  7. Ballasts are UL 935 Listed, Class P, Type 1 Outdoor, and CSA certified where applicable.
  8. Ballasts meet ANSI C82.11.
  9. Ballasts comply with the Federal Communications Commission rules and regulations, Title 47 CFR Part 18 Non-Consumer Equipment for EMI (power line conducted) and RFI (radiated).
  10. Ballasts withstand transients as specified in ANSI C62.41.
  11. Ballasts have class "A" sound rating.
  12. Lamp current crest factor is less than 1.7.
  13. Ballasts operate lamps with no visible flicker (3 percent flicker index).
  14. Ballasts start and operate T-8 lamps down to 0 degrees Fahrenheit (-18 degrees Celsius) or lower without shortening lamp life.

15. Ballasts are warranted for a minimum of five years. Ballast manufacturer provides replacement ballast and pays all labor costs associated with replacing ballasts that fail during their warranty period.
16. Ballasts are manufactured by one of the following: Universal "Triad HP", Osram/Sylvania "Quicktronic Professional", or Advance "Centium".

C. Programmed rapid start electronic ballasts comply with the following:

1. Ballasts are suitable for operation at the voltage and frequency of the building circuits to which they are connected, and sustained variations of +/- 10 percent (voltage and frequency) with no damage to the ballasts.
2. Input current Total Harmonic Distortion (THD) does not exceed 10 percent.
3. Power factor is 0.90 or greater.
4. Ballasts incorporate lamp shutdown circuitry for end of lamp life protection.
5. Ballast factor is between 0.95 and 1.05.
6. Ballasts operate lamps at a frequency of 40 kHz or greater.
7. Ballasts are UL 935 Listed, Class P, Type 1 Outdoor, and CSA certified where applicable.
8. Ballasts meet ANSI C82.11.
9. Ballasts comply with the Federal Communications Commission rules and regulations, Title 47 CFR Part 18 Non-Consumer Equipment for EMI (power line conducted) and RFI (radiated).
10. Ballasts withstand transients as specified in ANSI C62.41.
11. Ballasts have class "A" sound rating.
12. Lamp current crest factor is less than 1.7.
13. Ballasts start and operate lamps down to 0 degrees Fahrenheit (-18 degrees Celsius) or lower without shortening lamp life.
14. Ballasts are warranted for a minimum of five years. Ballast manufacturer provides replacement ballast, and pays all labor costs associated with replacing ballasts that fail during their warranty period.
15. Ballasts for T-5 standard and high output linear fluorescent lamps are manufactured by one of the following: Universal "Triad PRS", Osram/Sylvania "Quicktronic Professional PROStart", or Advance "Centium".

16. Ballasts for T-8 linear and U-bent fluorescent lamps be manufactured by one of the following: Universal "Accustart", Osram/Sylvania "Quicktronic Professional PROStart", or Advance "Mark V".
  17. Ballasts for T-5 "biax" 2G11-base lamps (excluding NEMA FT40W) are manufactured by one of the following: Universal "Triad PRS" or Advance "Centium".
  18. Ballasts for compact fluorescent lamps are manufactured by one of the following: Universal "Triad PRS", Osram/Sylvania "Quicktronic Professional CF Universal", or Advance "Smartmate".
- D. Preheat electromagnetic compact fluorescent ballasts comply with the following:
1. Ballasts are encapsulated or potted to ensure maximum thermal and structural integrity.
  2. Power factor is 0.90 or greater.
  3. Ballast factor is between 0.95 and 1.05.
  4. Ballasts are warranted for a minimum of two years. Ballast manufacturer provides replacement ballast and pays all labor costs associated with replacing ballasts that fail during their warranty period.
  5. Ballasts are manufactured by Universal, Advance, or Robertson Worldwide.
- E. Fluorescent dimming ballasts are solid-state electronic, providing smooth and continuous dimming over a minimum range of 100 percent light output to 1 percent light output unless connected to a daylight harvesting system. Ballasts connected to daylight harvesting systems dim lamps over a range of 100 percent light output to 10 percent light output. Dimming ballasts are endorsed by the manufacturer of the lighting control system to which they are connected. Unless otherwise noted, dimming ballasts are Lutron Hi-Lume or Lightolier PowerSpec HDF. Lutron ECO-10 ballasts area acceptable when connected to daylight harvesting systems.
- F. Electromagnetic core and coil ballasts for HID lamps are combined with appropriate capacitors and starters, referred to collectively as ballast assemblies, for operation of specified lamps. Ballast assemblies comply with the following:
1. Ballast assemblies for HID lamps rated 100W or higher are constant-wattage autotransformer (CWA) type.
  2. Ballast assemblies for HID lamps rated less than 100W are high-reactance autotransformer (HX-HPF) type.
  3. Power factor is 0.90 or greater.
  4. Ballast factor is 1.0.
  5. Ballasts are designed in accordance with all applicable ANSI specifications, including ANSI C82.4.

6. Core and coil ballasts are designed with class "H" (180 degree Celsius) or higher insulation system and vacuum impregnated with resin.
  7. Core and coil ballast and starter combinations are designed to provide reliable lamp starting down to negative 40 degrees Fahrenheit (negative 40 degrees Celsius) for High Pressure Sodium lamps and negative 20 degrees Fahrenheit (negative 30 degrees Celsius) for Metal Halide lamps.
  8. Ignitors are designed to provide six months of lamp open circuit operation without failure.
  9. Ballast assemblies are warranted for a minimum of two years. Manufacturer provides replacement ballast assembly, and pays all labor costs associated with replacing ballast assemblies that fail during their warranty period.
  10. Ballasts are manufactured by Universal, Advance, Venture, or Robertson Worldwide.
- G. Electronic ballasts for Metal Halide lamps comply with the following:
1. Ballasts operate from a 50/60 Hz input source of 108-305 volts with no damage to the ballasts.
  2. Input current Total Harmonic Distortion (THD) does not exceed 15 percent.
  3. Power factor is 0.90 or greater.
  4. Ballast is thermally protected and incorporate lamp shutdown circuitry for end of lamp life protection.
  5. Ballast factor is 1.0.
  6. Ballasts operate lamps at a frequency of less than 200 Hz.
  7. Ballasts comply with the Federal Communications Commission rules and regulations, Title 47 CFR Part 18 Non-Consumer Equipment for EMI (power line conducted) and RFI (radiated).
  8. Ballasts have class "A" sound rating.
  9. Lamp current crest factor is less than 1.5.
  10. Ballasts are designed to provide reliable lamp starting down to negative 20 degrees Fahrenheit (negative 30 degrees Celsius).
  11. Ballasts are warranted for a minimum of five years. Ballast manufacturer provides replacement ballast, and pays all labor costs associated with replacing ballasts that fail during their warranty period.
  12. Ballasts are manufactured by one of the following: Aromat, or Advance "e-Vision".

- H. Emergency battery packs (also known as emergency ballasts): An emergency battery pack incorporates a battery, charger, inverter circuit, and control electronics into one housing. Emergency battery packs comply with the following:
1. The emergency battery packs are designed to work in conjunction with the standard AC ballast in the fixture, and with an indicator light and test switch provided by the manufacturer of the battery pack.
  2. Emergency battery packs are UL 924 Listed, and meet or exceed all National Electrical Code (NFPA-70) and Life Safety Code (NFPA-101) emergency lighting requirements.
  3. Emergency battery packs incorporate maintenance-free Nickel-Cadmium (Ni-Cad) batteries.
  4. Emergency battery packs are designed to provide a minimum of 90 minutes of emergency illumination. Provide longer duration when required by code.
  5. Unless otherwise specified, emergency battery packs provide the following minimum initial lumen output per battery pack:
 

Lamp Type	Lumens
T-8, T-5	825
T-5 High Output	1,300
T-5 "biax" 2G11-base	825
Compact Fluorescent	650
  6. Emergency battery packs are warranted for a minimum of five years. Manufacturer provides replacement emergency battery pack and pays all labor costs associated with replacing emergency battery packs that fail during their warranty period.
  7. Emergency battery packs are manufactured by Iota Engineering or Bodine.

## 2.4 LAMPS

- A. Conform to the ANSI C78 series that is applicable to each type of lamp.
- B. Incandescent Lamps:
1. Unless otherwise noted, all 37W and 50W MR16 lamps are Osram/Sylvania "Tru-Aim IR". All other MR16 lamps are GE "Constant Color", Osram/Sylvania "Tru-Aim Titan", or Philips "Continuum Color" to insure consistent color. All MR16 lamps have an integral clear cover glass lens.
  2. Unless otherwise noted, all 50W, 60W, and 100W PAR38 lamps, and all 50W PAR30 lamps incorporate "halogen infrared" technology, by the following manufacturers: GE "HIR", Philips "IRC", or Osram/Sylvania "IR".

## C. Fluorescent lamps (T-8, T-5, and T-5 2G11-base):

1. Rated average life is a minimum of 20,000 hours when operated three hours per start. A shorter rated average life is acceptable for 50W and 55W T-5 2G11-base lamps only.
2. Unless otherwise noted, lamp phosphors are a composition that includes rare earth phosphors, with a correlated color temperature (CCT) of 3500 degrees Kelvin and a color rendering index (CRI) of not less than 80 (NEMA designation RE 835).
3. All T-8 linear fluorescent lamps are TCLP-compliant. Provide only GE "Ecolux", Philips "ALTO", or Osram/Sylvania "Ecologic" lamps.

## D. Compact fluorescent lamps (T-4):

1. Rated average life is a minimum of 10,000 hours when operated at three hours per start.
2. Lamp phosphors are a composition that includes rare earth phosphors, with a correlated color temperature (CCT) of 3,000 degrees Kelvin and a color rendering index (CRI) of not less than 80 (NEMA designation RE 830).
3. T-4 "twin tube" compact fluorescent lamps rated 13W or lower (NEMA CFT13W, CFT9W, and CFT7W) have two-pin bases. Four-pin bases are required for all other compact fluorescent lamps.

## E. Metal Halide Lamps:

1. Unless otherwise noted, all 20W, 39W, 50W, 70W, and 100W lamps incorporate ceramic arc tube technology. Provide only Philips "Mastercolor" or GE "CMH" lamps.
2. "Pulse Start" lamps, where specified, are combined with an appropriate ballast assembly to achieve manufacturer's rated performance.
3. Provide lamps with the highest color rendering index (CRI) available at the specified correlated color temperature (CCT). The minimum CRI for coated lamps is 70, and the minimum CRI for clear lamps is 65.
4. Provide "protected" or "open rated" lamps for use in all open fixtures.

## F. All lamps are manufactured by GE, Osram/Sylvania, Philips, or Venture.

## 2.5 FINISHES

- A. Provide metal finishes and paint colors as selected by the Architect.
- B. Where a "Custom Color Finish" is specified but not identified, match sample provided by Architect.
- C. Apply paint finishes over corrosion-resistant treatment or primer, free of streaks, runs, stains, blisters, and similar defects.



- D. When the Architect issues no instructions pertaining to finishes, provide standard finishes as follows:
1. Unpainted non-reflecting surfaces are satin finished and coated with a baked-on clear lacquer to preserve the surface. Where aluminum surfaces are treated with an anodic process, the clear lacquer coating may be omitted.
  2. Enamel coatings are of the high temperature baked-on type. Enamel reflecting surfaces are white with 90 percent minimum initial reflectance.
  3. Porcelain enameled finishes meet or exceed R.L.M. standards in all respects.
  4. Painted surfaces on fixtures for use outdoors or in damp locations exhibit weather and moisture resisting qualities equal to surfaces having epoxy based coatings. Unpainted aluminum are anodized.
  5. Unpainted aluminum reflecting surfaces are treated with an Alzak or anodizing process to insure a permanent reflective surface with a minimum 87 percent reflectance.

## 2.6 EXIT SIGNS

- A. Exit signs comply with the following:
1. Color, letter height, and letter stroke comply with all requirements of applicable state and local building codes.
  2. Edge-lit exit signs which are visible from two directions have a mylar film inserted in the center of the panel, so that the letters are not visible from the wrong direction.
- B. Self-illuminated exit signs equipped with integral battery packs for emergency operation comply with the following:
1. The battery is a sealed, maintenance-free nickel-cadmium battery with a five-year warranty.
  2. The charger is solid-state, fully automatic with a sealed transfer relay.
  3. When the input voltage drops to 80 percent of normal or below, the relay energizes the lamps from the battery pack, instead of the normal building power. When normal power is restored, the relay energizes the lamps from the normal building power, automatically recharge the battery, and float it on the charger.

## 2.7 LIGHTING CONTROLS

- A. Lighting controls including - but not limited to - switches, occupancy sensors, photoelectric sensors, timeclocks, dimmers, relays, panels, and other miscellaneous devices are provided as part of the electric work.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Set light fixtures plumb, square, and level with ceiling, walls, and/or ground and secure according to manufacturer's written instructions and approved Shop Drawings. Support fixtures according to requirements of Division 16 Section "Supporting Devices"

- B. Fixtures suspended more than 48 inches (1200mm) below ceiling are braced to limit swinging.
- C. When lamps are not specified, lamp units according to manufacturer's instructions.
- D. Light fixture locations shown on electrical drawings are approximate. For light fixtures in building equipment rooms (Mechanical, Electrical, Telecommunications, etc.), coordinate fixture locations with equipment, so that optimal light distribution is obtained, without obstructing access to equipment. All other light fixtures are installed as shown on architectural drawings, or as directed by Architect.
- E. Fixtures with asymmetric light distributions are oriented as shown in manufacturer's installation instructions. When manufacturer's instructions are not clear, obtain clarification from Architect before proceeding with installation.

### 3.2 CONNECTIONS

- A. Ground light fixtures. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical power to demonstrate proper operation of emergency lighting.
- C. Repair and retest malfunctioning fixtures and components. Repeat procedure until all units operate properly.
- D. Replace fixtures that show evidence of corrosion during Project warranty period.
- E. All permanent light fixtures used for temporary light during the construction phase for a period over 1,000 hours for fluorescent and HID sources and 100 hours for incandescent are relamped prior to acceptance.

### 3.4 ADJUSTING AND CLEANING

- A. Clean fixtures after installation. Use methods and materials recommended by manufacturer.
- B. Adjust aimable fixtures to provide required light intensities. Aim all adjustable fixtures after dark, under the direction of Lighting Consultant, Architect, or Engineer.

### 3.5 SPARES

A. Provide spare components to Owner at completion of project as outlined below:

1. For fluorescent, compact fluorescent, and HID lamps, provide one spare of each type for every ten installed (ten percent spare). Provide a minimum of four spare lamps of each type.
2. For incandescent lamps, provide one spare of each type for every five installed (twenty percent spare). Provide a minimum of four spare lamps of each type.
3. For ballasts and transformers, provide one spare of each type for every twenty installed (five percent spare). Provide a minimum of one spare of each type.
4. For interior lenses, louvers and diffusers, provide one spare of each type for every twenty-five installed (four percent spare). Provide a minimum of one spare of each type.

END OF SECTION 16500

## **Asbestos and Hazardous Material Abatement Project Manual:**

Asbestos and Hazardous Material Abatement  
Duluth International Airport

### **Location:**

Duluth International Airport  
4701 Grinden Drive  
Duluth, Minnesota

### **For:**

Duluth Airport Authority

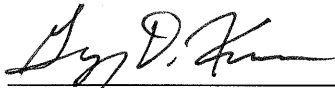
August 16, 2012

### **Prepared by:**

Braun Intertec Corporation  
11001 Hampshire Avenue South  
Bloomington, Minnesota 55438

Project DU-12-01858

I hereby certify that I am an accredited asbestos project designer in the state of Minnesota.  
A photocopy of my current asbestos project designer certificate is attached.



Gregg D. Kruse  
Principal Scientist  
Minnesota Certified Project Designer AD184

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## **Section 00004**

### **Drawings and Related Documents**

#### **Drawings**

Drawing No. ASB.1.0 – Asbestos Abatement Areas – Basement Level

Drawing No. ASB.1.1 – Asbestos Abatement Areas – First Floor

Drawing No. ASB.1.2 – Asbestos Abatement Areas – Second Floor

Drawing No. ASB.1.3 – Asbestos Abatement Areas – Third Floor

Refer to Appendix A

The drawings provided are for project reference information and may have been reduced in size, and are no longer drawn to scale.

#### **Hazardous Building Materials Inspection Report**

Refer to Appendix B for a copy of the Braun Intertec Hazardous Building Material Inspection Report for the Reynolds, Smith & Hills, Inc. – Duluth International Airport Project DU-12-01858 dated July 5, 2012.

## Section 01010

### Summary of Work

#### 01011 Work Covered by Contract Documents

- A. Pre-bid meeting (On site).
- B. Pre-construction meeting.
- C. The Contractor's scope of work includes providing all labor, material/ equipment, employee training, compliance with all Regulations, permits, notifications, licenses, and agreements necessary to perform the abatement work as described in this Project Manual.
- D. The Contractor's scope of work also includes the following, which shall be performed in accordance with Regulations and this Project Manual:
  - 1. Work area preparation including containment areas, decontamination facilities, disposal routes, and security.
    - a. **Building Access:** Duluth International Airport personnel will require access to designated areas of the building during the Asbestos and Hazardous Material Abatement. Designated areas are to remain accessible to authorized Duluth International Airport personnel for the duration of the project.
    - b. **Destructive Investigation/Abatement:** The abatement contractor is required to perform extensive destructive investigation/abatement to access and abate all ACM and ACM-contaminated materials.
    - c. **Utility Disconnects:** The Owner will be responsible for the mechanical, electrical, gas line, and other utility disconnects associated with the building components required for abatement. The abatement contractor is to coordinate with the Owner and field verify that all shut down and disconnects have occurred for mechanical, electrical, gas line, and other utility component disconnects as required for the abatement.
  - 2. Asbestos and Hazardous Material Abatement throughout the interior and exterior building areas including but not limited to the following.

Refer to the Braun Intertec Hazardous Building Material Inspection Report for the Duluth International Airport Project DU-12-01858 dated July 5, 2012.

**NOTE: It is the abatement contractor's responsibility to field verify and inventory all Asbestos and Hazardous Material quantities for their bids. Extras will not be granted based on discrepancies between the quantities listed in the Braun Intertec Hazardous Building Material Inspection Reports and actual quantities removed.**

a. **Asbestos Abatement:** Complete demolition, abatement, and disposal of the following items throughout, unless otherwise noted:

1. Asbestos-containing pipe and fitting insulation, boiler exhaust insulation, tank insulation, water heater/ converter insulation, air duct insulation, and other component thermal system insulation. Asbestos containing thermal system insulation is assumed to be located behind wall cavities, above ceiling systems, inside pipe chases and soffits, drinking fountain locations, restrooms and locker room shower walls and ceilings, and roof drain locations.
2. Asbestos-containing ceiling tile/panels.
3. Asbestos-containing floor tile and mastic.
4. Asbestos-containing black asphalt sealant between building and sidewalk.

b. **Hazardous Material Abatement:** Complete demolition, abatement, and disposal of the following items throughout, unless otherwise noted:

1. **Mercury:**

**Batteries** – smoke detectors, emergency lighting systems, exit signs, security systems and alarms, control panels.

**Lighting** – fluorescent lights, bulbs, high intensity discharge, metal halide, high-pressure sodium, mercury vapor, neon, switches and controls for lighting, “silent” wall switches.

**Heating, Ventilating, and Air Conditioning Systems** – controls, devices, thermostats, aquastats, pressurestats, firestats, manometers, thermometers, pneumatic control switches, control boxes.

**Boilers, Furnaces, Heaters** – mercury flame sensors by pilot lights, manometers, thermometers, gauges, pressure-trol, float and level controls, space heater and unit ventilator controls.

**Electrical Systems** – load meters and supply relays, phase splitters, microwave relays, mercury displacement relays.

**Miscellaneous** – all vacuum, pressure, fluid level, temperature and flow rate controls, equipment control boxes and panels.

2. **Poly-Chlorinated Biphenyl's (PCBs):** Transformers, transistors, capacitors, heat transfer equipment, light ballasts.



### 3. **Lead:**

**Lead-Acid Batteries** – lighting, exit signs, security systems.

**Miscellaneous** – lead flashing molds and roof vents. Lead pipes and solder.

**Lead Based Paint** – deteriorated (peeling/flaking) lead-based paint on the following components:

1. White paint on rubber furnace fittings in the boiler room.
2. Yellow paint on traffic and parking lines on the floor of the basement parking and driving area.
3. Yellow floor paint in the east HVAC room on the 3<sup>rd</sup> floor of the terminal.
4. Yellow paint on parking bollards located on the north and east sides of the terminal.
5. Yellow paint on the overhead doors in the northwest corner of the terminal.

### 4. **Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs):**

Fire extinguishers, air conditioners, water fountains, dehumidifiers, refrigerators/ freezers/chillers, heat pumps.

### 5. **Miscellaneous:**

**Hazardous Waste** – including all hazardous waste and household hazardous waste, boiler chemicals, general purpose cleaners, paints, thinners, all barrels and storage containers with liquids and solids (including un-labeled containers), white goods, computers, television sets, and universal waste.

**Oil** – used oil, hydraulic oils in door closers, elevator equipment, and other equipment.

**Equipment** – water heaters, ceiling-mounted space heaters, air compressors and controls, all building unit ventilators and fin tube radiators, fuse boxes, electrical panels, and roof top exhaust vents with motors.

**Note:** It is the abatement contractor's responsibility for all liquid and solid waste characterization testing for determining disposal requirements.

- c. Asbestos and hazardous material abatement operations shall meet the following safety requirements per the Local Fire Department:
1. The fire chief must be notified 24 hours prior to the commencement and closure of asbestos removal operations.
  2. Plastic film used must be flame resistant.
  3. Flammable and combustible liquids must be stored in U.L.-approved containers.
  4. Approved signs must be posted at the entrance, exits, decontamination areas and waste disposal areas for asbestos removal operations. The signs must state that asbestos is being removed from the area, that asbestos is a suspected carcinogen and that proper respiratory equipment is required. The signs must have a reflective surface and lettering must be a minimum of 2 inches high.
  5. The abatement contractor is to cover smoke detectors within the containment area with plastic fitted caps or Tyvek material to prevent false alarms from condensation or particulate overload.

**Note:** The plastic fitted caps or Tyvek material is to be removed at the end of each shift and return the detector to fully operational mode. Notify and coordinate with the Owner daily at the beginning and end of each shift.

6. The facility may be occupied in areas adjacent to the construction area; the contractor shall comply and coordinate with the local fire chief regarding Uniform Fire Code safety considerations for occupied buildings. Fire safety issues to be addressed include:
  - a. Prior to any construction or demolition, submit to the local fire chief, a fire protection plan.
  - b. Maintain proper exiting from any occupied portions of the building.
  - c. The Abatement Contractor must maintain a fully operational fire alarm system in proper operating condition at all times.
  - d. Provide a 24-hour fire watch or temporary fire alarm system when required by the fire chief or when the fire alarm safety systems have been disrupted.

**Note:** Costs attributed to false alarms during construction will be the Asbestos Abatement Contractor's responsibility.

7. Coordinate with the Owner for daily turnover requirements and procedures of the buildings fire alarm systems.

3. Packing, labeling, transporting, and disposal of all contaminated material.
4. Provide appropriate respiratory protection equipment, clothing, and personal protection training to all visitors authorized by the Owner or Consultant.
5. Decontaminate and encapsulate the work area prior to final clearance air monitoring.
6. Final cleanup and removal of all remaining temporary barriers, equipment, and supplies.

**Note:** The abatement contractor is responsible for the repair of any change in condition to the buildings exterior landscaping, city sidewalks or roadways, driveways, or parking lot areas that may have occurred as a result of dumpster placement, traffic, or other abatement-related activities.

7. The Contractor shall provide all monitoring and analysis of OSHA personal air samples as designated under current state and federal regulations.

#### 01015 **Maintaining Normal Working Conditions**

- A. The Contractor shall take all reasonable precautions to safeguard the property from damage and the public from injury during construction. The Contractor shall confine debris to the construction area so as to minimize any interruptions of the normal working conditions of the building occupants.
- B. Restrict all on-site activities to immediate work areas. Following the completion of abatement activities, the Contractor shall not be permitted to re-enter the completed area with any demolition debris, asbestos or other hazardous waste.

**Note:** The abatement contractor will only be able to use designated door entrance and exits as designated by the owner.

- C. Any inquiries made by building occupants or visitors concerning the abatement and demolition project shall be referred to the Owner or Consultant.
- D. Protect all areas under construction from inclement weather conditions.
- E. The contractor is shall be responsible for temporary lighting all work areas.
- F. Do not allow construction waste and debris to accumulate.
  1. Remove generated debris daily as it accumulates, and dispose of off site.
  2. Inspect the site and neighborhood daily, and pick up any construction debris.
- G. Contractor shall implement and maintain a chemical-free pest management program to include maintaining sanitary conditions and physical barriers to prevent access of pests and their infestation.

1. Contractor needs to comply with the recommendations of the Owner's integrated pest management company.
  2. Limit food and soft drink consumption to within the Contractor's trailer or outside of the building.
  3. Maintain physical barriers to pest access to the building.
- H. Conform to City noise control regulations, including limiting hours of construction operations. Fines for non-conforming will be the responsibility of the Contractor.
- I. Provide for building security.
1. The Abatement Contractor shall maintain the existing building security system and all devices currently in use throughout the abatement period. In the event of an outage to the building security system, the Abatement Contractor is to provide and retain personnel for (hourly) building watch tours until such time that the system is restored.
  2. Coordinate schedule for building access with Owner
  3. Coordinate with owner and assist with ensuring that the building is locked and secured at the completion of daily work.
  4. All costs associated with the replacement of vandalized or stolen property shall be the responsibility of the Contractor; this is to include all Owner equipment, furnishings, devices, etc., left on site.

**01016 "As Is" Condition**

- A. Contractor is to visit site and be familiar with existing conditions. Contractor will be required to accept conditions prior to mobilization.
- B. Protect existing systems and finishes that are to remain.
- C. The asbestos abatement contractor is to maintain the condition of the existing communication, and alarm system lines for the Site. The abatement contractor is responsible for fines assessed by the local Fire Department due to false alarms caused directly by their work, or failure to maintain a fully operational fire and smoke detection system.

## Section 01060

### Regulatory Requirements

The following references are applicable statutes, codes, patents, rules, and regulations. The references are not intended to be complete. The Contractor shall comply with the references listed below. Additionally, the Contractor shall be responsible for identifying and complying with all other applicable laws, statutes, codes, and duly promulgated rules and regulations. In all cases, the most stringent rule or regulation shall govern.

A. Code of Federal Regulations (CFR) Publications:

- |     |                            |   |
|-----|----------------------------|---|
| 1.  | 29 CFR 1910.20             | Access to Employee Exposure and Medical Records   |
| 2.  | 29 CFR 1910.132            | Personal Protective Equipment   |
| 3.  | 29 CFR 1910.133            | Eye and Face Protection   |
| 4.  | 29 CFR 1910.134            | Respiratory Protection  |
| 5.  | 29 CFR 1910.145            | Specifications for Accident Prevention Signs and Tags   |
| 6.  | 29 CFR 1910.1001           | "Asbestos" (General Industry Standard)  |
| 7.  | 29 CFR 1910.1200           | Hazard Communication  |
| 8.  | 29 CFR 1926.1101           | OSHA Construction Standard  |
| 9.  | 29 CFR 1926.62             | OSHA Lead in Construction Standard  |
| 10. | 40 CFR Part 61, Subpart M  | National Emission Standard for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations and Asbestos NESHAP Revision |
| 11. | 40 CFR Part 763, Subpart E | Asbestos-Containing Materials in Schools, Final Rule (AHERA)  |
| 12. | 49 CFR Part 171            | General Information, Regulations, and Definitions   |
| 13. | 49 CFR Part 172            | Hazardous Materials Tables and Hazardous Materials Communications Regulations                                       |

- B. American National Standards Institute (ANSI) Publications:
- Z9.2-1979 "Fundamentals Governing the Design and Operation of Local Exhaust Systems"
- C. Environmental Protection Agency (EPA)
- 560/5-85-024 "Guidance for Controlling Asbestos-Containing Materials in Buildings" (Purple Book)
- D. Minnesota
1. Minnesota Rules 7005.1550-7005.16102 "Emission Standards for Asbestos"
  2. Minnesota Rules 7005.1611 - 7005.1618 Minnesota Department of Health "Asbestos Abatement Rules"
  3. Minnesota Rules 5207.0035 "Demolition, Restoration, Remodeling Asbestos Survey"
  4. Minnesota Statutes 1988, Section 574.26 "Contractors' Bonds"
  5. Minnesota Rules 5205.1000 - 5205.1040 Minnesota Department of Labor and Industry "Confined Spaces"
- E. U.S. Patent No. 4,604,111
- Particulate Contamination Control Method and Filtration Device.

## Section 01090

### References

#### 01094 Definitions

The following definitions are applicable given the scope of this project. The list is not intended to be complete and shall be issued as a guideline for interpretation of the specifications as stated herein.

**Abatement** - The removal, encapsulation, enclosure or repair of asbestos-containing materials.

**Aggressive Sampling** - A sampling technique in which the Testing Laboratory collecting the air sample creates air movement by blowers or fans before/during the sampling period to stir up settled dust or particulate matter. Intended to simulate worst-case scenario for fiber release in the area contained.

**Airless Sprayer** - A sprayer suitable for application of an encapsulant or amended water, not using compressed air as propellant.

**Airlock** - A system for permitting entering and exiting a containment area with minimum air movement between the contaminated area and the external environment.

**Air Monitoring** - The collection of a known volume of air through a filter media for assessing airborne fiber concentrations. Also known as air sampling or air testing.

**Alternative Indoor Air Standard** - Determined by collection of preliminary air samples by phase contrast microscopy, as defined in the Minnesota Department of Health Asbestos Abatement Rules: 7005.1616.

**Amended Water** - Water to which a surfactant has been added.

**ANSI** - American National Standards Institute.

**Area Monitoring** - Any form of air sampling for fiber concentration within an asbestos controlled area, outside the asbestos-controlled area or outside of the building.

**Asbestos** - The asbestiform varieties of serpentine (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite (amosite), anthophyllite, actinolite, and tremolite.

**Asbestos-Containing Material (ACM)** - Material composed of any type of asbestos in an amount greater than 1% asbestos by weight.

**Asbestos-Containing Waste Material** - Asbestos-contaminated objects bagged, or sealed in poly or impermeable barrels requiring disposal.

**Asbestos Filtration Device (AFD)** - Device using high-efficiency particulate absolute (HEPA) filtration systems to filter air.

**Authorized Visitors** - Any visitor to the site whose visit has been authorized by the Owner or Consultant.

**Barrier** - Any surface that seals the work area to inhibit the movement of fibers.

**Certified Industrial Hygienist (CIH)** - An industrial hygienist certified by the American Board of Industrial Hygiene.

**Clean Room** - An uncontaminated area or room that is part of the worker decontamination chamber with provisions for storage of workers' street clothes and clean personal protective equipment.

**Clearance Air Monitoring** - Employing aggressive air sampling techniques in a previously contaminated area to verify that airborne fiber levels are at or below 0.01 fiber per cubic centimeter of air (PCM clearance). Also known as clearance sampling or clearance testing.

**Consultant** - Serves the role of Architect for purposes of the Contract Documents. Also is the testing laboratory representative contracted by the Owner to perform air monitoring.

**Container** - Six (6) mil polyethylene bags or fifty-five (55)-gallon barrels labeled with appropriate warning labels meeting OSHA and DOT requirements.

**Contractor** - The individual or business with which the Building Owner contracts to perform asbestos abatement.

**Critical Barrier** - Primary seal or barrier on all openings into adjacent areas including: doors, vents, corridors, etc.

**Daily Report** - Handwritten notes of the Testing Laboratory Representative that evaluate, on a daily basis, work activities and procedures performed by the Contractor, and all air-sampling data/results.

**Decontamination Chamber System** - A series of connected rooms, separated from the work area and from each other by airlocks, for the decontamination of workers and equipment.

**Demolition** - The removal of any building component, system, finish or assembly of a facility.

**DOT** - U.S. Department of Transportation.



**Encapsulant** - A liquid material that can be applied to asbestos-containing material which controls the possible release of asbestos fibers from the material either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding its components together (penetrating encapsulant).

**Encapsulation** - The treatment of asbestos-containing material with an encapsulant.

**Enclosure** - The construction of an airtight, impermeable, permanent barrier around asbestos-containing materials to control the release of asbestos fibers.

**EPA** - U.S. Environmental Protection Agency

**Equipment Room** - A contaminated area or room that is part of the worker decontamination chamber system, with provisions for storage of contaminated clothing and equipment.

**Equipment/Waste Decontamination Chamber System** - Decontamination chamber system for controlled transfer of waste material and equipment into or out of the work area.

**Fiber** - Refers to fibers having an aspect ratio of 3:1 or greater, and longer than 5 microns in length (NIOSH 7400 Method).

**Final Cleaning** - Final cleaning consists of a combination of wet wiping and HEPA vacuuming a previously contaminated area.

**Fixed Objects** - A unit of equipment or furniture in the work area that cannot be moved from the work area.

**Friable Asbestos** - Asbestos-containing material that can be crumbled pulverized or reduced to powder by hand pressure, when dry.

**Full-Body Disposable Suit** - Disposable protective suits as manufactured by Tyvek or approved equivalent.

**Glovebag** - A manufactured or fabricated device consisting of a bag (typically constructed of six (6) mil transparent polyethylene or polyvinyl chloride plastic), two (2) inward projecting long sleeves with rubber gloves and internal tool pouch. The glovebag is constructed and installed in such a manner that it surrounds the object or material to be removed and contains the asbestos fibers released during the process.

**Half-face Respirator** - A negative pressure respirator that covers only the nose/mouth area.

**HEPA Filter** - A high-efficiency particulate absolute filter capable of removing particulates greater than 0.3 micron in diameter with 99.97% efficiency.

**Hudson Sprayer** - A manual hand-held pressure sprayer with water-holding capacity of two (2) to three (3) gallons.

**HVAC** - Heating, ventilating, and air-conditioning systems.

**Industrial Hygienist Technician** - The Consultant's on-site representative. Conducts air sampling and evaluates Contractor's work procedures during the abatement project. Also known as the Testing Laboratory Representative.

**Initial Clean** - Removal of all visible bulk debris from all surfaces within the containment area.

**Manometer** - A monitor used for the detection of pressure differentials between the containment area and outside adjacent areas.

**MPCA** - Minnesota Pollution Control Agency.

**Negative Pressure Sensor** - A monitor used for the detection of pressure differentials between the containment area and outside adjacent areas.

**Negative Air Pressure Ventilation System** - An exhaust system equipped with AFDs and capable of maintaining a pressure differential whereby negative pressure is created inside the containment area. It also can be used to lower airborne fiber levels inside the containment area.

**NESHAPS** - The National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61)

**NIOSH** - National Institute for Occupational Safety and Health.

**OSHA** - Occupational Safety and Health Administration.

**Outside Air** - The air outside buildings and structures.

**PAPR** - Powered Air Purifying Respirator.

**PCM** - Phase Contrast Microscopy.

**Personal Monitoring** - Air sampling of asbestos fiber concentrations within the breathing zone of an abatement worker, thus determining the worker's potential exposure to airborne fibers.

**Phase Contrast Microscopy** - Method of optical microscopy used to count fibers for determination of airborne fiber concentrations.

**Polyethylene Sheeting** - (Poly) plastic sheeting used as critical barriers and to cover walls and floors of the containment area. Usually of four (4) or six (6) mil thickness.

**Powered Air-Purifying Respirator (PAPR)** - Full-face respirator with battery-powered fan unit capable of delivering four (4) to six (6) cubic feet of air per minute (CFM) to the face piece.

**Preliminary Air Sampling** - The method used to determine background airborne fiber concentrations inside and outside of the building prior to any asbestos abatement work.

**Removal** - The stripping of any asbestos-containing materials from surfaces or components of a facility.

**Renovation** - Altering in any way, one or more facility non-structural components, excluding demolition.

**Repair** - Encapsulation or restoration of the integrity of the outer protective covering of asbestos-containing materials, rendering the materials effectively non-friable.

**Shower Room** - A room between the clean room and the equipment room in the worker decontamination chamber, with hot- and cold-running water controllable within the shower, and suitably arranged for complete showering during decontamination.

**Site Superintendent** - Contractor's Representative working on-site during the project also known as "Foreman."

**Staging Area** - Area near the waste transfer airlock where contained asbestos waste has been placed prior to removal from the containment area.

**Surfactant** - A chemical wetting agent, typically one part polyoxyethylene ether to one part polyoxyethylene ester, or equivalent, mixed with water to provide a concentration of one (1) ounce surfactant to five (5) gallons of water.

**Tape** - Capable of sealing seams of adjacent sheets of polyethylene and for attachment of polyethylene to finished/unfinished surfaces and capable of adhering under both dry and wet conditions, including amended water.

**TEM** - Transmission Electron Microscopy.

**Transmission Electron Microscopy (TEM)** - A method of analyzing asbestos air samples for fiber concentration.

**Vacuum** - Dry vacuum or combination wet/dry vacuum equipped with HEPA filtration.

**Visible Emissions** - Any emissions containing particulate matter that are visually detectable without the aid of instruments. This does not include a condensed uncombined water vapor.

**Washroom** - A room between the work area and the holding area in the equipment/waste decontamination chamber where equipment or waste containers are wet-wiped or HEPA-vacuumed prior to transfer to the holding area.

**Water Filtration System** - Water-filtering system capable of trapping and retaining fibers greater than five (5) microns in length.

**Wet-Wipe** - The process of eliminating asbestos contamination from building surfaces and objects by wiping cloths, mops or other cleaning utensils, which have been dampened with water, over surfaces.

**Wetting Agent** - See Surfactant.

**Work Area** - A contained asbestos removal area that has been sealed and equipped with a decontamination chamber system and engineering controls. Also known as a regulated area by OSHA regulations. Also known as a containment area.

**Worker Decontamination Chamber** - A decontamination system consisting of a clean room, a shower room, and an equipment room separated from each other and from the work area by airlocks and curtained doorways. This system is used for all workers, other personnel and authorized visitors entering and exiting from the work area. This system may also be used for equipment/waste decontamination chamber for small jobs.

## **Section 01300**

### **Submittals**

#### **01310 Project Schedules**

The Contractor shall submit project schedules to the Consultant at least five (5) working days prior to the pre-construction meeting, and shall address:

- A. Number of work shifts
- B. Work schedule (include days, hours, and work progress)
- C. Approximate size of each shift's crew
- D. Start-up time
- E. Completion date(s) for asbestos removal

#### **01320 Progress Reports and Submittals**

During the project, the Contractor shall submit to the Consultant three (3) bound copies of the following, whenever applicable:

- A. Daily entry logs documenting the names of all approved personnel entering or leaving any containment area where an asbestos-contaminated or potentially contaminated atmosphere exists. These entry logs shall be submitted at the end of the project.
- B. Waste Transport and Disposal Certificates (Manifests) for each load shall be submitted at the end of the project.
- C. Pressure monitoring data shall be submitted at the end of the project.
- D. Personal air sampling data collected by Contractor. Results and sampling data shall be discussed with the Consultant's on-site representative daily. Records of results shall be submitted at the end of the project.
- E. The Contractor's site supervisor daily logs shall be submitted at the end of the project.
- F. Any substitution of products referencing any related specification sections, as well as documentation showing compliance with requirements established for any substitutions. Submit substitution information prior to actual use of product.

#### 01330 **Layout of Abatement Areas**

Proposed outline of abatement areas, including the following to be submitted to the Consultant five (5) days before the pre-construction meeting:

- A. Worker and equipment/waste decontamination chamber locations.
- B. Location of emergency exits.
- C. Location and number of engineering controls (i.e., Negative Air Pressure Ventilation Systems).
- D. Waste disposal routes within the building(s) and the location of the dumpster.

#### 01363 **Certificates**

The following documentation shall be submitted to the Consultant prior to start of work, or as noted:

- A. Insurance Certificates are to be submitted in accordance with Section 00650 of this Project Manual.
- B. Copy of physician's written opinion stating that each worker is physically qualified to wear a respirator in accordance with OSHA 29 CFR 1926.58 (m)(4).
- C. Written respirator program and fit test results.
- D. Employee training acknowledgment and certifications for asbestos abatement site supervisors and asbestos abatement workers to be used on the project as required in the Minnesota Department of Health's "Asbestos Abatement Rules" 7005.1614.
- E. An asbestos abatement contractor license as required in the Minnesota Department of Health's "Asbestos Abatement Rules" 7005.1613.

#### 01390 **Standard Operating Procedures**

Standard Operating Procedures to be utilized for asbestos removal shall include, at a minimum, the following steps:

- A. Preparation of containment area(s)
- B. Asbestos removal
- C. Decontamination of containment area
- D. Cleaning stages
- E. Bagging and disposal of waste
- F. List of equipment and supplies
- G. Contingency plan for emergencies including: fire, accident, power failure, contamination of areas, etc.

Copies of notifications for the following entities shall be submitted to the Consultant prior to the start of work.

- A. Approved landfill
  - B. Local police and fire departments
  - C. Local medical emergency personnel
  - D. "Notification of Intent to Perform an Asbestos Abatement Project"
1. The above notification form shall be submitted by the Contractor to the Minnesota Pollution Control Agency (MPCA) at least ten (10) business days before any disturbance of asbestos material begins for renovation projects.

Asbestos Coordinator  
Minnesota Pollution Control Agency  
Metro Districts - Regular Facilities Section  
520 Lafayette Road North  
St. Paul, MN 55155-4194

2. The same notification form shall be submitted to the Minnesota Department of Health five (5) calendar days before abatement work is started. The one percent (1%) project fee shall also accompany the notification.

Minnesota Department of Health  
Asbestos Abatement Unit  
625 North Robert Street  
P.O. Box 64975  
St. Paul, Minnesota 55164-0975

## **Section 01400**

### **Quality Control**

#### **01410 Testing Laboratory (Consultant)**

The Owner shall provide an independent third-party Testing Laboratory to serve as its Consultant, to perform the following work in addition to those responsibilities as defined in the General and Supplementary Conditions.

- A. Evaluate Contractor's compliance with specifications contained herein.
- B. Visually examine all barriers and decontamination chamber(s) on a daily basis.
- C. Evaluate proper operation of engineering control systems and equipment.
- D. Observe the abatement Contractor's work practices and procedures.
- E. Conduct visual examinations as defined in the project manual.
- F. Review and maintain Contractor submittals as required.
- G. Generate daily work log.
- H. Perform all air sampling, excluding Contractor's OSHA personal compliance monitoring, including preliminary air samples, air samples during abatement, and final clearance air samples. The asbestos air-sampling schedule to be utilized during the project by the Consultant is as follows:
  - 1. Pre-abatement (preliminary) air samples shall be collected. A sufficient number of air samples shall be collected prior to initiation of any abatement activities in order to determine prevailing airborne fiber levels. Representative samples shall be collected from both inside and outside the projected containment area, including outside of the existing building.
  - 2. Air samples during abatement shall be collected on a daily basis or as otherwise stated by the Owner. The Consultant shall determine the number of air samples collected during abatement.
    - a. Fiber levels inside the building, but outside the work area during removal, shall not exceed 0.01 fibers per cubic centimeter of air (f/cc). If fiber levels exceed 0.01 f/cc or the alternate clearance level outside the work area, the Consultant shall require the Contractor to immediately stop removal activities and evacuate any occupied area immediately adjacent to the containment area.



The Contractor shall also check the integrity of work being done and examine all barriers for any visible openings. Implement decontamination procedures as follows: repair all barriers, wet-wipe and HEPA-vacuum all areas that were potentially exposed to airborne asbestos fibers. The Consultant shall conduct air sampling within the immediate area to verify that levels do not exceed 0.01 f/cc upon completion of the above. Evacuated areas shall not be reoccupied until the above-stated corrective measures have been taken and documented.

- b. Within the containment area and during abatement work, fiber levels shall not exceed 0.5 f/cc on any two (2) consecutive days. If on the second consecutive day, fiber levels of 0.5 f/cc are detected, the Consultant shall require the Contractor to stop all abatement work and shall use appropriate fiber control methods to reduce the fiber concentration.
  - c. Work may resume only after fiber levels have dropped below 0.5 f/cc or with the approval of the Owner or Consultant.
- 3. All air sampling and analysis shall be performed in accordance with NIOSH Method 7400A using phase-contrast microscopy. All results shall be available within twenty-four (24) hours.
- 4. The Consultant shall maintain a daily field log. The log shall document all air sampling data and results and on-site observations regarding the contractor's work practices and compliance with applicable regulations and the Project Manual. All samples shall have a unique number and location description and all results and interpretations shall be reported to the Owner and Contractor according to the number and location description entered in the daily log. The Consultant shall verbally discuss all results and observations, as compiled in the log, on a daily basis with the Contractor.
- 5. Final air samples, collected in accordance with MDH AAR 4620.3594, using aggressive air-sampling techniques, as defined below, shall be analyzed in accordance with NIOSH Method 7400A using phase-contrast microscopy.
  - a. At least five (5) air samples shall be collected from inside the containment area.
  - b. Surfaces shall be physically disturbed by directing forced air from a one (1) horsepower leaf blower onto all surfaces.
  - c. One (1) twenty (20)-inch-diameter floor fan per ten thousand (10,000) cubic feet of containment area volume shall be mounted in a central location, directed towards the ceiling at low speed for the entire period of sample collection.

- d. The containment area is considered clean when the fiber concentrations of the air samples collected from inside the containment area are all 0.01 f/cc (or the alternative indoor air standard) or less.
  - e. Should any of the samples fail this criterion, the Contractor shall be required to re-clean the entire containment area by methods previously stated.
  - f. The above process shall continue until final clearance criteria, as stated herein, is reached.
6. Final air samples, using aggressive air sampling techniques as defined below, shall be collected for analysis using transmission electron microscopy (TEM).
- a. Air samples shall be collected and analyzed using TEM in accordance with 40 CFR Part 763 (AHERA), Appendix A to Subpart E - Interim Transmission Electron Microscopy Analytical Method and Field Sampling Protocol for clearance testing of an abatement site.
  - b. A minimum of five (5) air samples from inside the containment and five (5) air samples from outside the containment area shall be collected at the same time.
  - c. Surfaces shall be physically disturbed by directing forced-air from a one (1) horsepower leaf blower onto all surfaces.
  - d. One (1) twenty (20)-inch-diameter floor fan per ten thousand (10,000) cubic feet of containment area volume shall be mounted in a central location, directed towards the ceiling at low speed for the entire period of sample collection.
  - e. The containment area is considered clean only after TEM analysis results meet the final clearance criteria as specified in 40 CFR Part 763: Asbestos-Containing Materials in Schools. The analysis laboratory must be an accredited participant in the National Voluntary Laboratory Accreditation Program (NVLAP).
  - f. Should final air sampling results fail, the Contractor shall be required to re-clean the entire containment area.
  - g. The above process shall continue until final clearance criteria, as stated herein, is reached.
  - h. The Contractor shall bear all costs associated with the time and materials required for re-cleaning and all costs associated re-sampling and analysis by the Consultant.

7. Final air samples when using the mini-containment area as defined in Section 02084, shall be analyzed in accordance with NIOSH method 7400A using phase contrast microscopy.
  - a. The flaps of the air lock must be secured to prevent leakage outside the mini-containment area during the aggressive clearance air-sampling test.
  - b. At least five (5) air samples shall be collected from inside the mini-containment area.
  - c. All surfaces shall be physically disturbed by directing forced-air from a one (1) horsepower leaf blower onto all surfaces.
  - d. The mini-containment area is considered clean if the fiber concentration of each air sample collected from inside the mini-containment area is 0.01 f/cc or less.
  - e. Should final air sampling results fail, the Contractor shall be required to re-clean the entire mini-containment area by methods previously stated.
  - f. The above process shall continue until final clearance criteria, as stated herein, is reached.
  - g. The Contractor shall bear all costs associated with the time and materials required for re-cleaning and all costs associated with re-sampling by the Consultant.
  - h. The mini-containment area shall not be opened to persons not involved in asbestos-related work until the final clearance sampling has passed and the Owner or Consultant grants oral permission for the area to be re-occupied.
8. Air sampling during glovebag removal operations, as defined in Section 02085, shall be conducted as follows:
  - a. During removal operations, a minimum of two (2) air samples must be collected within ten (10) feet of the glovebag and within the critical barriers.
  - b. Fiber levels must be 0.01 f/cc or less, unless an alternate clearance has been established.
  - c. If fiber levels exceed this level, the area shall be cleaned using a HEPA-filtered vacuum and wet methods. Following cleaning, the area within the critical barriers shall be re-tested by PCM. Until fiber levels are 0.01 f/cc or less, this process shall be repeated.

- I. Perform all lead sampling, including preliminary samples, and samples following lead abatement. The lead sampling procedures to be utilized during the project by the Owners Designated Consultant will be a combination of the following.
  1. Clearance Testing
  2. Surface dust sampling shall be conducted by the testing laboratory on interior surfaces within 24 hours after completion of post-abatement cleaning to allow airborne dust to settle onto surfaces to be tested.
  3. Clearance sample collection locations shall be randomly selected. .
  4. Clearance criteria: Dust must not contain lead in a concentration of 100 micrograms or more per square foot on floors; 250 micrograms or more per square foot on accessible, below ceiling components; and 400 micrograms or more per square foot on above ceiling components.
  5. If any of the residual lead level results exceed the clearance criteria, the area shall be re-cleaned by the Contractor. Retesting by the testing laboratory shall occur at the Contractor's expense.

## **Section 01500**

### **Construction Facilities and Temporary Controls**

#### **01510 Utility Disconnects**

The Owner will be responsible for the mechanical, electrical, gas line, and other utility disconnects associated with the building components required for abatement. The abatement contractor is to coordinate with the Owner and field verify that all shut down and disconnects have occurred for mechanical, electrical, gas line, and other utility components disconnect as required for the abatement.

#### **01511 Temporary Electricity**

The Contractor shall supply and maintain temporary electrical energy for the project. The Contractor shall be responsible for:

- A. All temporary connections and their removal upon completion of the project and associated costs.
- B. Use only grounded extension cords with waterproof connectors where necessary and ground fault interrupters (GFI) for all electrical hookups.
- C. Use "hard surface" extension cords where exposed to abrasive sources or heavy traffic.
- D. All electrical equipment shall be disconnected, and installed according to National Electric Code.
- E. Compliance with OSHA and other regulatory agency requirements.

The Contractor at its own expense shall repair all damage to the existing system.

#### **01512 Temporary Lighting**

The Contractor shall supply and maintain lighting levels to comply with OSHA requirements.

#### **01513 Temporary Heat, Ventilation, Fuel, and Services**

The Contractor shall coordinate with the Owner and be responsible for the shutdown of air handlers, unit ventilators, steam piping, and other equipment or ducts where necessary.

#### **01514 Telephone Service**

The Contractor shall provide telephone service.

**01515 Temporary Water**

The Owner shall provide cold water through the existing plumbing system at no cost to the Contractor. The Contractor shall furnish temporary water lines and fittings from existing plumbing to the removal area and remove these lines and fittings upon completion of the project.

**01516 Sanitary Facilities**

The Contractor shall provide temporary facilities adjacent to the building. The Contractor shall be responsible for maintaining the facilities and shall be responsible for any costs or damages associated with the temporary facilities.

**01527 Scaffolding, Ladders**

The Contractor shall provide all scaffolding, ladders, etc., as necessary to complete the work of this contract. The type, erection and use of all scaffolding and ladders shall comply with all OSHA standards.

**01552 Provision of Parking Space**

An area shall be assigned to the Contractor for the parking of employee vehicles and heavy equipment.

**01590 Field Office Space**

The Contractor shall coordinate with the Owner for the location of a convenient space within the building to be used as a field office. In the event interior building space is unavailable, the Contractor shall provide a job trailer for the field office at no cost to the Owner. The Contractor shall remove its equipment and thoroughly clean the space upon completion of the project.

**End of Division 1**

**Division 2**

**Site Work**

## Section 02080

### Asbestos Abatement

#### 02081 Standard Operating Procedures

The Contractor shall be responsible for the development and implementation of the following standard operating procedures:

- A. Restrict access into the work area to only those employees or visitors previously approved to enter the area by the Owner or Consultant.
- B. Emergency exits shall be established and clearly labeled as such. They shall be secured so as to prevent access from uncontaminated areas yet permit emergency exiting. Emergency exits may include the Decontamination Chamber, Equipment/Waste Transfer Chamber, or other alternative exits approved by the Owner or Consultant. All personnel shall be trained on emergency procedures.
- C. Provide for an approved on-site superintendent (foreman) during asbestos abatement-related procedures. A site superintendent shall be present at all times while the Contractor is performing work.
- D. Practice safe work procedures in the workspace. Eating, drinking, or smoking is not permitted within the containment area(s) or near any polyethylene sheeting.
- E. Provide a smoke detection system capable of monitoring the entire containment area and sounding an alert when fire conditions are detected.
- F. Provide for personal air monitoring for determination of exposures during the work on a daily basis.
- G. Utilize safe work practices at all times to prevent accidents in and around the work area.
- H. Minimize release of asbestos fibers during all stages of the project.
- I. Be prepared to administer first aid to injured personnel at all times. Seriously injured personnel shall be treated immediately or removed without delay.

**Note:** *Extreme caution must be taken when moving injured personnel. Movement can aggravate certain types of injuries. Unless the injured person's life is threatened, medical personnel should not move them. Consult a physician if in doubt.*

- J. Maintain all barriers and engineering control systems. Perform regular examinations to identify and immediately correct any problems encountered.
- K. Provision of fire extinguishers in containment as required by 29 CFR OSHA 1926.150 (a)(1).



- L. Provision of worker training in the use of fire-fighting equipment as required by 29 CFR OSHA 1926.150 (a)(5).
- M. Asbestos removal operations meet the following requirements:
  - a. The chief must be notified 24 hours prior to the commencement and closure of asbestos removal operations.
  - b. Plastic film used must be flame resistant.
  - c. Approved signs must be posted at the entrance, exits, decontamination areas and waste disposal areas for asbestos removal operations. The signs must state that asbestos is being removed from the area, that asbestos is a suspected carcinogen and that proper respiratory equipment is required. The signs must have a reflective surface and lettering must be a minimum of 2 inches high.

#### **02082 Respiratory Protection**

- A. Powered air-purifying respirators (PAPRs) equipped with HEPA filter cartridges shall be the minimum level of respiratory protection utilized during the entirety of the project. However, in the following situations the Consultant may approve the use of half-face respirators equipped with HEPA filter cartridges.
  - 1. Preparation of barriers, Decontamination Chambers, and mini-containment areas.
  - 2. Pre-cleaning of work areas.
  - 3. Transfer of equipment or bags within the Equipment/Waste Decontamination Chamber Clean Room.
  - 4. Transfer of bagged or barreled debris from the Equipment/Waste Decontamination Clean Room to the dumpster and at the landfill site during unloading.

Approval for use of half-face respirators shall be dependent on demonstrated fiber concentrations for the type of operation involved. Low fiber concentrations do not guarantee approval, however.

- B. A fully equipped powered air-purifying respirator shall be made available at all times for Authorized Visitors' use. The respirator shall be stored in the Clean Room of the Decontamination Chamber.
- C. Should the Contractor desire use a Type C respirator (hard-line) system, application must be made to the Consultant at least one week prior to use. Type C systems must be operated in compliance with all OSHA regulations.
- D. All individuals assigned a respirator shall inspect their respirator on a daily basis in accordance with the manufacturers recommended testing procedures.

## **02083 Asbestos Abatement Standard Procedures**

The following procedures, in addition to compliance with MDH AAR 4620.3566 - 3594, are to be used when the removal of twenty-five (25) linear feet or greater of pipe insulation or ten (10) square feet or greater of asbestos-containing material per room is to be conducted.

### **A. Decontamination Chamber**

The Decontamination Chamber shall consist of three (3) distinct sections as a minimum. These include the Clean Room, Shower, and Equipment Room (dirty room). The overall size of the Decontamination Chamber is dependent on the availability of space; however, it shall be constructed so as to accompany at least four (4) to five (5) individuals at one time. The Decontamination Chamber shall be constructed of two (2) separate layers of six- (6) mil poly. Dark (black) poly shall be installed on the outside of the Decontamination Chamber. Each distinct section shall be separated from its adjacent room by an airlock door, which consists of three (3) distinct poly door flaps or two (2) sets of two (2) distinct poly door flaps with a minimum of three (3) feet of space between doorways.

#### **1. Clean Room**

- a. The Clean Room shall remain free from asbestos contamination throughout the entirety of the project. The floor surface shall remain free from any water accumulations. The Contractor shall wet-wipe all inside surfaces within the Clean Room on a daily basis or more frequently as needed.
- b. The Clean Room shall serve as a change room where workers remove all street clothing, including undergarments, and suit up in disposable full-body protective suits. Gym shorts or other articles of clothing to be worn over the disposable suits are permitted, but are required to be left inside the abatement area or Equipment Room.
- c. The Contractor shall provide all personnel, including the Owner, Consultant and all other Authorized Visitors, with clean full-body disposable protective suits allowing for an adequate number of changes and towels for drying purposes.
- d. Emergency procedures, phone numbers, and other applicable references shall be posted and be readily accessible.
- e. The Contractor shall provide for a fully charged dry chemical, multi-purpose type (Class ABC) fire extinguisher to be stored in the Clean Room.

#### **2. Shower Room**

- a. The Contractor shall provide a completely watertight operational shower to be used for access from the Clean Room into the Equipment Room and for showering by workers exiting the work area into the Clean Room.

- b. The shower shall have a floor drain that collects all water runoff. All water shall be directed through a water-filtering device effective for filtering particulate matter five (5) microns in size or larger. Water filters shall be treated as contaminated waste and changed on a routine basis or as needed so as to prevent water buildup in the shower basin. Filtered shower water may be discharged into a floor drain.
    - c. The shower shall provide both hot and cold water, controllable from inside the shower. Absolutely no cold showering is permitted.
    - d. The shower shall have separate openings for ingress and egress. Single-opening showers are not permitted. Access to the containment area must pass through the shower.
    - e. The Contractor shall provide soap and shampoo in the Shower Room.
    - f. The Contractor shall clean the shower area at least twice daily to prevent water or bulk asbestos buildup.
  - 3. Equipment Room (Dirty Room)
    - a. The Equipment Room shall be used for entering and leaving the containment or work area.
    - b. The Equipment Room shall serve as storage for re-usable outerwear, gloves, boots, and other clothing and equipment.
    - c. Workers shall remove and dispose of their disposable protective clothing in this room prior to entering the Shower. All suits shall be placed into a labeled, six (6) mil, and asbestos waste disposal bag.
    - d. The Contractor shall clean this room at least daily to prevent water build-up or accumulation of bulk asbestos.
- B. Decontamination Procedures
- 1. Entering Work Area
    - a. Workers shall remove all street clothing and undergarments and change into a clean full-body disposable protective suit. A respirator, as specified herein, equipped with HEPA cartridges shall be put on and properly fitted prior to entering the Shower Room.
    - b. The worker shall then proceed through the Shower Room or bypass area into Equipment Room. Any re-usable clothing, such as gloves or rubber boots, is put on at this point prior to entering work area.

2. Leaving Work Area

- a. The worker shall remove any visible bulk asbestos from suit in work area with HEPA vacuum or water prior to entering Equipment Room. All personnel should wipe their feet or spray off boots to minimize transfer of contamination into the Equipment Room.
- b. The worker shall remove the protective suit and dispose of it into a labeled, six (6) mil, asbestos waste disposal bag. All re-usable clothing shall be left in this room or sealed in a bag accordingly.
- c. With respirator still on, the worker shall proceed through the airlock door into the Shower Room.
- d. The worker shall wet the entire body and proceed to thoroughly rinse their respirator before removing from face. Any respirator cartridges to be re-used, where permitted, must be sealed or capped. Respirator cartridges shall be deposited into a disposable bag or left in a designated space within the Shower Room. The worker shall then thoroughly wash using soap and water before entering the Clean Room.
- e. The worker shall dry off with towels provided and change back into street clothes in the Clean Room. Used towels shall be deposited into a waste disposal bag when done. The individual's respirator shall be further cleaned and disinfected prior to drying it for storage.

C. Equipment/Waste Transfer Chamber

The Equipment/Waste Transfer Chamber shall, as a minimum, consist of two (2) separate areas: The Dirty Room (adjacent to and directly off of the containment area) and the Clean Room. Each room shall be separated from the other by airlock doors, including ingress/egress doors between the containment area and the Dirty Room and between the Clean Room and outside area. The entire Equipment/Waste Transfer Chamber shall be constructed of two (2) separate layers of six- (6) mil poly. All personnel working in the chamber shall wear full-body protective clothing and respirators as specified herein. The Contractor shall keep the Equipment/Waste Transfer Chamber clean and free from any waste or bulk asbestos buildup. The Clean Room must be wet-wiped at least twice daily.

The following procedures are to be used:

1. Equipment/Supplies

Prior to moving any equipment or supplies from the containment area through the Dirty Room, the Contractor shall thoroughly wash or wet-wipe all surfaces to remove any visible asbestos contamination. When transferring equipment/supplies that are difficult to clean or are suspected of asbestos contamination, they shall be wrapped in one (1) layer of six (6) mil poly and have the appropriate OSHA asbestos label affixed. All equipment/ supplies are then transferred into the Clean Room where they may be temporarily stored or transferred to the outside.

2. Asbestos Waste

All bagged waste shall be sprayed-off or wet-wiped prior to transfer into the Dirty Room. Once inside the Dirty Room, the bagged waste shall be placed into a second six (6) mil labeled waste bag taking precautions to minimize the amount of residual air left inside the outer bag prior to sealing it shut. The outer bag is then wet-wiped with clean water and rags prior to transfer into the clean room. All double-bagged waste is then transferred into the Clean Room.

All material to be disposed of as contaminated waste that cannot be bagged shall be wrapped in a layer of six- (6) mil poly while still inside the containment area. The outer poly surface shall be sprayed with water prior to transfer into the Dirty Room. The material shall be wrapped in another layer of six- (6) mil poly and the appropriate OSHA asbestos warning label affixed. Caution shall be taken to avoid puncturing the poly with any sharp objects.

D. Engineering Controls

The requirements of the Minnesota Asbestos Abatement Rules 7005.1616 Subpart 4, Section 7, affect Section 02083-part D of the Project Manual. Alternative work area ventilation systems may be proposed, but must be approved by the Minnesota Commissioner of Health, the Owner, and the Consultant.

1. The Contractor shall provide portable HEPA filtration systems positioned within the containment area. Each unit shall have a Magnehelic Gauge or equivalent device to measure the pressure drop across the internal HEPA filter. In addition, each unit shall be equipped with warning lights to signal abnormal operation or power loss.
2. All HEPA filtration systems shall be equipped with pre-filters for the collection of larger-sized particulate matter to prolong the operating life of the internal HEPA filter. Pre-filters shall be replaced with new ones, while the unit is still running, whenever the pressure drop across the filter becomes excessive.
3. Prior to start up, the Contractor shall inspect all gaskets and seals for any signs of damage or openings.
4. Each unit shall be serviced by a dedicated minimum 115V-20A circuits with an overload device tied into an existing building electrical panel, which has sufficient capacity to accommodate the load of all units connected to it.
5. All HEPA filtration systems shall remain in operation 24 hours per day, 7 days per week until all final clearance criteria has been met. Upon receiving approval from the Consultant, the Contractor may shut down the systems during encapsulation.

6. The Contractor shall provide for one (1) additional HEPA filtration system to be left on site as a backup unit. The Contractor's site superintendent shall document the number of hours of use for each individual unit's internal HEPA filter. The total operational time on each internal HEPA filter shall not exceed the manufacturer's specified life span for the filter.
7. The Contractor shall provide enough systems to maintain a negative pressure differential within the containment area. Negative pressure shall be demonstrated by the following:
  - a. Visual detection of negative pressure on the poly barriers or airlock doors.
  - b. Use of a negative pressure monitor hooked up to a strip chart recorder. The minimum pressure differential to be maintained in the containment area shall be a negative 0.02 inch of water (-0.02" H<sub>2</sub>O) as compared to outside the containment area. Readings shall be recorded continuously until final clearance levels have been achieved. The monitor shall be located as far away from the HEPA filtration system intakes as possible. The negative pressure monitor shall be zeroed and calibrated on a daily basis by the Contractor prior to each work-shift startup.
8. All HEPA filtration system discharge air shall be exhausted through flexible duct which shall be directed through windows to the outside of the building. Where possible, the Contractor shall install a temporary wood window [minimum thickness of 3/4-inch plywood] in place of the glass with an opening cut-to-size with respect to the flexible duct diameter. The Contractor shall seal the space between the duct and the wood window opening with duct tape or a caulking compound. The HEPA exhaust outlet shall be at least 25 feet away from all building entrances, vents or other openings.
9. If loss of power to the work area occurs, the Contractor shall immediately stop all work and proceed to seal up all openings into the work area prior to exiting the containment area. No removal work shall take place until power to the work area has been restored and all HEPA filtration systems are operating. Bagging/cleaning activities employing wet methods may take place, however.
10. The Contractor shall position the HEPA filtration systems so that airborne fiber levels are minimized throughout the work area.

E. Preparation of Work Area

1. Moveable items will be removed from the immediate work area by the Owner prior to initial setup of the containment area.
2. Shutdown air handling system to the work area.

3. The abatement Contractor shall pre-clean surfaces to remove visible asbestos-containing bulk materials.
4. All existing electrical wires, valve dampers, utility boxes, speakers, light panels, phone connections, etc., shall be pre-cleaned and covered with a minimum of one (1) layer of six (6) mil poly to prevent any water or encapsulation damage or contamination thereof. The Contractor shall take precautions to avoid any heat buildup and subsequent damage or potential fires.
5. All openings leading into or out of the containment area (critical barrier areas) shall be sealed with one layer of six (6) mil poly sheeting, duct tape, expanding foam sealant, or other suitable method.
6. All ventilation ductwork shall be pre-cleaned and wrapped with two (2) layers of six- (6) mil poly.
7. All containment walls shall have a minimum of two (2) layers of four (4)-mil poly sheeting.
8. All containment area floors excluding carpeted surfaces shall have a minimum of two (2) layers of six (6)-mil poly sheeting. All carpeted floors shall require three (3) layers of six (6)-mil poly sheeting. The sheeting shall extend at least twelve (12) inches up the pre-existing sidewalls to avoid contaminated water runoff. Each successive layer shall be installed underneath the wall poly. The first (undermost) layer of floor poly shall be installed and secured to the true wall surface with the first (undermost) layer of wall poly pulled over and secured to the floor poly. Next, the second layer (outer most layer) of floor poly shall be installed and secured to the wall poly. The second (outermost) layer of wall poly shall be pulled over and secured to the floor poly. Floor seams shall be staggered, so as to not have two (2) seams lying on top of each other.
9. Erect and install Decontamination Chamber, Equipment/Waste Transfer Chamber and engineering controls.

F. Final Preparation

1. The Contractor shall place asbestos warning signs, in accordance with OSHA requirements, along any potential access points into the work area.
2. Prior to the startup of any abatement work, the Contractor shall receive verbal approval from the Consultant. Approval shall be based on the establishment of all barriers, Decontamination Chambers, the engagement of all engineering controls, and smoke tests to determine airflow direction and the presence of leaks.

G. Gross Removal Procedures

1. Strip or remove designated ACM from facility components.
2. Continually wet all ACM with an amended water solution using an airless sprayer or Hudson sprayer with a fine-mist nozzle during abatement. Use a HEPA wet vacuum or any other approved means to avoid water accumulation on the floor poly.
3. Frequently mist the air in the work area with an amended water solution or removal encapsulant to minimize airborne fiber levels.
4. Bag all asbestos-containing waste as work progresses to prevent any ACM from drying or being re-disturbed.
5. Thoroughly brush or scrub all pipe and pipefitting surfaces, especially where corrosion or threaded pipe fittings exist.
6. Any water runoff occurring outside of the containment area shall be immediately contained using appropriate HEPA wet-dry vacuum or other approved methods. All water collected shall be treated as contaminated and disposed of accordingly.

H. Initial Clean

1. Upon completion of gross removal, the Contractor shall clean all visible bulk material and water accumulations from the floor, walls, and other surfaces.
2. The topmost layer of floor and wall poly shall be removed at this time and disposed of as asbestos waste. Caution shall be taken not to disturb the integrity of the wall and floor poly layers underneath.
3. No visible bulk ACM shall remain upon completion of the initial clean.
4. All water or debris collected shall be bagged or barreled as asbestos waste.
5. Upon completion of removal of the first layer of poly, the Contractor shall again wet-wipe or HEPA vacuum all surfaces in the containment area.

I. Encapsulation After Removal Procedures

1. Upon completion of the Initial Clean, the Contractor and Consultant shall conduct a thorough visual examination of all surfaces to determine that no visible bulk insulation or residual dust remains. Representatives of the Contractor and the Testing Laboratory shall complete a Pre-Final Inspection report, after which the following shall occur.



2. The Contractor shall apply a minimum of one (1) coat of an approved encapsulant to all surfaces within the containment area and the Decontamination Chamber's Equipment (Dirty) Room and the Equipment/Waste Transfer Chamber's Dirty Room. The Contractor shall allow the first coat to dry thoroughly prior to applying the second coat or proceeding to the final cleaning process.
3. Application shall be based on manufacturer's recommended mixture and techniques. A suitable colored dye additive shall be used in the encapsulant mixture, which can be visually identified when dry.
4. Once the encapsulation process is completed, the Contractor shall remove the second layer of poly sheeting including poly covering wires, utility boxes, etc. All critical barriers shall be left intact. All poly removed shall be bagged or barreled as asbestos-contaminated waste.
5. The Contractor shall wet-wipe or HEPA-vacuum all surfaces where poly was removed. This includes inside the Shower and Clean Rooms. All bagged waste and equipment shall be removed from the containment area.
6. With HEPA filtration systems still in operation, the Contractor shall remove and bag existing pre-filters and replace with new ones or clean pre-filters. All surfaces of the HEPA filtration systems shall be free of any visible particulate material.

J. Final Clean

1. Upon completion of encapsulation and after a minimum sixteen (16)-hour drying period, the Contractor shall re-clean all surfaces within the containment area by means of wet-cleaning or HEPA-vacuuming. The drying period may be reduced, at the discretion of the Consultant, provided all surfaces are dry with no puddles or tackiness evident.
2. All water and rags (if used) shall be frequently changed during the cleaning process.
3. All water collected inside the containment area shall be filtered prior to disposal, or disposed of as asbestos waste.
4. All debris collected shall be bagged or barreled as asbestos waste.
5. All surfaces within the containment area shall be free of any visual dust or other debris upon completion of the Final Clean. In addition, all bagged waste and equipment no longer in use, should be removed from the containment area using the procedures outlined for the Equipment/Waste Transfer Chamber.
6. The Contractor shall then inform the Testing Laboratory representative that the area is prepared for final clearance air testing, as outlined in Section 01400.

K. Disposal Activities

1. All asbestos waste must be transported directly from the project site to the disposal site. Waste from other projects may not be added to the transport container.
2. Double-bagged or barreled wastes may not be stored within the building unless approved by the Consultant and Owner. At the end of each working day, contained debris shall be hauled out to a locked dumpster or truck. The dumpster or truck shall be located in areas previously specified during the preconstruction meeting or as otherwise stated. The dumpster or truck shall be lined with a single layer of six (6) mil poly.
3. Storage of contained asbestos waste outside of the building will not be allowed unless contained in a secured dumpster to avoid potential damage due to weather or vandalism. The Contractor should coordinate the transportation of the dumpster or truck to the landfill on the same day that the dumpster or truck is loaded to avoid any overnight storage of waste outside the building.
4. All debris transported through the building to a secured dumpster/vehicle shall be double-bagged in separate six (6) mil bags or doubled-wrapped in six (6) mil poly with the appropriate asbestos OSHA label affixed.
5. All sharp objects or materials, which may puncture bags, including bags containing contaminated water, shall be contained in suitable and impermeable containers, such as fifty-five (55)-gallon fiber-pack barrels with lockable ring tops.

A barrel is re-usable providing it remains free of water and no visible debris remains after removal of the bag(s) within. All barrels containing bags with sharp objects or materials likely to puncture the bags or bags containing contaminated water shall remain sealed within the impermeable barrel and disposed of as such. Precautions shall be taken to avoid the breakage of any bags during transfer at the landfill.

6. Remove bagged debris from the vehicle at the landfill provided no visible evidence of tears, rips, or bulk debris is present. All bags with visible rips or tears shall be immediately resealed and disposed of in a barrel. All personnel disposing of the waste at the landfill shall wear full-body disposable protective suits and a half-face respirator (minimum level) equipped with HEPA cartridges.
7. The Contractor shall submit two (2) copies of the transport manifest, with all of the appropriate signatures in accordance with Section 01300.

L. Final Cleanup of Work Area

After all final clearance criteria have been met, the Contractor shall perform the following prior to re-insulation or continuation of work:

1. All remaining critical barriers, the Decontamination Chamber and the Equipment/Waste Transfer Chamber shall be removed.
2. Poly sheeting, tape, and any other debris associated with the above shall be treated and disposed of as contaminated waste.
3. All surfaces behind critical barriers or those surfaces previously covered by the Decontamination or Equipment/Waste Transfer Chambers shall be wet-wiped or HEPA-vacuumed and be visually free of any residual dust.
4. All walls, floors, trim, doors, furniture, or other fixtures are to remain in their original condition, but if damaged during the work shall be repaired and finished to match the existing material.
5. All fixtures such as fire sensors, lights, etc. removed by the Contractor prior to the abatement activities shall be remounted at this time, if it will not hinder re-insulation activities.
6. All HEPA filtration systems' air inlet openings shall be wrapped in one (1) layer (minimum) of six (6) mil poly prior to transporting the systems away from the project site.

02085 **General Glovebag Procedures**

The following are procedures that may be used in rooms where asbestos abatement will consist of the removal of less than twenty-five (25) lineal feet of pipe lagging or ten (10) square feet of asbestos-containing material per room in accordance with MDH AAR 4620.3580. These procedures may also be used in conjunction with wrap-and-cut removal methods, in accordance with MDH AAR 4620.3582.

- A. Glovebags must be constructed of transparent six (6) mil polyethylene plastic (poly) or comparable material with thermally welded seams.
- B. Each glovebag may be used on only one section of pipe insulation. Sliding or moving the glovebag during the abatement procedure is not permitted.
- C. All air-handling equipment servicing the area where abatement is to occur must be shutdown. Controls should be locked off, or marked to prevent tampering of people unaware of the abatement.
- D. Clean the area within ten (10) feet of the glovebag operation before any disturbance of asbestos-containing material.

- E. The work area should be a restricted access area. Entrances to the work area shall be posted with appropriate warning signs.
- F. Provide a remote decontamination unit.
  - 1. Personnel working within the immediate area shall wear two (2) full-body disposable suits and a PAPR equipped with HEPA cartridge(s) while in the glovebag area. Only one (1) suit shall be required if a decontamination unit is directly connected and accessible from the glovebag area.
  - 2. Before a worker leaves the asbestos work area, that worker must use a HEPA vacuum to remove potential contamination from the outer layer of protective clothing before proceeding to the remote decontamination unit.
- G. Construct critical barriers over doors, air vents, and any other openings using six (6) mil poly and duct tape. The purpose of this is to prevent the unrestricted spread of asbestos contamination should a fiber release occur. Critical barriers shall be used in both occupied and unoccupied areas.
- H. Place a drop cloth of six-(6) mil poly on the floor under the work site. It should extend ten (10) feet away from the work site.
- I. If the glove bag is to be used on one portion of a continuous section of damaged thermal system insulation, the entire damaged section shall be sealed in two (2) layers of six- (6) mil poly prior to the glovebag operation.
- J. Use glovebags according to the manufacturer's directions.
  - 1. Insert hand tools into tool pouch.
  - 2. Using duct tape, seal the upper flaps of the glovebag over the pipe or pipe fitting insulation. The seal must be airtight. Plan ahead so that the glovebag can be removed without damaging the remaining asbestos-containing material.
  - 3. Smoke test the glovebag to detect any breach in the seal. Repair any leaks and retest before commencing asbestos removal.
  - 4. Insert airless sprayer nozzle inside port of glovebag and thoroughly wet the area to be removed with an encapsulant or wetting solution.
  - 5. Insert the HEPA filtered vacuum hose into the side port and seal around it with tape. OSHA regulations require that glovebag operations must be conducted under negative air pressure. Use the vacuum as necessary to maintain a lower air pressure inside the bag than ambient pressure. (As an alternative, the entire area inside the critical barriers may be kept under negative pressure.)

6. Insert arms into arm sleeves and gloves. Remove asbestos utilizing utility knife or other means. If asbestos-containing insulation is to remain on the pipe, cut the exposed edge to a smooth surface. If fitting insulation is being removed from a pipe that is insulated with fiberglass lagging, be sure to cut away enough of the fiberglass insulation to remove any asbestos contamination present.
  7. Scrub, brush, or wet-wipe pipefitting surface to remove any residue. Pay special attention to threaded surfaces or surfaces where corrosion exists.
  8. Using sprayer, wash debris on pipefitting and sides of the bag to the bottom of bag. Wet-wipe if necessary. Also, clean gloves and arm sleeves. Encapsulate any exposed edges of ACM that will remain following removal.
  9. The Contractor and Consultant shall perform a visual inspection of the abated surface to verify the absence of ACM on the surface.
  10. Invert one arm sleeve, turning it inside out. Insert cleaned hand tools into arm sleeve. Tape around the arm sleeve, pinching the sleeve closed above the tools. Cut the glove off, cutting through the midpoint of the taped seal. Save the sealed glove to be inserted into the next glovebag used.
  11. Evacuate all remaining air from the glovebag, using the HEPA-vacuum.
  12. Squeeze bag tightly, near the top. Twist bag several times and tape around the twisted area. All removed ACM should be below the sealed point.
  13. Remove the vacuum hose from the bag. Seal the side port with tape.
  14. Place a six (6) mil asbestos disposal bag around the glovebag. Cut the glovebag down by cutting through the midpoint of the taped area, and place it inside the disposal bag. Seal the disposal bag.
- K. Air sampling shall be conducted in accordance with Section 01400.
- L. Any exposed ACM remaining must be sealed using a palm grade mastic. The resulting surface should be air tight, resilient, and impact resistant.
- M. A final visual examination of the abated area must be performed by the Consultant. The work is not complete unless no visible asbestos-containing residue remains. Encapsulated areas must have an airtight seal.
- N. Prior to exiting the glovebag area, the worker shall remove the outer disposable suit and wet-wipe their face, hands and respirator. The worker, with the innermost suit and respirator still on, shall proceed to the remote Decontamination Chamber.
- O. The drop cloth and disposable suits shall be treated as contaminated waste and disposed of as such.
- P. Disposal of asbestos waste shall be conducted in accordance with Section 02083.

## **02088 Removal of Entire Facility Components with Intact Asbestos-Containing Material**

Procedures of this section may be used when removing asbestos-containing material from a facility via "wrap-and-cut" or other similar methods, whereby asbestos-containing material is removed in sections and disposed of intact as asbestos-containing waste. All work of this type is subject to the provisions of Section 02085, this section, and MDH AAR 4620.3582.

- A. All air handling equipment servicing the area where abatement is to occur must be shutdown. Controls should be locked off, or marked to prevent tampering of people unaware of the abatement.
- B. Clean the area within ten (10) feet of the work area before any disturbance of asbestos-containing material.
- C. The work area should be a restricted access area. Entrances to the work area shall be posted with appropriate warning signs.
- D. Provide a remote decontamination unit.
  - 1. Personnel working within the immediate area shall wear two (2) full-body disposable suits and a half-face respirator equipped with HEPA cartridge(s). Only one (1) suit shall be required if a decontamination unit is directly connected and accessible from the work area.
  - 2. Before a worker leaves the asbestos work area, that worker must use a HEPA vacuum to remove potential contamination from the outer layer of protective clothing before proceeding to the remote decontamination unit.
- E. Place a drop cloth of six (6) mil poly on the floor under the work site. It should extend ten (10) feet away from the work site.
- F. Wet the ACM with amended water. Do not break the covering to wet the ACM. Maintain the ACM in a wet condition until final disposal.
- G. Wrap the component with two (2) layers of six (6) mil poly and provide an airtight seal with tape.
- H. Attach glovebags to the poly wrap (if necessary). Remove sufficient ACM, using glovebag methods as in Section 02085, if necessary to accomplish the cutting of the component into manageable sections without disturbance of ACM.
- I. Cover the encapsulated ends of the ACM with six (6) mil poly and provide an airtight seal with tape.
- J. Cut into sections at glovebag points, lowering the section to the ground (do not drop).
- K. Air sampling shall be conducted in accordance with Section 01400.

- L. Any exposed ACM remaining must be sealed using palm grade mastic. The resulting surface should be air tight, resilient, and impact resistant.
- M. A final visual examination of the abated area must be performed by the Consultant. The work is not complete unless no visible asbestos-containing residue remains.
- N. Prior to exiting the glovebag area, the worker shall remove the outer suit and wet-wipe their face, hands and respirator. The worker, with the innermost suit and respirator still on, shall proceed to the remote Decontamination Chamber.
- O. The drop cloth and disposable suits shall be treated as contaminated waste and disposed of as such.
- P. Label sections properly for transport and disposal. Disposal of asbestos waste shall be conducted in accordance with Section 02083.

## Section 02090

### Lead Abatement

#### 02091 Standard Operating Procedures

The Contractor shall be responsible for the development and implementation of the following standard operating procedures:

- A. Restrict access into the work area to only those employees or visitors previously approved to enter the area by the Owner or Consultant.
- B. Emergency exits shall be established and clearly labeled as such. They shall be secured so as to prevent access from uncontaminated areas yet permit emergency exiting. Emergency exits may include the Decontamination Chamber, Equipment/Waste Transfer Chamber, or other alternative exits approved by the Owner or Consultant. All personnel shall be trained on emergency procedures.
- C. Provide for an approved on-site superintendent (foreman) during lead abatement related procedures. A site superintendent shall be present at all times while work is being performed by the Contractor.
- D. Practice safe work procedures in the workspace. Eating, drinking, or smoking is not permitted within the containment area(s) or near any polyethylene sheeting.
- E. Provide a smoke detection system capable of monitoring the entire containment area and sounding an alert when fire conditions are detected.
- F. Provide for personal air monitoring for determination of exposures during the work on a daily basis.
- G. Utilize safe work practices at all times to prevent accidents in and around work areas.
- H. Minimize release of lead dust during all stages of the project.
- I. Be prepared to administer first aid to injured personnel at all times. Seriously injured personnel shall be treated immediately or removed without delay.

**Note:** *Extreme caution and care must be taken when moving injured personnel. Certain types of injuries can be exacerbated by movement. Unless the injured person's life is threatened, they should not be moved except by medical personnel. Consult a physician if in doubt.*

- J. Maintain all barriers and engineering control systems. Perform regular examinations to identify and immediately correct any problems encountered.



- K. Provision of fire extinguisher in containment as required by 29 CFR OSHA 1926.150 (a) (1). The fire extinguisher must be rated not less than 2A, with a least one extinguisher for every 3,000 square feet of containment area, with a travel distance not to exceed 100 feet.
- L. Provision of worker training in the use of fire fighting equipment as required by 29 CFR OSHA 1926.150 (a) (5).

## 02092 Worker Protection

- A. Engineering and work practice controls.
  - 1. Workers shall have received training on personal hygiene practices, including:
    - a. Workers shall have received training on personal hygiene practices, including:
    - b. Eating, drinking, or smoking is prohibited in the work area.
    - c. Workers shall use designated changing and wash/shower areas to avoid cross-contamination of street and work clothes.
    - d. Workers shall wash hands and face before breaks, lunch, and end of shift.
    - e. Workers shall use HEPA vacuums to clean dust from protective clothing before leaving work area.
  - 2. Prohibited activities:
    - a. Open flame burning
    - b. Use of heat guns over 700 degrees fahrenheit.
    - c. Machine sanding without attached HEPA filtration.
  - 3. On-site washing facilities and change areas shall be segregated from active abatement areas.
  - 4. Forced-air heating and ventilation systems shall be shut down, and alternate sources of heat provided, if necessary.
  - 5. Dry sweeping is prohibited.
- B. Respiratory Protection
  - 1. At a minimum, all workers shall wear half-face respirators equipped with HEPA cartridges at all times in the work area until final clearance criteria is achieved, or at any time there is potential exposure to lead. Refer to the OSHA Respiratory Protection Standard 29 CFR 1910.134, and the OSHA Lead Standard 29 CFR 1910.1025.

C. Protective Clothing and Equipment

1. The Contractor shall provide protective clothing and equipment whenever the potential of lead exposure exists.
  2. The following protective work clothing and equipment may be required during abatement, cleanup, and disposal: disposable coveralls, disposable shoe covers, gloves, vented goggles and face shields, and hats or other hair protection.
  3. Disposable shoe covers shall be removed when leaving the work area. Disposable coveralls shall be replaced daily or more often if needed.
  4. Whenever solvents, detergents or caustic agents are used, the Contractor shall provide:
    - a. Eyewashes
    - b. Appropriate protective gloves and clothing
  5. Workers shall follow these procedures upon leaving the work area.
    - a. HEPA vacuum heavily contaminated protective work clothing while still wearing.
    - b. Remove shoe covers, leave in work area.
    - c. Remove disposable coveralls in the dirty area of the designated change area. Roll down to contain dust.
  6. If at the end of the shift, the following additional procedures shall be followed.
    - a. Place coveralls and shoe covers in waste storage.
    - b. Place work clothes in closed container for laundering.
    - c. Clean protective gear and respirators.
    - d. If showers are provided as required for some types of abatement, the workers shall shower completely and wash hair. If showers are not provided, workers should shower immediately at home.
- D. The Contractor shall implement medical surveillance for all workers who are potentially exposed to lead, in accordance with OSHA regulations.
- E. All employees of the Contractor shall be informed of hazards they will be exposed to, what precautions to take, and what sources of information are available to them in accordance with the OSHA Hazard Communication Standard 29 CFR 1926.59.

## **02093 Lead Abatement Standard Procedures**

The following procedures are to be used when conducting the removal of lead or lead-containing dust or debris.

### **A. Preparation of Work Area**

1. All surfaces of the containment area must be cleaned before abatement.
2. Shutdown air handling system to the work area.
3. Clean contaminated objects to remove visible lead-containing debris.
4. Clean all existing electrical wires, valve dampers, utility boxes, light panels, phone connections, etc., scheduled to remain and cover with a minimum of one (1) layer of six (6) mil poly sealed to prevent any water or encapsulation damage or contamination thereof. The Contractor shall take precautions to avoid any heat build-up and subsequent damage or potential fires.
5. Seal all openings between the containment area and uncontaminated areas with at least one (1) layer of six (6) mil poly securely fastened to achieve and airtight seal around the opening.
6. Seal all penetrations leading into or out of the containment area (critical barrier areas), with one (1) layer of six (6) mil poly sheeting, duct tape, expanding foam sealant, or other suitable method.
7. Clean the exterior surfaces of all ventilation ductwork. Seal any HVAC openings and seams with two (2) layers of six (6) mil poly.
8. Establish containment constructed to separate and isolate the containment area from the rest of the building and the outdoors. The containment must be airtight and leak proof.
9. All containment walls shall have a minimum of two (2) layers of four (4) mil poly sheeting, overlapping to provide an airtight and leak proof seal. Freestanding containment walls shall be framed with materials painted with a nonporous paint to allow proper cleaning.

### **B. Decontamination Chamber**

1. Establish a decontamination chamber, contiguous with the work area.
2. The decontamination chamber shall consist of three (3) distinct sections as a minimum. These include the clean room, shower, and equipment room.

3. The decontamination chamber shall be constructed of two (2) separate layers of six (6) mil poly. Opaque poly shall be installed on the outside of the decontamination chamber. Each distinct section shall be separated from its adjacent room by an airlock door, which consists of 3 distinct poly door flaps or 2 sets of 2 distinct poly door flaps with a minimum of 3 feet of space between doorways.
4. The clean room shall remain free from lead contamination throughout the entirety of the project. The floor surface shall remain free from any water accumulations. The Contractor shall wet-wipe all inside surfaces within the clean room on a daily basis or more frequently as needed.
5. The clean room shall serve as a change room where workers remove all street clothing, including undergarments, and suit-up in disposable full-body protective suits. Gym shorts or other articles of clothing to be worn over the disposable suits are permitted but are required to be left inside the abatement area or Equipment Room.
6. Provide all personnel, including the Owner, Consultant and all other Authorized Visitors, with clean full-body disposable protective suits allowing for an adequate number of changes and towels for drying purposes.
7. Emergency procedures, phone numbers, and other applicable references shall be posted and be readily accessible in the clean room.
8. Provide for a fully charged dry chemical, multi-purpose type (Class ABC) fire extinguisher to be stored in the clean room.
9. Provide a completely watertight operational shower to be used for access from the clean room into the equipment room and for showering by workers exiting the work area into the clean room.
10. The shower shall have a floor drain which collects all water run-off. All water shall be directed through a water-filtering device effective for filtering particulate matter five (5) microns in size or larger. Water filters shall be treated as contaminated waste and changed on a routine basis or as needed so as to prevent water build-up in the shower basin.
11. The shower shall provide both hot and cold water, controllable from inside the shower. Absolutely no cold showering is permitted.
12. The shower shall have separate openings for ingress and egress. Single-opening showers are not permitted. Access to the containment area must pass through the shower.
13. The equipment room shall serve as storage for re-usable outerwear, gloves, boots, and other clothing and equipment.

14. Workers shall remove and dispose of their disposable protective clothing in this room prior to entering the Shower. All suits shall be placed into a labeled, six (6) mil, waste disposal bag.
15. Clean the decontamination chamber frequently to prevent water build-up or accumulation of bulk debris.

C. Decontamination Procedures

1. Entering Work Area

- a. Workers shall remove all clothing and undergarments and change into a clean full-body disposable protective suit. A respirator equipped with HEPA cartridges shall be put on and properly fitted prior to entering the shower room.
- b. The worker shall then proceed through the shower room or bypass area into equipment room. Any re-usable clothing, such as gloves or rubber boots, is put on at this point prior to entering work area.

2. Leaving Work Area

- a. The worker shall remove any visible debris from suit in work area with HEPA vacuum or water prior to entering the equipment room. All personnel should wipe their feet or spray off boots to minimize transfer of contamination into the equipment room.
- b. The worker shall remove the protective suit and dispose of it into a labeled, six (6) mil, lead waste disposal bag. All re-usable clothing shall be left in this room or sealed in a bag accordingly.
- c. With respirator still on, the worker shall proceed through the airlock door into the shower room.
- d. The worker shall wet the entire body and proceed to thoroughly rinse their respirator before removing from face. Any respirator cartridges to be re-used, where permitted, must be sealed or capped. Respirator cartridges shall be deposited into a disposable bag or left in a designated space within the shower room. The worker shall then thoroughly wash using soap and water before entering the clean room.
- e. The worker shall dry off with towels provided and change back into street clothes in the clean room. Used towels shall be deposited into a waste disposal bag when done. The individual's respirator shall be further cleaned and disinfected prior to drying it for storage.

D. Engineering Controls

1. Provide portable HEPA filtration systems positioned within the containment area. Each unit shall have a calibrated pressure gauge or equivalent device to measure the pressure drop across the internal HEPA filter. In addition, each unit shall be equipped with an audible alarm or an automatic unit shutdown mechanism to signal abnormal operation or power loss.
2. All HEPA filtration systems shall be equipped with pre-filters for the collection of larger-sized particulate matter to prolong the operating life of the internal HEPA filter. Pre-filters shall be replaced with new ones, while the unit is still running, whenever the pressure drop across the filter becomes excessive.
3. Prior to start-up, inspect all gaskets and seals for any signs of damage or openings.
4. Each unit shall be serviced by a dedicated minimum 115V-20A circuit with an overload device tied into an existing building electrical panel, which has sufficient capacity to accommodate the load of all units connected to it.
5. All HEPA filtration systems shall remain in operation twenty-four (24) hours per day, seven (7) days per week until all final clearance criteria has been met. Upon receiving approval from the Consultant, the Contractor may shutdown the systems during encapsulation.
6. The Contractor shall provide enough systems to maintain a negative pressure differential within the containment area. Negative pressure shall be demonstrated by the following:
  - a. Visual detection of negative pressure on the poly barriers or airlock doors.
  - b. The minimum pressure differential to be maintained in the containment area shall be a negative 0.02 inches of water (-0.02" H<sub>2</sub>O) as compared to outside the containment area.
7. All HEPA filtration system discharge air shall be exhausted through flexible duct which shall be directed through windows to the outside of the building. Where possible, the Contractor shall install a temporary wood window in place of the glass with an opening cut-to-size with respect to the flexible duct diameter. The Contractor shall seal the space between the duct and the wood window opening with duct tape or a caulking compound. The HEPA exhaust outlet shall be at least twenty-five (25) feet away from all building entrances, vents or other openings.

8. The amount of air exhausted from the containment must provide for at least four air changes per hour. If it is not possible to establish or maintain required negative pressure, the amount of air exhausted must be increased to six air changes per hour.
9. If loss of power to the work area occurs, the Contractor shall immediately stop all work and proceed to seal up all openings into the work area prior to exiting the containment area. No removal work shall take place until power to the work area has been restored and all HEPA filtration systems are operating.
10. The Contractor shall position the HEPA filtration systems so that airborne fiber levels are minimized throughout the work area.

E. Final Preparation

1. The Contractor shall place lead warning signs, in accordance with OSHA requirements, along any potential access points into the work area.
2. Prior to the start-up of any abatement work, the Contractor shall receive verbal approval from the Consultant. Approval shall be based on the establishment of all barriers, Decontamination Chambers, the engagement of all engineering controls, and smoke tests to determine air-flow and leaks.

F. Gross Removal Procedures

1. Continually wet all lead waste with an amended water solution using an airless or Hudson sprayer with a fine mist nozzle during abatement. Use a HEPA wet-vacuum or any other approved means to avoid water accumulation on the floor poly.
2. Strip or remove designated lead waste from facility components.
3. Any water run-off occurring outside of the containment area shall be immediately contained using an appropriate HEPA wet-dry vacuum or other approved methods. All water collected shall be treated as contaminated and disposed of accordingly.

G. Initial Cleaning

1. Upon completion of gross removal, the Contractor shall clean all visible material and water accumulations from the floor, walls, and other surfaces of the containment and the decontamination unit using HEPA vacuums and/or wet wipe methods.
2. No visible lead waste shall remain upon completion of the cleaning.
3. All water or debris collected shall be bagged or barreled as Lead waste.

4. A visual inspection of the containment and decontamination unit shall be performed after drying completely. The Contractor shall conduct a thorough visual examination of all surfaces to determine that no residual dust remains. A damp cloth should be used to confirm the absence of visible dust from horizontal surfaces (this is a qualitative test and should not be confused with dust monitoring.) Cleaning and inspections shall be repeated until the area passes visual inspection.

#### H. Removal of Containment Barriers

1. Once the initial cleaning process is completed, remove the poly sheeting, and poly covering wires, utility boxes, etc. All critical barriers shall be left intact. All poly removed shall be bagged or barreled as lead-contaminated waste.
2. Wet-wipe or HEPA-vacuum all surfaces where poly was removed. This includes inside the shower and clean rooms of the decontamination unit.
3. Remove all bagged waste and equipment from the containment area.
4. Cleaning shall include the HEPA vacuuming of all surfaces in the work area, followed by a high-phosphate wash. The wash solution shall contain at least one ounce of detergent per gallon of water. The detergent shall contain at least 5 percent trisodium phosphate (TSP). All surfaces of the work area shall be cleaned, starting with the ceiling and working down. Change wash solution regularly. A final rinse of clean water shall follow the TSP cleaning.
5. With HEPA filtration systems still in operation, the Contractor shall remove and bag existing pre-filters and replace with new ones or clean pre-filters. All surfaces of the HEPA filtration systems shall be free of any visible particulate material.
6. The Contractor shall conduct another thorough visual examination of all surfaces where wall and floor poly was present to determine that no residual dust remains. Any observed contamination must be cleaned until the area passes visual inspection.

#### I. Clearance Testing

1. Surface dust sampling shall be conducted by the testing laboratory no sooner than 24 hours after completion of post-abatement cleaning to allow airborne dust to settle onto surfaces to be tested.
2. Dust sample collection locations shall be randomly selected.
3. Clearance criteria: Dust must not contain lead in a concentration of 100 micrograms or more per square foot on floors; 250 micrograms or more per square foot on accessible, below ceiling components; and 400 micrograms or more per square foot on above ceiling components.



4. If any of the residual lead dust level results exceed the clearance criteria, the containment area shall be re-cleaned by the Contractor. Retesting by the testing laboratory shall occur at the Contractor's expense.

J. Disposal Activities

1. All lead waste must be transported directly from the project site to the disposal site. Waste from other projects may not be added to the transport container.
2. Storage of contained lead waste outside of the building will not be allowed unless contained in a secured dumpster to avoid potential damage due to weather or vandalism.
3. All debris transported through the building to a secured dumpster/ vehicle shall be double-bagged in six (6) mil bags or barreled with the appropriate Lead OSHA label affixed.
4. All sharp objects or materials which may puncture bags, including bags containing contaminated water, shall be contained in suitable and impermeable containers, such as fifty-five (55) gallon fiber-pak barrels with lockable ring tops.
5. The Contractor shall submit two (2) copies of the transport manifest, with all of the appropriate signatures in accordance with Section 01300.

K. Final Clean-up of Work Area

After all final clearance criteria have been met, the Contractor shall perform the following prior:

1. All remaining critical barriers and the Decontamination Chamber shall be removed.
2. Poly sheeting, tape, and any other debris associated with the above shall be treated and disposed of as contaminated waste.
3. All surfaces behind critical barriers or those surfaces previously covered by the Decontamination Chambers shall be wet-wiped or HEPA-vacuumed and be visually free of any residual dust.
4. A visual inspection of the work area shall be conducted following the removal of critical barriers. Areas where critical barriers had been placed shall be inspected and cleaned as specified above to ensure that no surface contamination is visible.
5. All walls, floors, trim, doors, furniture, or other fixtures are to remain in their original condition, but if damaged during the work shall be repaired and finished to match the existing material.

6. All HEPA filtration systems' air inlet openings shall be wrapped in one (1) layer (minimum) of six (6) mil poly prior to transporting the systems away from the project site.

## **02095 Chemical Stripping Agents**

The following procedures are to be used, in addition to 02093 - Lead Abatement Standard Procedures, for the removal of lead or lead dust from building components by use of chemical stripping agents.

### **A. Products**

1. Chemical stripping agents shall contain no methylene chloride. Chemical agents shall be compatible with, and not harmful to, the substrate to which they are applied.
2. Chemical stripping agent neutralizers shall be compatible with, and not harmful to, the substrate to which they are applied. Neutralizers shall be compatible with the stripping agent previously applied to the substrate.

### **B. Stripping**

1. Remove surface dust and debris by scrubbing with TSP detergent solution, followed by a clean water rinse.
2. Apply the chemical stripping agent according to manufacturer's recommendations. Remove the agent using scrapers and brushes. Repeat if necessary, until all layers of paint are removed.
3. If a caustic stripping agent is being used, a neutralizer shall be applied following the removal of all excess stripper. Rinse with clear water. Check surface pH with litmus paper. Repeat application of neutralizer and rinsing if necessary until area pH registers 7 (neutral).

### **C. Final Cleaning**

1. Final cleaning shall include the HEPA vacuuming of all surfaces in the work area, followed by a TSP wash. All surfaces of the work area shall be cleaned, starting with the ceiling and working down. Change wash solution regularly. A final rinse of clean water shall follow the TSP cleaning.

### **D. Final Inspection**

1. The inspector shall first determine that all components have been enclosed according to plan.

2. The work area shall be examined for visible dust. A damp cloth should be used to confirm the absence of visible dust from surfaces (this is a qualitative test and should not be confused with dust monitoring.)

E. Clearance Testing

1. Surface dust sampling shall be conducted by the testing laboratory no sooner than 24 hours after completion of post-abatement cleaning to allow airborne dust to settle onto surfaces to be tested.
2. Dust sample collection locations shall be randomly selected.
3. Clearance criteria: Dust must not contain lead in a concentration of 100 micrograms or more per square foot on floors; 250 micrograms or more per square foot on accessible, below ceiling components; and 400 micrograms or more per square foot on above ceiling components.
4. If any of the residual lead dust level results exceed the clearance criteria, the containment area shall be re-cleaned by the Contractor. Retesting by the testing laboratory shall occur at the Contractor's expense.

**End of Division 2**

## **Appendix A**

### Drawings

ASB.1.0 ASBESTOS ABATEMENT  
BASEMENT FLOOR PLAN  
DULUTH INTERNATIONAL AIRPORT  
MAIN TERMINAL BUILDING  
DULUTH, MINNESOTA

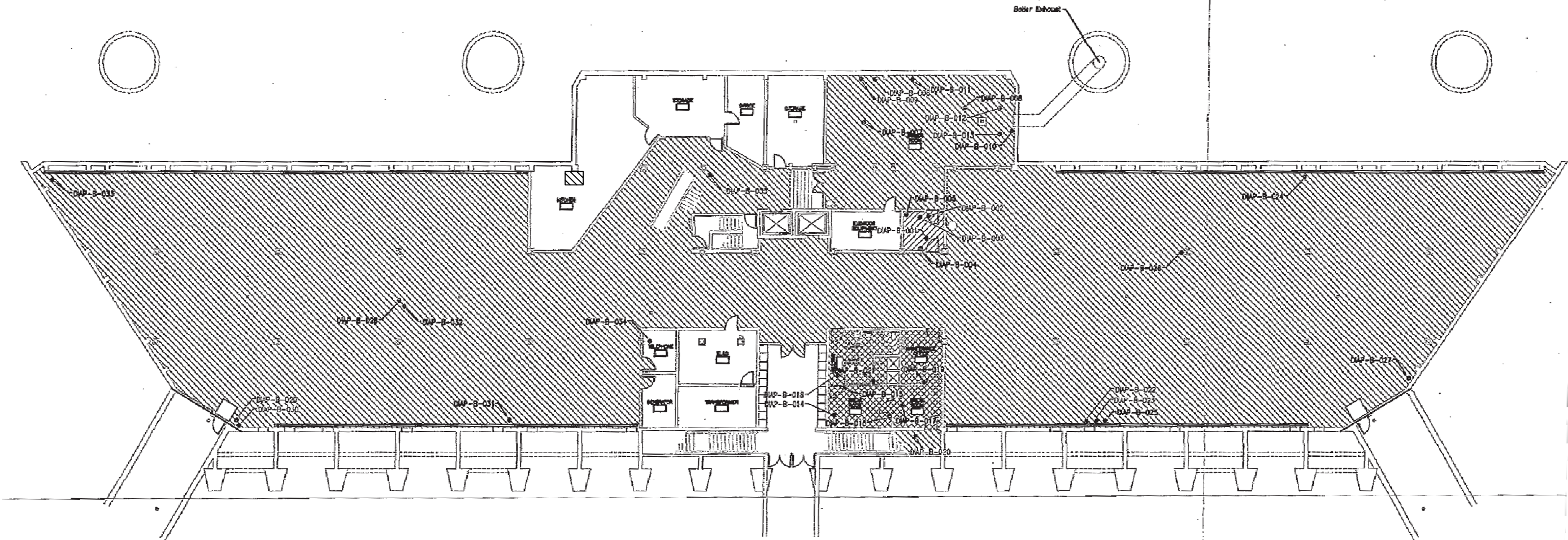
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DU1201858

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Checked By: GDK  
Last Modified: 8/7/12

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- ACM FLOOR TILE AND MASTIC
- ACM PIPE FITTINGS AND WRAP
- ACM CEILING TILE
- ACM AIR VENT INSULATION
- ACM SEALANT



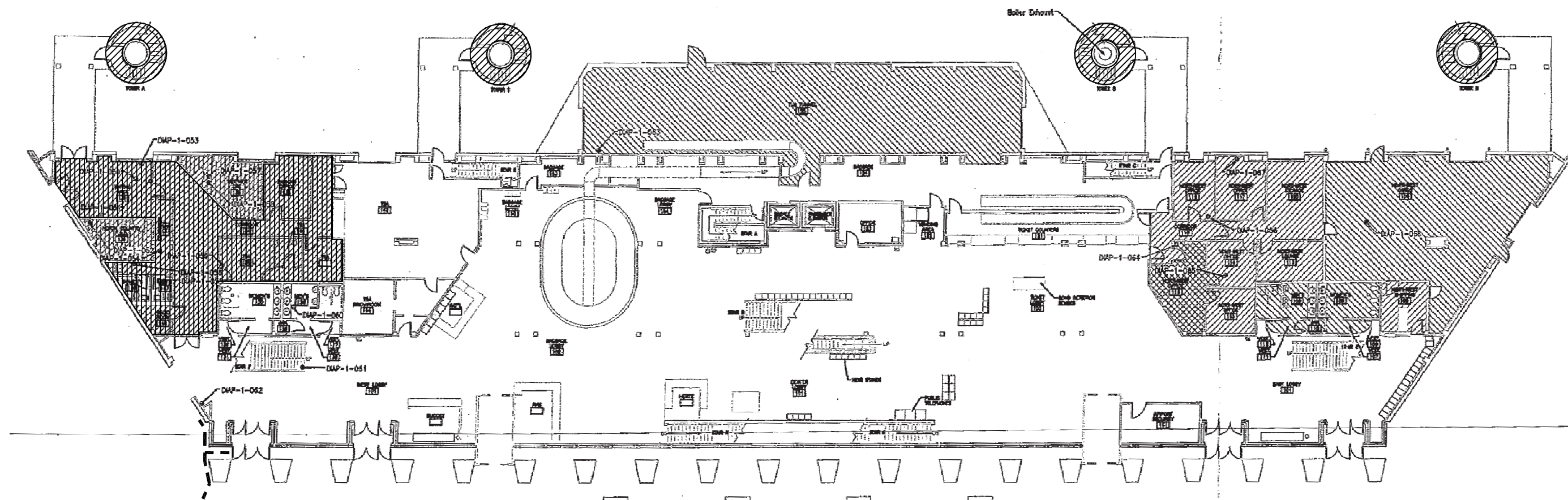
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FIRST FLOOR PLAN  
DULUTH INTERNATIONAL AIRPORT  
MAIN TERMINAL BUILDING  
DULUTH, MINNESOTA

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DU1201858

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Last Modified:	8/7/12

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## ACM FLOOR TILE AND MASTIC



## ACM PIPE FITTINGS AND WRAP



ACM CEILING TILE

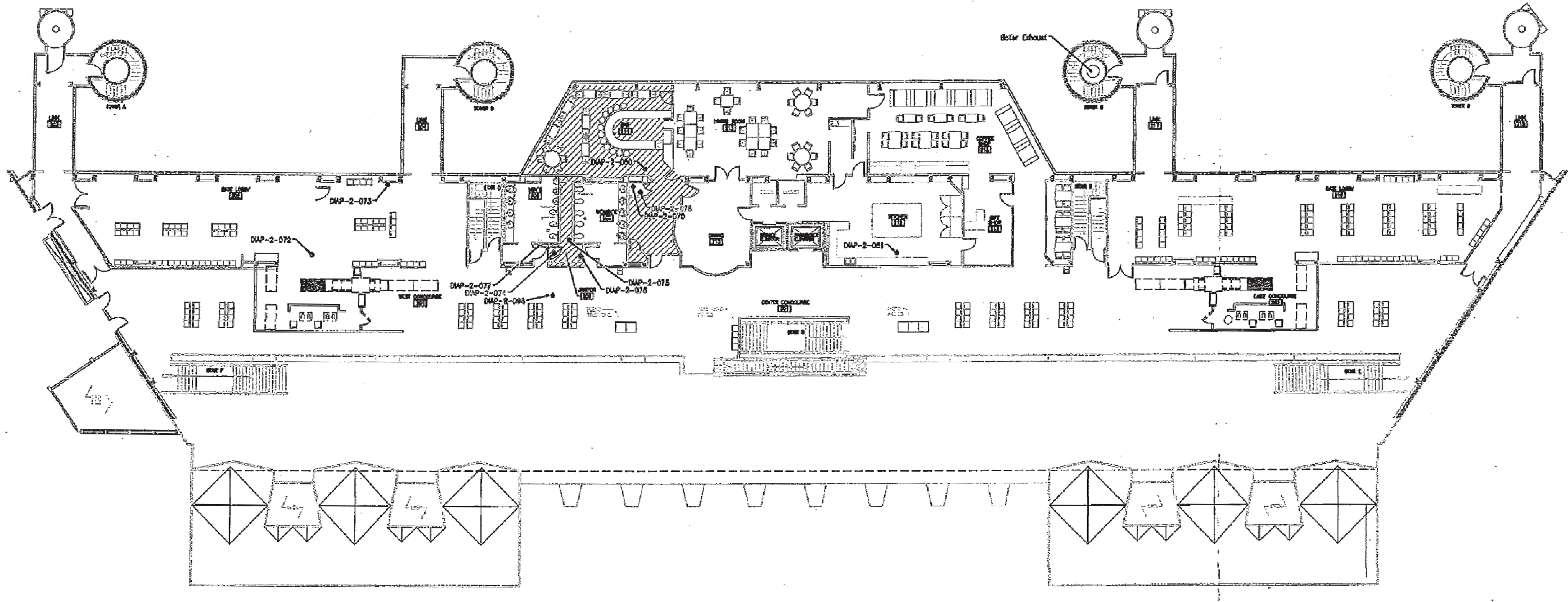


ACM AIR VENT INSULATION



ACM SEALANT

ASB.1.2 ASBESTOS ABATEMENT  
SECOND FLOOR PLAN  
DULUTH INTERNATIONAL AIRPORT  
MAIN TERMINAL BUILDING  
DULUTH, MINNESOTA



- ACM FLOOR TILE AND MASTIC
- ACM PIPE FITTINGS AND WRAP
- ACM CEILING TILE
- ACM AIR VENT INSULATION
- ACM SEALANT

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Date Drawn:	8/6/12
Checked By:	GDK
Last Modified:	8/7/12

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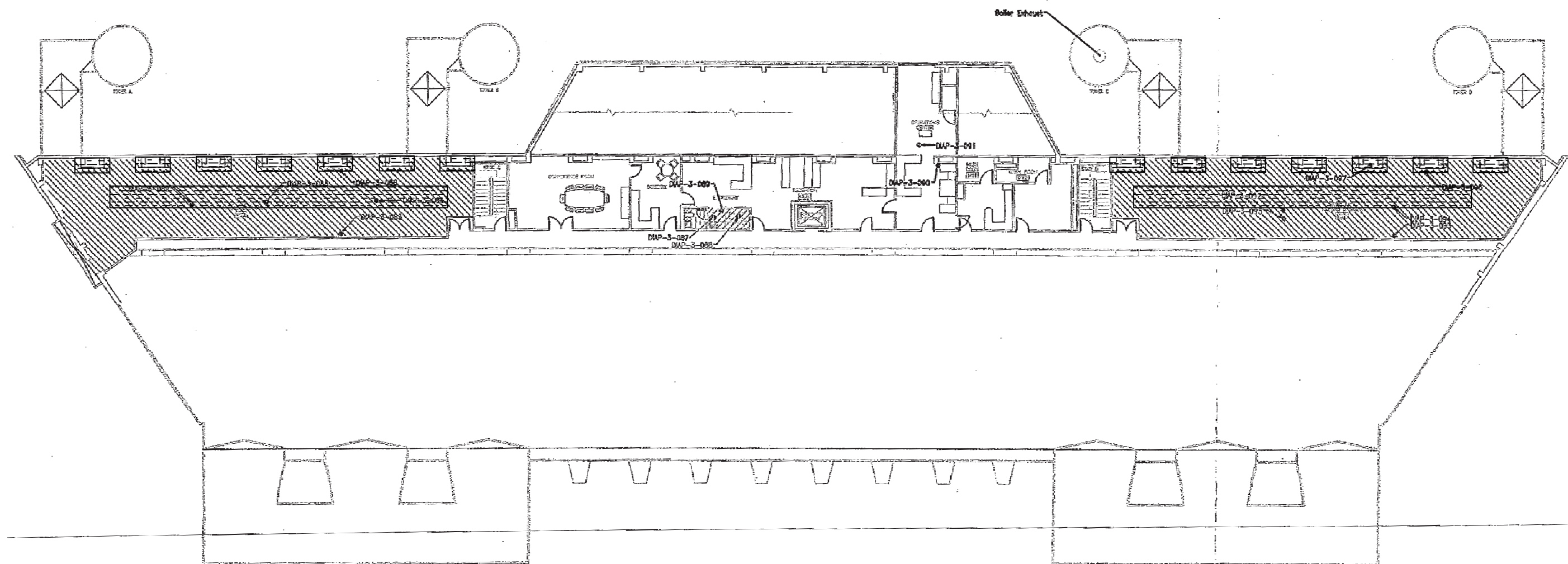
ASB.1.3 ASBESTOS ABATEMENT  
THIRD FLOOR PLAN  
DULUTH INTERNATIONAL AIRPORT  
MAIN TERMINAL BUILDING  
DULUTH, MINNESOTA

Project No:  
DU1201858

Drawing No:  
DU1201858

Scale:	NONE
Drawn By:	JAG
Date Drawn:	8/6/12
Checked By:	GDK
Last Modified:	8/7/12

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of	



ACM FLOOR TILE AND MASTIC

## ACM PIPE FITTINGS AND WRAP

ACM CEILING TILE

ACM AIR VENT INSULATION

ACM SEALANT



## **Appendix B**

### Hazardous Building Materials Inspection Report

# **Hazardous Building Materials Inspection Report**

Duluth International Airport Terminal  
4701 Grinden Drive  
Duluth, Minnesota

*Prepared for*

**Reynolds, Smith and Hills, Inc.**

Project BL-12-01858  
July 5, 2012

Braun Intertec Corporation

July 5, 2012

Project DU-12-01858

Mr. John Hippchen  
Reynolds, Smith and Hills, Inc.  
4525 Airport Approach Road, Suite A  
Duluth, Minnesota 55811

Re: Hazardous Building Materials Inspection Report  
Duluth International Airport Terminal  
4701 Grinden Drive  
Duluth, Minnesota

Dear Mr. Hippchen:

The enclosed report provides the results of the hazardous materials inspection conducted June 15, 2012 at the Duluth International Airport Terminal, 4701 Grinden Drive, Duluth, Minnesota. Braun Intertec Corporation (Braun Intertec) was authorized to provide these services in accordance with our proposal DU-12-01858 dated May 8, 2012.

The following outline provides the structure of the report.


- Scope of Services
- Site Description
- Results
- Discussion
- Limitations

If you have any questions or need further assistance, please call Gregg Kruse at 952.995.2438.

Sincerely,

BRAUN INTERTEC CORPORATION

  
Enc: Camron M. Vollbrecht  
Project Scientist

  
Gregg D. Kruse  
Principal

Attachment:  
Hazardous Building Materials Inspection Report

Pre Demo HazMat Rpt - 7-6-2012

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### Appendices:

Appendix A: Table I. Asbestos Building Inspection Results

Appendix B: Table II. Bulk Asbestos Analytical Results

Appendix C: Table III. Lead-Based Paint Testing Results

Appendix D: Table IV. Miscellaneous Hazardous/Regulated Materials

Appendix E: Asbestos Inspection Report dated January 11, 2006, prepared by EMR, Inc.

Appendix F: Braun Intertec Bulk Asbestos Analysis Report

Appendix G: Asbestos Building Inspector Certificate

## A. Scope of Services

The scope of our services was limited to:

- Visually examine accessible areas and identify the locations of suspect asbestos-containing materials (ACM), lead, poly-chlorinated biphenyls (PCB), mercury, and other miscellaneous hazardous building materials.
- Collecting and analyzing representative bulk samples of materials suspected of containing asbestos. Examples of materials to be collected for analysis include, but are not limited to: floor tile, linoleum flooring, wall and ceiling plaster, suspended and acoustical ceiling tile, sheetrock, thermal system insulation, textured ceiling material and fireproofing.
- Conducting limited lead-based paint testing of deteriorated painted surfaces suspected of containing lead. Testing was accomplished using a Niton X-ray fluorescence (XRF) spectrum analyzer.
- Documenting the various materials' current conditions and ACM quantities.
- Generating a final report documenting the sample locations, analysis results, conditions, ACM quantities and recommendations.

A copy of the "Asbestos Inspection Report" dated January 11, 2006, prepared by EMR, Inc. (EMR) was provided for our review (refer to Appendix E). This report was used as an informational reference in the preparation of this report.

## B. Site Description

The subject site is Duluth International Airport Terminal, 4701 Grinden Drive, Duluth, Minnesota. The site consists of a three story Airport Terminal with basement. The Terminal Building was constructed in 1974. An addition was constructed on the west end of the Terminal in the mid-1980s. This addition currently houses the U.S. Customs and Border Patrol. The buildings are constructed of concrete floors, concrete block and poured walls, Steel roof supports, and sheet metal roof with rubber membrane.

The building's heating, ventilation and air conditioning (HVAC) system is a combination of steam heat from boilers in the basement and forced air from HVAC units on the second and third floors, as well as the west addition. Typical interior finishes include: plaster, gypsum board (sheetrock), vinyl baseboard, ceiling tile, carpet, floor tile and concrete.

## **C. Results**

### **C.1.1. Asbestos-Containing Materials**

The following is a summary of building materials found or assumed to contain greater than 1 percent asbestos (asbestos-containing materials by regulatory definition). These results are taken from sample data collected by Braun Intertec and also information from previous asbestos testing at the site.

#### **Terminal Building**

- White/beige/tan thermal system insulation (TSI) on pipe fittings
- Brown TSI on water pipe
- Tan TSI on boiler exhausts
- White TSI on water heat converters
- White TSI on air ducts
- White 2'x2' suspended ceiling tile
- White 2'x4' suspended ceiling tile
- White 12"x12" floor tile and black mastic
- Black asphalt sealant between building and sidewalk

#### **Customs and Border Patrol – West Addition**

- No accessible ACM was observed at the time of this inspection.

### **C.1.2. Non-Asbestos-Containing Materials**

The following is a summary of building materials found to contain no asbestos or materials that contain one percent or less asbestos (non-asbestos-containing materials by regulatory definition). These results are taken from sample data collected by Braun Intertec and also information from previous asbestos testing at the site.

- Spray-on insulation/fireproofing
- 12"x12" ceiling tiles
- 2'x2' textured ceiling tiles
- 2'x2' step down ceiling tiles
- 2'x2' ribbed pattern ceiling tiles
- 2'x4' worm pattern ceiling tiles
- 2'x4' ribbed pattern ceiling tiles
- Sheetrock and joint compound

### **C.1.2. Non-Asbestos-Containing Materials (continued)**

- Plaster
- Wall texture
- Vinyl baseboard
- Vinyl stair tread
- Vinyl flooring
- Carpet mastic
- Fiberglass Insulation
- Insulation tape near HVAC doors
- Window caulking
- Asphalt air vent sealant
- Asphalt plumbing vent sealant
- Roof underlayment
- Asphalt roof sealant
- Clear roof caulk
- Black roof caulking

Please refer to Appendix A - Table I. Asbestos Building Inspection Results, which lists individual functional spaces of the building, the suspect materials identified in that functional space, whether the suspect material was identified by analysis to be an asbestos-containing material, an estimated amount of each suspect material for the functional space, and includes condition and hazard ratings based on subjective observations made by our representatives.

Please refer to Appendix B - Table II. Bulk Asbestos Analytical Results, which lists the homogenous material sample numbers, sample locations, suspect material descriptions, and the analysis results for each sample. This table summarizes the results from the Bulk Asbestos Analysis Report found in Appendix F.

Bulk asbestos analysis was conducted in accordance with the Environmental Protection Agency's (EPA) Method 40 CFR, Chapter 1, Part 763, Subpart F, and Appendix A (7/1/87 Edition). Bulk samples are retained at our laboratory for 60 days and then disposed of, unless instructed otherwise. Detailed quality-control information is available upon request.

## **C.2. Lead-Based Paint**

Testing of deteriorated painted surfaces for lead was accomplished utilizing a Niton XL X-Ray Fluorescence (XRF) field portable analyzer, Model No. XLP303A - Serial No. 22287, equipped with a 40-milcurie CD-109 source - Serial No. TR0385, installed on December 29, 2011. Analysis decision-making protocols were based on compliance with the U.S. Environmental Protection Agency (EPA) and Minnesota Department of Health (MDH), which consider any XRF result of 1.0 milligram per square centimeter (mg/cm<sup>2</sup>) or greater to be "lead-based paint." The following is a list of deteriorated (peeling/flaking) lead-based paint at the site:

### **Terminal Building**

- White paint on rubber furnace fittings in the boiler room.
- Yellow paint on traffic and parking lines on the floor of the basement parking and driving area.
- Yellow floor paint in the east HVAC room on the 3<sup>rd</sup> floor of the terminal.
- Yellow paint on parking bollards located on the north and east sides of the terminal.
- Yellow paint on the overhead doors in the northwest corner of the terminal.

### **Customs and Border Patrol – West Addition**

- No accessible lead-based paint was observed at the time of this inspection.

Please refer to Appendix C - Table III. Lead-Based Paint Testing Results, which lists the sample numbers, sample locations, component descriptions, XRF field results and the paint condition for each sample.

## **C.3. Other Hazardous/Regulated Materials**

A visual inspection for miscellaneous hazardous/regulated materials that require separate handling and disposal prior to building demolition was also performed as part of this inspection. The following is a list of the items documented at the Site.

- |                                      |                        |
|--------------------------------------|------------------------|
| ▪ Fluorescent bulbs                  | ▪ Transformers         |
| ▪ Light ballasts                     | ▪ Exit signs           |
| ▪ Thermostats                        | ▪ Door closers         |
| ▪ Fire extinguishers                 | ▪ Electrical panels    |
| ▪ Smoke detectors                    | ▪ HVAC equipment       |
| ▪ Battery back-up emergency lighting | ▪ Overhead door motors |
| ▪ Elevator and hydraulic equipment   | ▪ Miscellaneous motors |
| ▪ HVAC equipment/refrigerant         | ▪ Water heaters        |



### **C.3. Other Hazardous/Regulated Materials (continued)**

- Refrigerators/Freezers
- Miscellaneous appliances
- Computer equipment
- 55-gallon drums of boiler conditioner
- 55-gallon drums of oil
- Diesel generator
- Drinking fountains
- Security system equipment
- Televisions/monitors
- Miscellaneous office equipment
- Lead-acid batteries
- 265-gallon diesel AST

Please refer to Appendix D - Table IV. Miscellaneous Hazardous/Regulated Materials, which lists the locations and descriptions for miscellaneous hazardous/regulated materials.

## **D. Discussion**

### **D.1. Asbestos-Containing Materials**

#### **Friable ACM**

The following ACM are classified as friable materials according to EPA 40 CFR Part 61 National Emission Standard for Hazardous Air Pollutants (NESHAPs).

#### **Terminal Building**

- White/beige/tan thermal system insulation (TSI) on pipe fittings
- Brown TSI on water pipe
- Tan TSI on boiler exhausts
- White TSI on water heat converters
- White TSI on air ducts
- White 2'x2' suspended ceiling tile
- White 2'x4' suspended ceiling tile

The above friable ACM was observed to be in good condition at the time of our assessment. These ACM should be maintained in good condition to prevent potential exposure to asbestos fibers. Friable ACMs are to be removed by an MDH certified asbestos abatement contractor prior to disturbance by demolition in accordance with applicable state and federal regulations.

### **Category I Non-Friable ACM**

The following asbestos-containing materials are classified as Category I non-friable materials according to EPA NESHAPs:

#### **Terminal Building**

- White 12"x12" floor tile and black mastic
- Black asphalt sealant between building and sidewalk

The above Category I non-friable ACMs were observed to be in good condition at the time of our assessment. These ACM should be maintained in good condition to prevent potential exposure to asbestos. Category I non-friable ACM is not considered a hazard unless cut, drilled, sanded or otherwise abraded. However, any Category I non-friable ACM that may become friable during demolition must be removed prior to that activity. Category I ACM in good condition may be left in place for demolition. However, if left in place, the crushing or recycling of demolition debris is strictly prohibited. In addition, all demolition debris containing Category I ACM must be disposed of at a landfill specifically permitted to accept this type of waste.

## **D.2. Lead-Based Paint**

Building components with lead coatings or lead paint are not required to be disposed of as lead or hazardous waste, as long as the paint is adhered to its substrate prior to disturbance from demolition. If lead-based paint (XRF result of 1.0 mg/cm<sup>2</sup> or greater) is peeling or flaking, the paint that is not attached to the substrate must be removed and disposed of as lead waste in accordance with state and federal regulations, prior to disturbance from demolition.

The following components were found to have peeling or flaking lead-based paint and must be stabilized and/or removed and disposed of as lead waste in accordance with state and federal regulations, prior to disturbance from demolition.

#### **Terminal Building**

- White paint on rubber furnace fittings in the boiler room.
- Yellow paint on traffic and parking lines on the floor of the basement parking and driving area.
- Yellow floor paint in the east HVAC room on the 3<sup>rd</sup> floor of the terminal.
- Yellow paint on parking bollards located on the north and east sides of the terminal.
- Yellow paint on the overhead doors in the northwest corner of the terminal.

The U.S. Occupational Safety and Health Administration (OSHA) Lead in Construction Standard 29 CFR 1926.62 applies to all situations where employees are engaged in the disturbance of lead-containing coatings, regardless of the quantity of lead involved. Therefore, any XRF result above 0.0 mg/cm<sup>2</sup> is considered "lead-containing coatings" in order to be in compliance with the OSHA standard. Demolition of the building may involve disturbing lead-containing coatings. Contractors should be informed of the presence of lead coatings and that they will be required to comply with the OSHA lead standard.

### **D.3. Other Hazardous/Regulated Materials**

In the case of building demolition, all of the hazardous/regulated materials listed in Section C.3 must be removed and recycled or disposed of in accordance with state and federal guidelines.

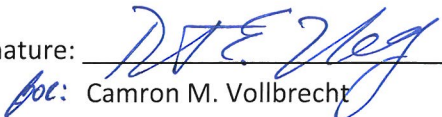
## **E. Limitations**

In any building the potential exists for hazardous building materials to be located inside walls, above ceilings, under floors, buried underground, and other inaccessible areas. This inspection attempted to identify hazardous building materials in these inaccessible areas. However, it was not feasible to inspect 100 percent of these areas. Therefore, Braun Intertec cannot be held responsible for the presence of any such hidden materials. The demolition contractor and other contractors involved in the project should be made aware of this potential. If previously unidentified suspect hazardous building materials are exposed during their activities they should be sampled and analyzed for content prior to any disturbance.

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

## **F. Asbestos Building Inspector Certification**

I, the undersigned, do hereby certify that I am an accredited Asbestos Building Inspector in the State of Minnesota. A photocopy of my current asbestos inspector certificate is attached to this section.

Signature:  Date: July 5, 2012  
for: Camron M. Vollbrecht  
Environmental Technician  
Minnesota Department of Health Asbestos Inspector No: AI9598

## **Appendix A**

### **Table I. Asbestos Building Inspection Results**

## Table I. Asbestos Building Inspection Results

Client: Reynolds, Smith, and Hills, Inc.

Location: Duluth International Airport, Duluth, MN

Date of Inspection: June 15, 2012

Project No.: DU-12-01858

Functional Space	Homogenous Material Description	Contains Asbestos (Yes/No)	Ref. Client Sample No. (see Table II)	Estimated Quantity/ Units	Material Condition <sup>1</sup>	Hazard Category <sup>2</sup>
Skyline Room	Ceiling Sheetrock	No	DIAP-R-100	12,000 sf	ND	0
Skyline Room	12"x12" Ceiling Tile	No	DIAP-R-099	800 sf	ND	0
Skyline Room	Sheetrock/Joint Compound	No	BR-100A-C	2,500 sf	ND	0
Skyline Room (bathrooms)	2'x2' Ceiling Tiles	No	BR-101	200 sf	ND	0
Skyline Room	Tan Vinyl Baseboard with Adhesive	No	BR-102	200 lf	ND	0
Skyline Room	Carpet Adhesive	No	BR-103	2,500 sf	ND	0
Skyline Room (janitor closet)	2'x2' Ceiling Tile	No	BR-104	5 sf	ND	0
Gates 3 and 4	Sheetrock/Joint Compound	No	DIAP-1-072	5,000 sf	ND	0
Gates 3 and 4	12"x12" Ceiling Tile	No	DIAP-R-098	5,000 sf	ND	0
Gates 3 and 4	Tan Vinyl Baseboard with Adhesive	No	DIAP-1-039	500 lf	ND	0
Gates 3 and 4	Carpet Adhesive	No	DIAP-1-046	5,000 sf	ND	0
Gates 3 and 4	Spray-on Insulation	No	DIAP-1-049	5,000 sf	ND	0
Gates 3 and 4	Plaster	No	DIAP-2-076	500 sf	ND	0
Gates 1 and 2	Sheetrock/Joint Compound	No	DIAP-2-072	5,000 sf	ND	0
Gates 1 and 2	12"x12" Ceiling Tile	No	DIAP-2-098	5,000 sf	ND	0
Gates 1 and 2	Tan Vinyl Baseboard with Adhesive	No	DIAP-1-039	500 lf	ND	0
Gates 1 and 2	Carpet Adhesive	No	DIAP-1-046	5,000 sf	ND	0
Gates 1 and 2	Spray-on Insulation	No	DIAP-1-049	5,000 sf	ND	0
Gates 1 and 2	Plaster	No	DIAP-2-073	500 sf	ND	0
2nd Floor West End Janitor Closet	2'x4' Ceiling Tile	No	BR-105	35 sf	ND	0
2nd Floor West End Janitor Closet	Sheetrock Tile Backer	No	BR-106	100 sf	ND	0
2nd Floor West End Janitor Closet	3" Pipe Hard Fitting	No	DIAP-2-075	5 fittings	ND	0
2nd Floor West End Janitor Closet	12"x12" White Floor Tile and Mastic	Yes	DIAP-2-074	30 sf	ND	1
2nd Floor West End Janitor Closet	Plaster	No	DIAP-2-076	30 sf	ND	0
2nd Floor West End Janitor Closet	Black Vinyl Baseboard	No	DIAP-2-077	15 lf	ND	0

**Table I. Asbestos Building Inspection Results**

Functional Space	Homogenous Material Description	Contains Asbestos (Yes/No)	Ref. Client Sample No. (see Table II)	Estimated Quantity/ Units	Material Condition <sup>1</sup>	Hazard Category <sup>2</sup>
West 2nd Floor Bathroom	2'x4' Ceiling Tile	No	BR-105	100 sf	ND	0
West 2nd Floor Bathroom	2'x2' Ceiling Tile	No	BR-101	250 sf	ND	0
Afterburner Bar	Door Threshold	No	BR-107	1 door	ND	0
Afterburner Bar	Carpet Adhesive	No	BR-108	1,200 sf	ND	0
Afterburner Bar	12"x12" White Floor Tile and Mastic	Yes	DIAP-2-078	2,000 sf	ND	1
Afterburner Bar	Sheetrock/Joint Compound	No	DIAP-1-042	2,000 sf	ND	0
Afterburner Bar	12"x12" Ceiling Tile	No	DIAP-2-080	2,000 sf	ND	0
Afterburner Kitchen	12"x12" Ceiling Tile	No	DIAP-2-080	200 sf	ND	0
Afterburner Kitchen	2'x4' Ceiling Tile	No	DIAP-2-081	2,000 sf	ND	0
Afterburner Kitchen	Gray Vinyl Baseboard with Adhesive	No	DIAP-1-047	50 lf	ND	0
Coffee Shop	12"x12" Ceiling Tile	No	DIAP-R-098	200 sf	ND	0
Coffee Shop	Sheetrock/Joint Compound	No	DIAP-2-072	1,000 sf	ND	0
Coffee Shop	2'x2' Ceiling Tiles	No	BR-109	60 sf	ND	0
2nd Floor Concourse	Carpet Adhesive	No	BR-110	Unknown	ND	0
2nd Floor Concourse	Sheetrock/Joint Compound	No	DIAP-2-072	15,000 sf	ND	0
2nd Floor Concourse	12"x12" Ceiling Tile	No	DIAP-R-098	30,000 sf	ND	0
2nd Floor Concourse	Brown Vinyl Baseboard with Adhesive	No	DIAP-2-069	350 lf	ND	0
2nd Floor Concourse	Black Vinyl Baseboard with Adhesive	No	DIAP-2-077	20 lf	ND	0
Gift Shop	Sheetrock/Joint Compound	No	DIAP-2-072	500 sf	ND	0
Gift Shop	12"x12" Ceiling Tile	No	DIAP-R-098	250 sf	ND	0
East HVAC Room	4" Pipe Hard Fitting	Yes	DIAP-3-094/095	38 Fittings	ND	2
East HVAC Room	6" Pipe Hard Fitting	Yes	DIAP-3-092/093	20 Fittings	ND	2
East HVAC Room	12"x12" Ceiling Tile	No	DIAP-R-098	10,000 sf	ND	0
East HVAC Room	Sheetrock/Joint Compound	No	DIAP-1-042	6,000 sf	ND	0
East HVAC Room	Insulating Tape near doors of the HVAC units	No	BR-111	Unknown	ND	0
East HVAC Room	Insulation on Air Vents	Yes	BR-112	10,000 sf	ND	2
West HVAC Room	4" Pipe Hard Fitting	Yes	DIAP-3-094/095	38 Fittings	ND	2
West HVAC Room	6" Pipe Hard Fitting	Yes	DIAP-3-092/093	20 Fittings	ND	2
West HVAC Room	12"x12" Ceiling Tile	No	DIAP-R-098	10,000 sf	ND	0
West HVAC Room	Sheetrock/Joint Compound	No	DIAP-1-042	6,000 sf	ND	0
West HVAC Room	Insulating Tape near doors of the HVAC units	No	BR-111	Unknown	ND	0

**Table I. Asbestos Building Inspection Results**

Functional Space	Homogenous Material Description	Contains Asbestos (Yes/No)	Ref. Client Sample No. (see Table II)	Estimated Quantity/ Units	Material Condition <sup>1</sup>	Hazard Category <sup>2</sup>
West HVAC Room	Insulation on Air Vents	Yes	BR-112	10,000 sf	ND	2
3rd Floor Conference Room	12"x12" Ceiling Tile	No	DIAP-R-098	300 sf	ND	0
3rd Floor Conference Room	Sheetrock/Joint Compound	No	DIAP-1-042	1,000 sf	ND	0
3rd Floor Conference Room	Carpet Adhesive	No	BR-110	300 sf	ND	0
3rd Floor Offices	Plaster	No	DIAP-3-086	5,000 sf	ND	0
3rd Floor Offices	12"x12" White Floor Tile and Mastic	Yes	DIAP-3-088	90 sf	ND	1
3rd Floor Offices	2'x4' Ceiling Tile	Yes	DIAP-3-087	90 sf	ND	2
3rd Floor Offices	Brown Vinyl Baseboard with Adhesive	No	DIAP-3-089	20 sf	ND	0
3rd Floor Ops Room	2'x4' Ceiling Tile	No	DIAP-3-091	90 sf	ND	0
3rd Floor Ops Room	2'x2' Step Down Ceiling Tiles	No	BR-113	100 sf	ND	0
3rd Floor Ops Room	2'x2' Ceiling Tiles	No	BR-114	30 sf	ND	0
3rd Floor Ops Room	Brown Vinyl Baseboard with Adhesive	No	DIAP-3-089	20 lf	ND	0
3rd Floor Main Hallway	Wall Texture	No	BR-115A-C	1,000 sf	ND	0
Basement Telephone Room	2'x4' Ceiling Tile	No	DIAP-B-034	60 sf	ND	0
Basement Generator Room	4" Pipe Hard Fitting	Yes	DIAP-B-002	1 Fitting	ND	2
Basement Kitchen Area	2'x4' Ceiling Tile	No	DIAP-B-017	500 sf	ND	0
Basement Kitchen Area	Brown Pipe Wrap	Yes	BR-116	6 lf	ND	2
Basement Kitchen Area	Spray-on Insulation	No	BR-117	Unknown	ND	0
Mechanical Room	12"x12" White Floor Tile with black Mastic	Yes	DIAP-B-001	100 sf	ND	1
Mechanical Room	4" Pipe Hard Fitting	Yes	DIAP-B-002	1 Fitting	ND	2
Mechanical Room	3" Pipe Hard Fitting	No	DIAP-B-003	2 Fittings	ND	0
Mechanical Room	Brown Vinyl Baseboard with Adhesive	No	DIAP-B-004	40 lf	ND	0
Mechanical Room	2'x4' Ceiling Tile	No	DIAP-B-005	100 sf	ND	0
Boiler Room	4" Pipe Hard Fitting	Yes	DIAP-B-006/007	50 Fittings	ND	2
Boiler Room	4" Pipe Hard Fitting on out of service boiler	No	DIAP-B-008	20 lf	ND	0
Boiler Room	6" Pipe Hard Fitting	Yes	DIAP-B-009/010	6 Fittings	ND	2
Boiler Room	Converter #2 Hard Insulation	Yes	DIAP-B-011	20 sf	ND	2
Boiler Room	24" Boiler Exhaust Insulation	Yes	DIAP-B-012	20 lf	ND	2
Boiler Room	24" Boiler Exhaust Insulation on out of service boiler	Yes	DIAP-B-013	20 lf	ND	2
Break Room	12"x12" White Floor Tile with black Mastic	Yes	DIAP-B-014	720 sf	ND	1
Break Room	Brown Vinyl Baseboard with mastic	No	DIAP-B-015	150 lf	ND	0
Break Room	Sheetrock/Joint Compound	No	DIAP-B-016	170 sf	ND	0

**Table I. Asbestos Building Inspection Results**

Functional Space	Homogenous Material Description	Contains Asbestos (Yes/No)	Ref. Client Sample No. (see Table II)	Estimated Quantity/ Units	Material Condition <sup>1</sup>	Hazard Category <sup>2</sup>
Break Room	2'x4' Ceiling Tile	No	DIAP-B-017	600 sf	ND	0
Break Room	2'x2' Ceiling Tiles	Yes	DIAP-B-018	200 sf	ND	2
Break Room	6" Pipe Hard Fitting	Yes	DIAP-B-020	1 Fitting	ND	2
Break Room	4" Pipe Hard Fitting	Yes	DIAP-B-021	4 Fittings	ND	2
East Garage	4" Pipe Hard Fitting	Yes	DIAP-B-022	15 Fittings	ND	2
East Garage	6" Pipe Hard Fitting	Yes	DIAP-B-023	10 Fittings	ND	2
East Garage	6" Pipe Hard Fitting	Yes	DIAP-B-024	10 Fittings	ND	2
Basement Parking Area	Spray-on Insulation	No	DIAP-B-025	20,500 sf	ND	0
Basement Parking Area	Spray-on Insulation	No	DIAP-B-026	20,500 sf	ND	0
Basement Parking Area	Spray-on Insulation	No	DIAP-B-027	20,500 sf	ND	0
Basement Parking Area	Spray-on Insulation	No	DIAP-B-032	20,500 sf	ND	0
Basement Parking Area	Spray-on Insulation	No	DIAP-B-033	20,500 sf	ND	0
West Garage	4" Pipe Hard Fitting	Yes	DIAP-B-028	15 Fittings	ND	2
West Garage	4" Pipe Hard Fitting	Yes	DIAP-B-029	15 Fittings	ND	2
West Garage	6" Pipe Hard Fitting	Yes	DIAP-B-030	10 Fittings	ND	2
West Garage	6" Pipe Hard Fitting	Yes	DIAP-B-031	10 Fittings	ND	2
Weather One Office Area	2'x4' Ceiling Tile	Yes	BR-118	2,100 sf	ND	2
Weather One Office Area	12"x12" White Floor Tile and Mastic	Yes	DIAP-1-064	2,100 sf	ND	1
Weather One Office Area	Brown Vinyl Baseboard with mastic	No	DIAP-1-066	400 lf	ND	0
Weather One Office Area	Plaster	No	DIAP-1-067	5,000 sf	ND	0
Loading Ramp	4" Pipe Hard Fitting	Yes	DIAP-1-035	2 Fittings	ND	2
Weather One	3" Pipe Hard Fitting	Yes	DIAP-1-057	2 Fittings	ND	2
Weather One	Spray-on Insulation	No	DIAP-1-058	20,500 sf	ND	0
N. Country Area	12"x12" White Floor Tile and Mastic	Yes	DIAP-1-050	2,100 sf	ND	1
N. Country Area	Brown Vinyl Baseboard	No	DIAP-1-051	200 lf	ND	0
N. Country Area	Plaster	No	DIAP-1-053	4,600 sf	ND	0
N. Country Area	2'x4' Ceiling Tile	No	DIAP-1-054	300 sf	ND	0
N. Country Area Hallway	Brown Vinyl Baseboard with Adhesive	No	DIAP-1-056	150 lf	ND	0
N. Country Bathrooms	2'x4' Ceiling Tile	Yes	DIAP-1-055	85 sf	ND	2
1st Floor Customs Clearing Area	2'x2' Ribbed Ceiling Tile	No	DIAP-1-036	1,500 sf	ND	0
1st Floor Customs Clearing Area	Brown Vinyl Baseboard with Adhesive	No	DIAP-1-037	80 lf	ND	0
Customs Clearing Bathroom	White/grey floor linoleum	No	DIAP-1-038	400 sf	ND	0
Customs Clearing Bathroom	Tan Vinyl Baseboard with Adhesive	No	DIAP-1-039	80 lf	ND	0



**Table I. Asbestos Building Inspection Results**

Functional Space	Homogenous Material Description	Contains Asbestos (Yes/No)	Ref. Client Sample No. (see Table II)	Estimated Quantity/ Units	Material Condition <sup>1</sup>	Hazard Category <sup>2</sup>
Customs Clearing Area	2'x4' Wormy Ceiling Tile	No	DIAP-1-040	2,300 sf	ND	0
Customs Clearing Area	Red Vinyl Baseboard with Adhesive	No	DIAP-1-041	500 lf	ND	0
Customs Clearing Area	Sheetrock/Joint Compound	No	DIAP-1-042	60,000 sf	ND	0
Customs Clearing Area	3" Pipe Hard Fitting	No	DIAP-1-043	30 Fittings	ND	0
Customs Electrical Room	Brown Vinyl Baseboard with Adhesive	No	DIAP-1-044	80 lf	ND	0
Customs Search Room	3" Pipe Hard Fitting	No	DIAP-1-045	3 Fittings	ND	0
Customs Area (janitors Closet)	2'x2' Textured Ceiling Tile	No	BR-119	10 sf	ND	0
Utility Room	Carpet Adhesive	No	DIAP-1-046	600 sf	ND	0
Utility Room	Gray Vinyl Baseboard with Adhesive	No	DIAP-1-047	120 lf	ND	0
Utility Room	Sheetrock/Joint Compound	No	DIAP-1-048	9,000 sf	ND	0
TSA Area	2'x4' Ceiling Tile	No	DIAP-1-065	35sf	ND	0
TSA Area	Grey Vinyl Baseboard/Tan Mastic	No	BR-120	50 lf	ND	0
X-Ray Room	Spray Insulation	No	BR-121	5,000 sf	ND	0
X-Ray Room	Sheetrock/Joint Compound	No	BR-122	5,000 sf	ND	0
NW Offices	12"x12" White Floor Tile with Black Mastic	Yes	DIAP-1-064	2,100 sf	ND	1
NW Offices	2'x4' Wormy Ceiling Tile	No	DIAP-1-065	2,100 sf	ND	0
NW Offices	Brown Vinyl Baseboard with Adhesive	No	DIAP-1-066	400 lf	ND	0
NW Offices	Carpet Adhesive	No	BR-123	2,100 sf	ND	0
NW Offices	Plaster	No	DIAP-1-067	5,000 sf	ND	0
NW Cargo Area	4" Pipe Hard Fitting	Yes	DIAP-1-068	21 Fittings	ND	2
E. Tug Tunnel	3" Pipe Hard Fitting	Yes	DIAP-1-063	1 Fitting	ND	2
Main Floor Concourse	12"x12" Ceiling Tile	No	DIAP-R-099	26,000 sf	ND	0
Main Floor Concourse	Sheetrock/Joint Compound	No	DIAP-R-100	12,000 sf	ND	0
Main Floor Concourse	Stair Treads	No	DIAP-1-061	300 sf	ND	0
Main Floor Concourse	Plaster	No	DIAP-1-062	20,000 sf	ND	0
Main Floor Concourse	3" Pipe Hard Fitting	Yes	DIAP-1-052	3 Fittings	ND	2
East Roof	Clear Caulking	No	BR-124	2,000 lf	ND	0
East Roof	Asphalt Sealant on Main Roof	No	BR-125	2,000 lf	ND	0
East Roof	Roof Underlayment	No	BR-126	50,000 sf	ND	0
Customs Area Roof	Clear Caulk	No	BR-127	2,000 lf	ND	0
Customs Area Roof	Asphalt Air Vent Sealant	No	BR-128	250 sf	ND	0
Customs Area Roof	Asphalt Plumbing Vent Sealant	No	BR-129	2 sf	ND	0

**Table I. Asbestos Building Inspection Results**

Functional Space	Homogenous Material Description	Contains Asbestos (Yes/No)	Ref. Client Sample No. (see Table II)	Estimated Quantity/ Units	Material Condition <sup>1</sup>	Hazard Category <sup>2</sup>
Exterior	Asphalt Sealant between building and sidewalk near sw corner of main terminal	Yes	BR-130	3 sf	ND	1
Exterior	Window Calking	No	BR-131	Unknown	ND	0
Exterior	Expansion Joint between building and sidewalk	No	BR-132	Unknown	ND	0
Loading Towers	Brown Vinyl Baseboard with mastic	No	DIAP-2-069	50 lf	ND	0
Loading Towers	12"x12" Floor Tile and Mastic with Mastic	Yes	DIAP-B-001	500 sf	ND	1

**1. Condition of ACM**

ND = Not Damaged

D = Damaged

SD = Significantly Damaged

**2. Hazard Category**

0 — No hazard - material does not contain asbestos.

1 — ACM with potential for damage.

2 — ACM with potential for significant damage.

3 — Damaged or significantly damaged asbestos-containing miscellaneous material.

4 — Damaged or significantly damaged friable asbestos-containing thermal system insulation.

5 — Damaged or significantly damaged friable asbestos-containing surfacing material.

sf = square feet

lf = lineal feet

## **Appendix B**

### **Table II. Bulk Asbestos Analytical Results**

## Table II. Bulk Asbestos Analytical Results

Client: Reynolds, Smith, and Hills, Inc.  
 Location: Duluth International Airport, Duluth, MN  
 Date of Inspection: June 15, 2012  
 Project No.: DU-12-01858

Sample No.	Sample Location	Material	Asbestos Content (%) <sup>1</sup>
BR-100A-C	Skyline Room	Sheetrock/Joint Compound	N.D. <sup>2</sup>
BR-101	Skyline Room (bathrooms)	2'x2' Ceiling Tile	N.D.
BR-102	Skyline Room	Tan Vinyl Baseboard with Adhesive	N.D.
BR-103	Skyline Room	Carpet Adhesive	N.D.
BR-104	Skyline Room (janitor closet)	2'x2' Ceiling Tile	N.D.
BR-105	2nd Floor West End Janitor Closet	2'x4' Ceiling Tile	N.D.
BR-106	2nd Floor West End Janitor Closet	Sheetrock Tile Backer	N.D.
BR-107	Afterburner Bar	Door Threshold	N.D.
BR-108	Afterburner Bar	Carpet Adhesive	N.D.
BR-109	Coffee Shop	2'x2' Ceiling Tile	N.D.
BR-110	2nd Floor Concourse	Carpet Mastic	N.D.
BR-111	West HVAC Room	Insulating Tape near doors of the HVAC units	N.D.
BR-112	West HVAC Room	Insulation on Air Vents	Chrysotile 4%
BR-113	3rd Floor Ops Room	2'x2' Step Down Ceiling Tile	N.D.
BR-114	3rd Floor Ops Room	2'x2' Ceiling Tile	N.D.
BR-115A-C	3rd Floor Main Hallway	Wall Texture	N.D.
BR-116	Basement Kitchen Area	Brown Pipe Wrap	Chrysotile 5%
BR-117	Basement Kitchen Area	Spray-on Insulation	N.D.
BR-118	NW Offices	2'x4' Suspended Ceiling Panels	Chrysotile 2%
BR-119	Customs Area (janitors Closet)	2'x2' Textured Ceiling Tile	N.D.
BR-120	TSA Area	Gray Vinyl Baseboard with Adhesive	N.D.
BR-121	X-Ray Room	Spray Insulation	N.D.
BR-122	X-Ray Room	Sheetrock/Joint Compound	N.D.
BR-123	Northwest Offices	Carpet Adhesive	N.D.
BR-124	East Roof	Clear Caulking	N.D.
BR-125	East Roof	Asphalt Sealant on Main Roof	N.D.
BR-126	East Roof	Roof Underlayment	N.D.
BR-127	Customs Area Roof	Clear Caulk	N.D.
BR-128	Customs Area Roof	Asphalt Air Vent Sealant	N.D.
BR-129	Customs Area Roof	Asphalt Plumbing Vent Sealant	N.D.
BR-130	Exterior	Black Asphalt Sealant between building and sidewalk in sw corner of main terminal	Chrysotile 5%
BR-131	Exterior	Window Calking	N.D.
BR-132	Exterior	Expansion Joint between building and sidewalk	N.D.
DIAP-B-001	Mechanical Room	12"x12" White Floor Tile with Black Mastic	Floor Tile: 7% Chrysotile, Mastic: 10% Chrysotile
DIAP-B-002	Mechanical Room	4" Pipe Hard Fitting	70% Chrysotile
DIAP-B-003	Mechanical Room	3" Pipe Hard Fitting	<1% Chrysotile

1. Asbestos content is indicated as an approximate percent by area.

2. N.D. = None Detected

**Table II. Bulk Asbestos Analytical Results**

Sample No.	Sample Location	Material	Asbestos Content (%) <sup>1</sup>
DIAP-B-004	Mechanical Room	Brown Vinyl Baseboard with mastic	N.D.
DIAP-B-005	Mechanical Room	2'x4' Ceiling Tile	N.D.
DIAP-B-006	Boiler Room	4" Pipe Hard Fitting	60% Chrysotile
DIAP-B-007	Boiler Room	4" Pipe Hard Fitting	N.D.
DIAP-B-008	Boiler Room	4" Pipe Hard Fitting on out of service boiler	N.D.
DIAP-B-009	Boiler Room	6" Pipe Hard Fitting	30% Chrysotile
DIAP-B-010	Boiler Room	6" Pipe Hard Fitting	N.D.
DIAP-B-011	Boiler Room	Converter #2 Hard Insulation	30% Chrysotile
DIAP-B-012	Boiler Room	24" Boiler Exhaust Insulation	5% Chrysotile
DIAP-B-013	Boiler Room	24" Boiler Exhaust Insulation on out of service boiler	5% Chrysotile
DIAP-B-014	Break Room	12"x12" White Floor Tile with Black Mastic	Floor Tile: 7% Chrysotile, Mastic: 10% Chrysotile
DIAP-B-015	Break Room	Brown Vinyl Baseboard with mastic	N.D.
DIAP-B-016	Break Room	Sheetrock/Joint Compound	N.D.
DIAP-B-017	Break Room	2'x4' Ceiling Tile	N.D.
DIAP-B-018	Break Room	2'x2' Ceiling Tile	3% Chrysotile
DIAP-B-019	Maint. Office	Brown Vinyl Baseboard with mastic	N.D.
DIAP-B-020	Maint. Office	6" Pipe Hard Fitting	70% Chrysotile
DIAP-B-021	Break Room Bath	4" Pipe Hard Fitting	N.D.
DIAP-B-022	East Garage	4" Pipe Hard Fitting	70% Chrysotile
DIAP-B-023	East Garage	6" Pipe Hard Fitting	70% Chrysotile
DIAP-B-024	East Garage	6" Pipe Hard Fitting	N.D.
DIAP-B-025	Basement Parking Area	Spray-on Insulation	N.D.
DIAP-B-026	Basement Parking Area	Spray-on Insulation	N.D.
DIAP-B-027	Basement Parking Area	Spray-on Insulation	N.D.
DIAP-B-028	West Garage	4" Pipe Hard Fitting	<1% Chrysotile
DIAP-B-029	West Garage	4" Pipe Hard Fitting	70% Chrysotile
DIAP-B-030	West Garage	6" Pipe Hard Fitting	70% Chrysotile
DIAP-B-031	West Garage	6" Pipe Hard Fitting	N.D.
DIAP-B-032	Basement Parking Area	Spray-on Insulation	N.D.
DIAP-B-033	Basement Parking Area	Spray-on Insulation	N.D.
DIAP-B-034	Telephone Room	2'x4' Worm Pattern Ceiling Tile	N.D.
DIAP-B-035	Loading Ramp	4" Pipe Hard Fitting	50% Chrysotile
DIAP-1-036	1st Floor Customs Clearing Area	2'x2' Ribbed Ceiling Tile	N.D.
DIAP-1-037	1st Floor Customs Clearing Area	Brown Vinyl Baseboard with Adhesive	N.D.
DIAP-1-038	Customs Clearing Bathroom	White/grey floor linoleum	N.D.
DIAP-1-039	Customs Clearing Bathroom	Tan Vinyl Baseboard	N.D.
DIAP-1-040	Customs Clearing Area	2'x4' Wormy Ceiling Tile	N.D.
DIAP-1-041	Customs Clearing Area	Red Vinyl Baseboard	N.D.
DIAP-1-042	Customs Clearing Area	Sheetrock/Joint Compound	N.D.
DIAP-1-043	Customs Clearing Area	3" Pipe Hard Fitting	N.D.

1. Asbestos content is indicated as an approximate percent by area.

2. N.D. = None Detected

**Table II. Bulk Asbestos Analytical Results**

Sample No.	Sample Location	Material	Asbestos Content (%) <sup>1</sup>
DIAP-1-044	Customs Electrical Room	Brown Vinyl Baseboard with mastic	N.D.
DIAP-1-045	Customs Search Room	3" Pipe Hard Fitting	N.D.
DIAP-1-046	Utility Room	Carpet Adhesive	N.D.
DIAP-1-047	Utility Room	Gray Vinyl Baseboard	N.D.
DIAP-1-048	Utility Room	Sheetrock/Joint Compound	N.D.
DIAP-1-049	W Passenger Lounge	Spray-on Insulation	N.D.
DIAP-1-050	N. Country Area	12"x12" White Floor Tile with Black Mastic	Floor Tile: 3% Chrysotile, Mastic: 10% Chrysotile
DIAP-1-051	N. Country Area	Brown Vinyl Baseboard with mastic	N.D.
DIAP-1-052	N. Country Area	3" Pipe Hard Fitting	50% Chrysotile
DIAP-1-053	N. Country Area	Plaster	N.D.
DIAP-1-054	N. Country Area Hallway	Ceiling Tile	N.D.
DIAP-1-055	N. Country Bathrooms	Ceiling Tile	3% Chrysotile
DIAP-1-056	N. Country Area Hallway	Brown Vinyl Baseboard with mastic	N.D.
DIAP-1-057	Weather One	3" Pipe Hard Fitting	50% Chrysotile
DIAP-1-058	Weather One	Spray-on Insulation	N.D.
DIAP-1-059	TSA Area	Black Vinyl Baseboard with mastic	N.D.
DIAP-1-060	W. Passenger Area Bathroom	2'x2' Ceiling Tile	N.D.
DIAP-1-061	Stair Case	Vinyl Stair Tread	N.D.
DIAP-1-062	W. Passenger Area	Plaster	N.D.
DIAP-1-063	E. Tug Tunnel	3" Pipe Hard Fitting	70% Chrysotile
DIAP-1-064	NW Offices	12"x12" White Floor Tile with Black Mastic	Tile: 5% Chrysotile, Mastic: 10% Chrysotile
DIAP-1-065	NW Offices	2'x4' Worm Pattern Ceiling Tile	N.D.
DIAP-1-066	NW Offices	Brown Vinyl Baseboard with mastic	N.D.
DIAP-1-067	NW Offices	Plaster	N.D.
DIAP-1-068	NW Cargo Area	4" Pipe Hard Fitting	45% Chrysotile
DIAP-2-069	Skyline Lounge	Brown Vinyl Baseboard with mastic	N.D.
DIAP-2-070	Skyline Lounge	Sheetrock/Joint Compound	N.D.
DIAP-2-071	Skyline Lounge	12"x12" White Speckled Floor Tile with tan Mastic	N.D.
DIAP-2-072	West Gate Lobby	Sheetrock/Joint Compound	N.D.
DIAP-2-073	W. Concourse Observ/Lounge	Plaster	N.D.
DIAP-2-074	W Concourse Janitor Closet	12"x12" White Speckled Floor Tile with Tan Mastic	Floor Tile: 4% Chrysotile, Mastic: 10% Chrysotile
DIAP-2-075	W Concourse Janitor Closet	3" Hard Pipe Fitting	N.D.
DIAP-2-076	W Concourse Janitor Closet	Plaster	N.D.
DIAP-2-077	W Concourse Bathroom Area	Black Vinyl Baseboard with mastic	N.D.
DIAP-2-078	Bar Closet	12"x12" White Floor Tile with Black Mastic	Floor Tile: N.D. Mastic: 3% Chrysotile
DIAP-2-079	Bar Closet	Spray-on Insulation	N.D.

1. Asbestos content is indicated as an approximate percent by area.

2. N.D. = None Detected

**Table II. Bulk Asbestos Analytical Results**

Sample No.	Sample Location	Material	Asbestos Content (%) <sup>1</sup>
DIAP-2-080	Bar	12"x12" Ceiling Tile	N.D.
DIAP-2-081	Kitchen	2'x4' Ceiling	N.D.
DIAP-3-082	West HVAC Room	6" Hard Pipe Fitting	80% Chrysotile
DIAP-3-083	West HVAC Room	6" Hard Pipe Fitting	70% Chrysotile
DIAP-3-084	West HVAC Room	4" Hard Pipe Fitting	Fitting: 3% Chrysotile, Wrap: 70% Chrysotile
DIAP-3-085	West HVAC Room	4" Hard Pipe Fitting	Fitting: 3% Chrysotile, Wrap: 70% Chrysotile
DIAP-3-086	West HVAC Room	Plaster	N.D.
DIAP-3-087	Reception Area Coffee Room	2'x4' Ceiling Tile	3% Chrysotile
DIAP-3-088	Reception Area Coffee Room	White 12"x12" Vinyl Floor Tile with Black Mastic	Floor Tile: 5% Chrysotile, Mastic: 10% Chrysotile
DIAP-3-089	Reception Area Coffee Room	Brown Vinyl Baseboard with Adhesive	N.D.
DIAP-3-090	Operations Center Office	Brown Vinyl Baseboard with Adhesive	N.D.
DIAP-3-091	Operations Center Office	2'x4' ribbed/speckled white Ceiling Tile	N.D.
DIAP-3-092	East HVAC Room	6" Hard Pipe Fitting	Fitting: 3% Chrysotile, Wrap: 65% Chrysotile
DIAP-3-093	East HVAC Room	6" Hard Pipe Fitting	Fitting: 3% Chrysotile, Wrap: 70% Chrysotile
DIAP-3-094	East HVAC Room	4" Hard Pipe Fitting	Fitting: 3% Chrysotile, Wrap: 70% Chrysotile
DIAP-3-095	East HVAC Room	4" Hard Pipe Fitting	Chrysotile 70%
DIAP-3-096	West HVAC Room	Plaster	N.D.
DIAP-3-097	West HVAC Room	Spray-on Insulation	N.D.
DIAP-3-098	Main Terminal	12"x12" Ceiling Tile	N.D.
DIAP-3-099	Skyline Room	12"x12" Ceiling Tile	N.D.
DIAP-3-100	Skyline Room	Ceiling Sheetrock	N.D.
DIAP-1-101	Customs Clearing Area	3" Pipe Hard Fitting	N.D.
DIAP-1-102	Customs Clearing Area	3" Pipe Hard Fitting	N.D.

1. Asbestos content is indicated as an approximate percent by area.

2. N.D. = None Detected

## **Appendix C**

### **Table III. Lead-Based Paint Testing Results**



### Table III. Lead Based Paint Testing Results

Client: Reynolds, Smith, and Hills, Inc.

Location: Duluth International Airport, Duluth, MN

Date of Inspection: June 15, 2012

Project No.: DU-12-01858

Sample No.	Sample Location	Component Description	Lead Content (mg/cm <sup>2</sup> )	Lead-Based Paint (Yes/No)	Paint Condition
1	Basement Mech Room	Red Paint	0.29	No	Peeling
2	Basement Mech Room	White Paint on Rubber Pipe Fittings	18.90	Yes	Peeling
3	Basement Mech Room	White Paint on Sewer Pipe	0.00	No	Peeling
4	Basement Parking Area	Tan HVAC Vent Paint	0.00	No	Peeling
5	Basement Parking Area	Yellow Floor Paint	18.00	Yes	Peeling
6	Basement Parking Area	Yellow Parking Line Paint	25.00	Yes	Peeling
7	Concourse 1st Floor	White Paint on Ceiling Beam	0.00	No	Peeling
8	Concourse 1st Floor	White Wall Paint	0.00	No	Peeling
9	1st Floor Baggage Claim	White Wall Paint	0.00	No	Peeling
10	1st Floor West Entrance	White Wall Paint	0.00	No	Peeling
11	1st Floor Tug Tunnel	Yellow Paint on Bollards	0.00	No	Peeling
12	2nd Floor Skylights	Pink Paint	0.00	No	Peeling
13	3rd Floor West HVAC	White Wall Paint	0.00	No	Peeling
14	3rd Floor West HVAC	White Equipment Paint	0.01	No	Peeling
15	3rd Floor East HVAC	Yellow Floor Paint	2.40	Yes	Peeling
16	3rd Floor East HVAC	White Wall Paint	0.00	No	Peeling
17	3rd Floor East HVAC	White Equipment Paint	0.00	No	Peeling
18	3rd Floor Operations Office	White Beam Paint	0.00	No	Peeling
19	Concrete Beams on the Exterior of Terminal	Tan Paint	0.00	No	Peeling
20	Concrete Beams on the Exterior of Terminal	White Paint	0.01	No	Peeling
21	Metal Roof	Brown Paint	0.00	No	Peeling
22	Generator Exhaust Pipe	Brown Paint	0.01	No	Peeling
23	Metal Railing on West e0.00 of Terminal	Black Paint	0.00	No	Peeling
24	Concrete Curb	Yellow Paint	0.02	No	Peeling
25	Bollards Near East OH Doors	Yellow Paint	9.60	Yes	Peeling
26	Mechanical Piping on N side of Terminal	Grey Paint	0.00	No	Peeling
27	Northwest OH Doors	Yellow Paint	1.10	Yes	Peeling

The U.S. Environmental Protection Agency, MN Pollution Control Agency and MN Department of Health consider any XRF result of 1.0 milligrams per square centimeter (mg/cm<sup>2</sup>) or greater to be "lead-based paint".

## **Appendix D**

### **Table IV. Miscellaneous Hazardous/Regulated Materials**

**Table IV. Miscellaneous Hazardous/Regulated Materials**
*Providing engineering and environmental solutions since 1957*

Client: Reynolds, Smith and Hills, Inc.  
 Location: Duluth International Airport  
 Date of Inspection: 6/15/12  
 Project No.: DU-12-01858

Location	Identification
Gates 3 and 4	Electric switches
	Door Closers
	Overhead Door Motor
	Thermostat
	Fluorescent Light Ballast and Bulbs
	Computer Equipment
	Security Equipment
	Exit Signs
Gates 1 and 2	Electric switches
	Door Closers
	Overhead Door Motor
	Thermostat
	Fluorescent Light Ballast and Bulbs
	Computer Equipment
	Exit Signs
	Security Equipment
Skyline Room	Electric Switches and Panel
	Air Handling Motor
	Door Closers
	Fluorescent Light Bulbs and Ballast
Afterburner Bar and Kitchen	Door Closers
	Fluorescent Light Bulb and Ballast
	Thermostat
	Kitchen Appliances
	Ansul® System
	Fan Motors
2 <sup>nd</sup> Floor Concourse and Bathrooms	Door Closers
	Thermostats
	Fluorescent Light Bulbs and Ballasts
East HVAC Room	Air Handling Units
	Electrical Panels
East HVAC Room	Electrical Switches
	Door Closers
	Emergency Lights
	Electrical Motors
	Fluorescent Light Bulbs and Ballasts
	Exit Signs
	Air Handling Units
West HVAC Room	Electrical Panels
	Electrical Switches
	Door Closers
	Emergency Lights

Location	Identification
West HVAC Room	Electrical Motors
	Fluorescent Light Bulbs and Ballasts
	Gallon Jugs of Antifreeze
	Exit Signs
3 <sup>rd</sup> Floor Offices, Conference Room and Operations Room	Door Closers
	Electrical Switches
	Emergency Lights
	Fluorescent Light Bulbs and Ballasts
	Thermostats
	Sound Systems
Basement Electrical Room, Telephone Room and Generator Room	Telephone Switching Gear
Basement Electrical Room, Telephone Room and Generator Room	Electrical Switching Gear
	Generator
	Lead Acid Batteries
	Door Closers
	Fluorescent Lights and Ballasts
	265-gallon Diesel AST
	Exit Signs
Basement Kitchen Prep and Storage Area	Fluorescent Lights and Ballasts
	Door Closers
	Extra Fluorescent Light Bulbs and Ballasts
	Electric Motors
	Overhead Door Opener
Basement Mechanical and Boiler Room	Fluorescent Lights and Ballasts
	Door Closers
	Electrical Switches and Panels
	Thermostats
	55-gallon Drums of Boiler Fluid
	Electrical Motors
	Sump pump
	Emergency Lights
	Water Heater
	Boiler Equipment
Basement Breakroom	Fluorescent Lights and Ballasts
	Appliances
	Thermostats
	Electrical Switches
	Emergency Lights
	Exit Signs
Basement Parking Areas	Electrical Transformers
	Emergency Lights
	Overhead Door Openers
	Door Closers
	Fluorescent Lights and Ballasts
	Exit Signs
Basement Storage Area	Overhead Door Openers

Location	Identification
Basement Storage Area	Emergency Lights
	Fluorescent Lights and Ballasts
	Door Closers
	Gasoline Cans
	Miscellaneous Small Containers of Various Hazardous Materials (oil, paint, etc.)
	Exit Signs
North Country, Monoco Air, TSA and Weather One Areas	Fluorescent Lights and Ballasts
	Emergency Lights
	Electrical Switches/Panels
	Door Closers
	Exit Signs
	Security Equipment
Customs Area	Exit Signs
	Door Closers
	Emergency Lights
	Electrical Switches/Panels
	Door Closers
	Fluorescent Lights and Ballasts
X-Ray and Tunnel	Elevator Equipment
	X-Ray Equipment
	Overhead Door Openers
	Exit Signs
	Door Closers
	Emergency Lighting
NW Office and Cargo Area	Exit Lights
	Emergency Lights
	Door Closers
	Electrical Panels
	Thermostats
	Office Machines
	55-gallon Drums of Oil
	Various Small Containers of Miscellaneous Hazardous Materials (oil, paint, etc)
	Lead-Acid Batteries
Main Floor Concourse	Exit Signs
	Door Closers
	Emergency Lights
	Thermostat
	Miscellaneous Electronic Equipment

Table IV – Duluth Int. Airport, Duluth, MN

## **Appendix E**

**Asbestos Inspection Report prepared by EMR, Inc.**

# ASBESTOS INSPECTION REPORT

*at*

**The Duluth International Airport**

4701 Grinden Drive

Duluth, Minnesota

EMR Project #7124.001

*Prepared for:*

Reynolds, Smith and Hills, Inc.

900 Diehl Road – Suite 101

Naperville, IL 60563

*Prepared by:*

**EMR, Inc.**

11 East Superior Street, Suite #541

Duluth, Minnesota

JANUARY 11, 2006



**ENVIRONMENTAL MANAGEMENT RESOURCES**

**Asbestos Inspection Report**

*at*

**The Duluth International Airport**  
4701 Grinden Drive  
Duluth, Minnesota

*Prepared for:*

Reynolds, Smith and Hills, Inc.  
900 Diehl Road – Suite 101  
Naperville, IL 60563

*Prepared by:*

**EMR, Inc.**

11 East Superior Street, Suite #541  
Duluth, Minnesota

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JANUARY 11, 2006



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Figure 5. Second Floor Skyline Room (West Addition) Plan with Sample Locations

Figure 6. Third Floor Plan with Sample Locations and ACM Areas

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## **APPENDICIES**

Appendix A. Asbestos Inspector Certifications

Appendix B. Laboratory Reports

Appendix C. Homogenous Area Physical Assessment Forms

## EXECUTIVE SUMMARY

EMR, Inc. (EMR) was retained by Reynolds, Smith and Hills, Inc. (RS&H) to conduct a pre-renovation asbestos inspection of the Duluth International Airport Terminal Building, located at 4701 Grinden Drive in Duluth, Minnesota. The inspection was conducted between November 7, 2005 and January 3, 2006 by Chuck Deye of EMR who possesses current Minnesota Department of Health asbestos inspection certifications.

During the inspection, bulk samples were collected from the building materials suspected to contain asbestos. These samples were submitted to an accredited laboratory for polarized light microscopy (PLM) analysis. Laboratory analysis of the bulk samples collected from the site has indicated building materials with asbestos concentrations above regulated levels including: floor tile and mastic; ceiling tile; pipe wrap and hard fitting insulation. Additional materials were sampled during the inspection and were determined to be non-detect for asbestos content. Listed below is a summary of the types of asbestos-containing materials (ACM) in the building.

- White 12" x 12" Floor Tile and Mastic
- White 2' x 2' Suspended Ceiling Tile
- White 2' x 4' Suspended Ceiling Tile
- White Thermal System Insulation on Pipe Elbows
- White/Beige/Tan TSI Wrap on Pipe Elbows

The Environmental Protection Agency's (EPA) National Emission Standard for Hazardous Air Pollutants (NESHAP) regulations require that all friable ACM, and Category II Non-Friable ACM be removed from the building prior to renovation/demolition activities. Minnesota Pollution Control Agency (MPCA) guidelines state that if building materials are to be recycled during demolition or renovation, all Category 1 Non-Friable ACM must be removed prior to demolition of renovation.

EMR understands that the building is scheduled for renovation. Destructive investigation methods were not employed on the interior of the building during the time of the inspection due to the facility being open and operational. Additionally, destructive methods were not employed in order to not damage the appearance and aesthetics of the building. Ceiling cavities were accessed above suspended ceilings and unfinished wall cavities were accessed above plaster and sheetrock where possible in an attempt to verify the location of all suspect materials. Suspect materials were noted on both the interior and exterior of the building. Vertical pipe runs between the basement and third floor

HVAC rooms were partially encased in wall cavities, therefore portions of these pipe runs were not accessible at the time of inspection.

## **1.0 INTRODUCTION**

### **1.1 INTRODUCTION**

EMR, Inc., (EMR) was contacted by Reynolds, Smith and Hills, Inc. (RS&H) to conduct an asbestos inspection at the Duluth International Airport Terminal Building, located at 4701 Grinden Drive in Duluth, Minnesota. The inspection was authorized by Mr. Mark Wilcer, senior aviation architect, for RS&H.

The inspection was conducted between November 7, 2005 and January 3, 2006 by Chuck Deye (MN Certification #AI9479) (Appendix A). The inspection was conducted prior to planned renovations, but destructive investigation techniques were not employed since the facility was inhabited by employees and the general public during the inspection.

The purpose of the inspection was to locate and sample suspect asbestos-containing materials (ACM) throughout the building. Suspect materials were sampled and analyzed following the Environmental Protection Agency (EPA) "Asbestos Hazard Emergency Response Act" (AHERA) sampling protocol. This inspection also included quantifying the suspect ACM.

The survey was conducted by an EPA-AHERA accredited and Minnesota Department of Health (MDH) licensed inspector (Appendix A). Samples were analyzed using Polarized Light Microscopy (PLM) procedures by EMSL Analytical, Inc (EMSL) in Minneapolis, Minnesota.

This report summarizes EMR's methods, results, and observations; and it provides recommendations regarding the management of the identified and assumed ACM to ensure compliance with local, state, and federal regulations. Table 1 contains a listing of all suspect materials inventoried and sampled. Table 2 contains a listing of the identified ACM, homogenous materials identified, quantities, asbestos types, location, and percentage present in each ACM. The locations of bulk samples and the extent of identified ACM are found in Figures 1 through 6.

### **1.2 BUILDING CONSTRUCTION**

The Duluth International Airport Terminal Building (Terminal) is a three-story building with basement that is constructed with a combination of concrete block and poured concrete exterior walls and basement, engineered-stud construction interior walls, and steel roof supports. The Terminal was expanded to the west in the mid-1980s to include Customs and Immigrations offices, as well as a passenger lounge and gate for international flights (herein referred to as Customs Area). All levels feature concrete floors, concrete and plaster exterior walls and either un-insulated ceilings (in the original part of the Terminal) or fiberglass insulated ceilings (in the newer addition Customs

Area). The Terminal's main roof as well as the Customs Area roof is sheet metal and a white rubber membrane covers the parking aprons on the front side of the Terminal.

The Terminal features steam heat provided by boilers contained in the basement that are used in concert with a forced-air Heating, Ventilation and Air Conditioning (HVAC) system. The forced-air HVAC serves the second and third floors of the main terminal as well as the western Customs Area addition. Boiler-fed radiators were observed on the first floor. Multiple suspect materials were observed on HVAC system components. The boiler exhaust exits underground to an exhaust tower on the runway side of the Terminal. The underground portion of this exhaust line could not be inspected and was not sampled, however samples taken from the accessible portions of the boiler exhaust line did show regulated levels of asbestos.

## **2.0 METHODS**

### **2.1 PROCEDURES**

The asbestos inspection was conducted by Chuck Deye (AI9479) and who is EPA-certified and MDH-licensed asbestos inspector. The asbestos inspection included all wall and ceiling cavities of the Terminal that could be accessed through non-destructive techniques. Homogenous areas and suspect materials were identified during the inspection. Field drawings were prepared of the building to identify the homogenous areas and random sample collection sites. The field drawings have been reproduced and are presented in Figures 1 through 6.

Destructive investigation techniques were not employed since the facility was inhabited by employees and the general public during the inspection. Prior to conducting sampling, the area was thoroughly wetted using an airless sprayer and water. Material was then carefully removed with additional wetting being employed as necessary. All material removed was contained in the sample bag, ensuring that no sampling debris was created in the process.

### **2.2 SAMPLE COLLECTION**

Bulk samples of suspect materials were collected randomly. Similar systems and materials were grouped into "homogenous (sample) areas."

Representative samples of suspect materials (thermal system insulation, surfacing materials, miscellaneous materials, etc.) were collected by carefully removing a small portion of the wetted suspect material and sealing it in a plastic bag. Friable material sample locations were sealed with a latex caulk to prevent post-sampling fiber releases. Samples were collected from inconspicuous or damaged locations whenever possible.

Each bulk sample was labeled with unique sample identifications such as DIAP-B-001. The sample name consists of "DIAP" for the Duluth International Airport, while the "B" designates which level the samples were collected (B -- Basement, 1 -- First Floor, 2 -- Second Floor, 3 -- Third Floor) and "001" the order in which designates the order in which the samples were collected.

### **2.3 BULK ASBESTOS ANALYSIS**

The samples were analyzed by EMSL, a National Voluntary Laboratory Accreditation Program (NVLAP) certified laboratory using PLM procedures and EPA 600/R-93/116 method to verify the presence or absence of asbestos fibers and asbestos types including: actinolite, amosite, anthophyllite, chrysotile, crocidolite, and tremolite. All analyses were in compliance with the quality control procedures specified by the method. Complete laboratory reports and chain of custody forms are found in Appendix B.

## **3.0 RESULTS**

### **3.1 INVENTORY OF SUSPECT ASBESTOS CONTAINING MATERIALS**

The following suspect materials were identified and sampled in the Terminal and International Flight Area. (Table 1):

- White, Drywall with Joint Compound
  - White, Wall Plaster Surfacing
  - White/Tan, Spray-On Structural Fire Proofing
  - White, 12" x 12" Floor Tile with Black Mastic
  - White, 12" x 12" Floor Tile with Brown Mastic
  - White/Gray, Linoleum Floor Sheeting
  - Brown, Vinyl Baseboard with White Mastic
  - Brown, Vinyl Baseboard with Tan Mastic
  - Brown, Vinyl Baseboard with Brown Mastic
  - Black, Vinyl Baseboard with Brown Mastic
- 
- Tan, Vinyl Baseboard with Tan Mastic
  - Red, Vinyl Baseboard with Tan Mastic
  - Gray, Vinyl Baseboard with Gray Mastic
  - Tan/White, Carpet Mastic and Underlayment
  - White, 2' x 4' Suspended Ceiling Tile
  - White, 2' x 2' Suspended Ceiling Tile
  - White, Interlocking 12" x 12" Ceiling Tile
  - Hard, White Thermal System Insulation (TSI) Elbows
  - Hard, White TSI Boiler Exhaust



- Hard, White TSI on Water Heat Converters
- Tan/Beige, Fabric Pipe Wrap on TSI Elbows
- White/Black, Roof Moisture Barrier

All suspect materials that were sampled are listed in Table 1, "Inventory of Suspect Materials". The Inventory of Suspect Materials provides a listing of the bulk sample numbers used throughout the report, for each sample and location collected. The location of all bulk samples are found on Figures 1 through 6.

### 3.2 SAMPLE RESULTS

Table 2 – "Inventory of Asbestos Containing Materials" summarizes the complete list of materials sampled that are classified as ACM. The following materials are considered ACM since they contain regulated amounts of asbestos (> 1% asbestos):

- White 12" x 12" Floor Tile and Mastic
- White 2' x 2' Suspended Ceiling Tile
- White 2' x 4' Suspended Ceiling Tile
- White Thermal System Insulation Elbows
- Beige/Tan TSI Wrap on Elbows
- Boiler Exhaust 24-inch diameter pipe wrap
- Tan TSI Wrap on Water Heat Converters

No ACM was identified in the first floor International Flight Area (Figure 3) or in the second floor Skyline Room (Figure 5).

The condition and quantity of each suspect material was noted during the inspection and recorded on a Homogenous Physical Assessment Form. In addition the suspect materials were classified as either Friable (able to be reduced to powder with hand pressure) or Non-Friable (not able to be reduced to powder with hand pressure). The condition of the identified ACM is discussed in Section 4.0 and the Homogenous Physical Assessment forms for the above-discussed ACM are found in Appendix C.

### 3.3 QUANTITY OF ASBESTOS-CONTAINING MATERIALS

The type and approximate quantity of friable and non-friable ACM identified during the inspection consist of the following (Table 2):

- White 12" x 12" Floor Tile and Mastic ..... 7,800 ft<sup>2</sup>
- White 2' x 2' Suspended Ceiling Tile ..... 385 ft<sup>2</sup>
- White 2' x 4' Suspended Ceiling Tile ..... 90 ft<sup>2</sup>
- White Thermal System Insulation Elbows..... 102 fittings
- Beige/Tan TSI Wrap on Elbows..... 237 fittings
- Boiler Exhaust 24-inch diameter pipe wrap..... 40 feet
- Tan TSI Wrap on Water Heat Converters..... 20 ft<sup>2</sup>

Please note that the quantities of TSI and TSI Elbows include all observed, interior and exterior above-ground piping. The quantities do not account for any underground insulated piping that may be encountered during excavation or demolition.

## **4.0 DISCUSSION**

Materials classified as asbestos containing were found at the Duluth International Airport Terminal and are categorized as follows:

### **Thermal System Insulation**

- White/Tan Fabric TSI Pipe Wrap
- Hard White Pipe Elbow Insulation
- Boiler Exhaust 24-inch diameter pipe wrap
- Tan TSI Wrap on Water Heat Converters

Asbestos was detected in multiple TSI pipe wrap samples from pipe elbows and fittings throughout the Terminal. Analytical results indicate that only the fabric wrap on hard pipe fittings contains asbestos. The ACM elbow and fitting wrap was found on fiberglass insulated steam piping and boiler exhaust duct fittings and elbows in the basement, and first and second floors. In several areas the ACM wrapped fittings were mixed with plastic shelled, fiberglass insulated elbows and fitting that do not contain asbestos. All hard, woven-fabric covered elbows and fittings in the basement, and first and second floors are considered ACM. Figures 1, 2, 4, 5, and 6 show the areas that contain TSI elbows and fittings. The ACM pipe wrap is considered to be in damaged condition since <10% of the pipe wrap has distributed damage.

---

Asbestos was detected in TSI elbow/fittings samples collected in the third floor HVAC rooms (East and West), indicating that the hard, white elbow and fitting insulation and the associated White/Tan fabric wrap contained regulated levels of asbestos. All hard insulated (non-fiberglass), fabric wrapped elbows and fittings in the West and East HVAC rooms are considered ACM (Figure 6). The ACM pipe wrap and associated insulation is considered to be in damaged condition since <10% of the pipe wrap and insulation has distributed damage.

Asbestos was detected in TSI pipe wrap samples collected from the fabric wrap on the 24-inch diameter boiler exhaust runs. This ACM pipe wrap is considered to be in damaged condition since <10% of the pipe wrap has distributed damage.

Asbestos was detected in the TSI fabric wrap on the water heat converters in the basement boiler room. There are two cylindrical water heat converts present in the boiler room. This ACM fabric wrap is considered to be in good condition.

It is assumed that any elbows and fittings on the underground portion of the boiler exhaust piping are asbestos containing. Any such elbows or fittings that are encountered during demolition or subsequent construction should be treated as ACM.

No asbestos was detected in TSI samples collected in the Customs Area, which is west of the Terminal.

#### **Miscellaneous Materials**

- White 12" x 12" Vinyl Floor Tile and Mastic
- White 2' x 2' Suspended Ceiling Tile
- White 2' x 4' Suspended Ceiling Tile

Asbestos was detected in white 12" x 12" floor tile samples collected throughout the building (i.e. DIAP-B-001). The floor tile (Category I non-friable material) is considered damaged, since less than 10% was damaged and the observed damage was distributed.

Asbestos was detected in 2' x 2' suspended ceiling tiles located in the basement maintenance office's bathroom and hallway, and in North Country Aviation's bathrooms. This ceiling tile is categorized as friable and is considered to be in good condition.

Asbestos was detected in 2' x 4' suspended ceiling tiles located in the 3<sup>rd</sup> floor coffee room and bathroom near the reception area. This ceiling tile is categorized as friable is considered to be in good condition.

| Homogenous Area Physical Assessment Forms for the above-described ACM are found in Appendix D.

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## **5.0 GENERAL RECOMMENDATIONS**

The information and findings of EMR's asbestos building inspection have been used to prepare this report and may be used as part of a management development process to determine response actions necessary to protect human health and the environment. Proper handling procedures on identified or assumed ACM will prevent the release of asbestos fibers. These materials require special handling procedures by certified asbestos professionals.

The United States EPA's NESHAP regulation and MDH rules require that all friable ACM and non-friable (Category II) ACM that may become friable during renovation or demolition must be removed from structures prior to demolition or renovation activities. Examples of Category II, non-friable ACM are: plaster, sheetrock, transite board, etc. If building materials are to be recycled, MPCA guidelines state that all Category I ACM (roofing material, resilient floor covering, etc) is to be removed since the recycling process could result the non-friable Category I materials becoming friable. All ACM abatement should be conducted by a reputable and certified asbestos abatement contractor.

Friable TSI pipe wrap was observed on the boiler exhaust pipe elbows and fittings within the boiler room. This pipe run extended outside of the basement walls and continued below ground. Pre-demolition abatement should include all insulated exterior and underground piping hard, fabric covered elbows and fittings that will or may be disturbed during demolition and or subsequent construction.

## 6.0 STANDARD OF CARE

The data generated and conclusions provided are based upon the scope of work performed. All work was conducted in a manner consistent with customary principles in the fields of science and engineering. EMR is not responsible for the independent conclusions, opinions, or recommendations made by others based on the data presented in this report. No other warranty, expressed or implied, is made.

The results reported and any opinions reached by EMR are for the benefit of the client and unless agreed to by EMR in writing, are not to be disclosed to or relied upon by any third party. The results and opinions set forth by EMR in this report will be valid as of the date of the report. EMR assumes no obligation to advise you of any changes that may later be brought to our attention.

EMR, Inc., as environmental consultants, respectfully submits this report.

The preceding report was prepared and reviewed by the following EMR personnel.

Author:




Chuck Deye

MDH Asbestos Inspector #AI9479

1/13/06

Date

Reviewed By:



Scott Carney

MDH Asbestos Inspector #AI3627

1/13/06

Date

## TABLES

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Table 1  
Inventory of Suspect Materials  
Duluth International Airport  
4701 Grinden Drive - Duluth, Minnesota  
EMR Project#7124.001

Sample Number	Unique Room ID	Material Type	Homogenous Area Description
DIAP-B-001	--	White 12"x12" F.T. with black mastic	Mech. Room F.T. 100 square feet
DIAP-B-002	--	4-inch dia. Pipe hard fitting	Mech. Room 1 fitting on 4-inch pipe
DIAP-B-003	--	3-inch dia. Pipe hard fitting	Mech. Room 2 fittings on 3-inch pipe
DIAP-B-004	--	Brown vinyl baseboard with white mastic	Mech. Room - 40 linear feet of baseboard
DIAP-B-005	--	White 2'x4' suspended ceiling tile	Mech. Room C.T. 100 square feet
DIAP-B-006	--	4-inch dia. Pipe hard fitting	Boiler Room 50 fittings on 4-inch pipe
DIAP-B-007	--	4-inch dia. Pipe hard fitting	Boiler Room 50 fittings on 4-inch pipe
DIAP-B-008	--	4-inch dia. Pipe hard fitting on out-of-service boiler	Boiler Room 50 fittings on 4-inch pipe
DIAP-B-009	--	6-inch dia. Pipe hard fitting	Boiler Room 3 fittings on 6-inch pipe
DIAP-B-010	--	6-inch dia. Pipe hard fitting	Boiler Room 3 fittings on 6-inch pipe
DIAP-B-011	--	Converter #2 hard insulation	Boiler Room water heat conv. #2 - 20 sq. ft.
DIAP-B-012	--	24-inch dia. In-Service Boiler exhaust	Boiler Room boiler exhst. 20 linear feet
DIAP-B-013	--	24-inch dia. Out-Of-Service Boiler exhaust	Boiler Room boiler exhst. 20 linear feet
DIAP-B-014	--	White 12"x12" F.T. with black mastic	Break Room F.T. 720 square feet
DIAP-B-015	--	Brown vinyl baseboard with tan mastic	Break Room - 150 linear feet of baseboard
DIAP-B-016	--	Drywall	Break Room drywall - 170 square feet
DIAP-B-017	--	White 2'x4' suspended ceiling tile	Break Room C.T. 600 square feet
DIAP-B-018	--	White 2'x2' suspended ceiling tile	Break Rm. Hallway/Bathroom 300 sq. ft.
DIAP-B-019	--	Brown vinyl baseboard with tan/clear mastic	Maint. Office - 80 linear feet
DIAP-B-020	--	6-inch dia. Water main inlet to bldg. Hard fitting	Maint. Office closet - 1 hard fitting
DIAP-B-021	--	4-inch dia. Pipe hard fitting	Break Room Bathroom - 4 hard fittings
DIAP-B-022	--	4-inch dia. Pipe hard fitting	East Garage - 15 hard fittings
DIAP-B-023	--	6-inch dia. Pipe hard fitting	East Garage - 10 hard fittings
DIAP-B-024	--	6-inch dia. Pipe hard fitting	East Garage - 10 hard fittings
DIAP-B-025	--	White/Tan Spray-on Fireproofing material	Basement/Parking Garage - 20,500 sq. ft.
DIAP-B-026	--	White/Tan Spray-on Fireproofing material	Basement/Parking Garage - 20,500 sq. ft.
DIAP-B-027	--	White/Tan Spray-on Fireproofing material	Basement/Parking Garage - 20,500 sq. ft.
DIAP-B-028	--	4-inch dia. Pipe hard fitting	West Garage - 15 hard fittings
DIAP-B-029	--	4-inch dia. Pipe hard fitting	West Garage - 15 hard fittings
DIAP-B-030	--	6-inch dia. Pipe hard fitting	West Garage - 10 hard fittings
DIAP-B-031	--	6-inch dia. Pipe hard fitting	West Garage - 10 hard fittings
DIAP-B-032	--	White/Tan Spray-on Fireproofing material	Basement/Parking Garage - 20,500 sq. ft.
DIAP-B-033	--	White/Tan Spray-on Fireproofing material	Basement/Parking Garage - 20,500 sq. ft.
DIAP-B-034	--	White speckled/wormy suspended 2'x4' ceiling tile	Telephone Room C.T. - 120 square feet
DIAP-B-035	--	4-inch dia. Pipe hard fitting	Loading Ramp 2 fittings on 4-inch pipe
DIAP-1-036	193, 196, 197, 198	White ribbed 2'x2' suspended ceiling tile	1st Floor Customs Ramp C.T. 1,500 sq. ft.
DIAP-1-037	193, 196, 197, 198	Brown vinyl baseboard	1st Floor Customs Ramp BB - 80 linear ft.
DIAP-1-038	186, 190	White/Gray Floor Linoleum	Customs Clearing bathrooms - 400 sq. ft.
DIAP-1-039	186, 190	Tan vinyl baseboard	Customs Clearing bathrooms - 150' linear
DIAP-1-040	174, 180	White speckled/wormy suspended 2'x4' ceiling tile	Customs Clearing area C.T. 2,300 sq. ft.
DIAP-1-041	174, 180	Red vinyl baseboard	Customs Clearing area BB - 500 linear ft.
DIAP-1-042	174, 180	Drywall	Customs Clearing area drywall - 60,000 sq. ft.
DIAP-1-043	174, 180	3-inch dia. Pipe hard fitting	Customs Clearing area fittings - 30 fittings
DIAP-1-044	181	Brown vinyl baseboard	Cust. Electrical Room BB - 80 linear feet
DIAP-1-045	169	3-inch dia. Pipe hard fitting	Cust. Search Rm. 1 fitting - 3 fittings
DIAP-1-046	171, 173	Carpet mastic/underlayment	Utility Room 171 - 600 sq. ft.
DIAP-1-047	171, 173	Gray vinyl baseboard	Utility Room 171 - 120 linear ft.
DIAP-1-048	171, 173	Drywall	Utility Room 171 - 9,000 sq. ft.
DIAP-1-049	160	White/Tan Spray-on Fireproofing material	W. Pass. Lounge - 20,500 sq. ft.
DIAP-1-050	136, 139	White 12"x12" F.T. with black mastic	N. Cntry area - 700 sq. ft.



Table 1  
Inventory of Suspect Materials  
Duluth International Airport  
4701 Grinden Drive - Duluth, Minnesota  
EMR Project#7124.001

Sample Number	Unique Room ID	Material Type	Homogenous Area Description
DIAP-1-051	136, 139	Brown vinyl baseboard with tan mastic	N. Cntry area - 200 linear feet
DIAP-1-052	136, 139	3-inch dia. Pipe hard fitting	N. Cntry area - 2 hard fittings
DIAP-1-053	136, 139	White wall plaster	N. Cntry area - 4,600 square feet
DIAP-1-054	142	Suspended Ceiling Tile	N. Cntry hallway ceiling tile - 300 sq. ft.
DIAP-1-055	146, 147	Suspended Ceiling Tile	N. Cntry bathrooms - 85 sq. ft.
DIAP-1-056	142	Brown vinyl baseboard with brown mastic	N. Cntry hallway - 150 linear feet
DIAP-1-057	135	3-inch dia. Pipe hard fitting	Weather One - 2 hard fittings
DIAP-1-058	135	White/Tan Spray-on Fireproofing material	Weather One - 20,500 sq. ft.
DIAP-1-059	138	Black vinyl baseboard with brown mastic	TSA office - 60 linear feet
DIAP-1-060	126, 130	2'x2' suspended ceiling tile	W. Pass. Area bathrooms - 800 sq. ft.
DIAP-1-061	101	Gray vinyl stair tread wrap	2 stair cases - 300 sq. ft.
DIAP-1-062	101	White wall plaster	W. Pass. Area plaster
DIAP-1-063	125	3-inch dia. Pipe hard fitting	E. Tug Tunnel (west end) - 1 hard fitting
DIAP-1-064	113-120	White 12"x12" Vinyl Floor Tile	NW Offices - 2,100 sq.ft
DIAP-1-065	113-120	White speckled/wormy suspended 2'x4' ceiling tile	NW Offices - 2,100 sq.ft
DIAP-1-066	113-120	Brown vinyl baseboard with tan mastic	NW Offices - 400 linear feet
DIAP-1-067	113-120	White wall plaster	NW Offices - 5,000 square feet
DIAP-1-068	104	4-inch dia. Pipe hard fitting	NW Cargo Area (104) - 21 hard fittings
DIAP-2-069	--	Brown vinyl baseboard with tan mastic	Skyline Lounge - 250 linear feet
DIAP-2-070	--	Drywall	Skyline Lounge - 60,000 sq. ft.
DIAP-2-071	--	12"x12" white speckled floor tile with tan mastic	Skyline Lounge - 1,000 sq. ft.
DIAP-2-072	202	Drywall	West Gate Lobby - 3,000 sq.ft.
DIAP-2-073	--	White wall plaster	West Conc. Obsrv. Lnge. - 1,500 sq. ft.
DIAP-2-074	208	12"x12" white speckled floor tile	West Conc. Janitor Closet - 30 sq. ft.
DIAP-2-075	208	3-inch dia. Pipe hard fitting	West Conc. Janitor Closet - 5 fittings
DIAP-2-076	208	White wall plaster	West Conc. Janitor Closet - 600 sq. ft.
DIAP-2-077	201	Black vinyl baseboard with brown mastic	West Conc. Bathroom area - 100 linear ft.
DIAP-2-078	--	12"x12" white vinyl floor tile	Bar Closet 1 - 25 sq. ft.
DIAP-2-079	--	White/Tan Spray-on Fireproofing material	Bar Closet 1 - 41,000 sq. ft.
DIAP-2-080	214	White (w/ gray paint) 12"x12" suspended ceiling tile	Bar - 2,000 square feet
DIAP-2-081	212	White 2'x4' suspended ceiling tile	Kitchen - 2,400 square feet
DIAP-3-082	M02	6-inch dia. Pipe hard fitting	West HVAC - 5 fittings
DIAP-3-083	M02	6-inch dia. Pipe hard fitting	West HVAC - 5 fittings
DIAP-3-084	M02	4-inch dia. Pipe hard fitting	West HVAC - 40 fittings
DIAP-3-085	M02	4-inch dia. Pipe hard fitting	West HVAC - 40 fittings
DIAP-3-086	M02	White wall plaster	West HVAC - 4,500 sq. ft.
DIAP-3-087	M05	White 2'x4' suspended ceiling tile	Reception Area coffee room - 90 sq. ft.
DIAP-3-088	M05	White 12"x12" Vinyl Floor Tile	Reception Area coffee room - 72 sq. ft.
DIAP-3-089	M05	Brown vinyl baseboard with tan mastic	Reception Area coffee room - 30 linear ft.
DIAP-3-090	--	Brown vinyl baseboard with tan mastic	Operations Center Office - 350 linear ft.
DIAP-3-091	--	2'x4' ribbed/speckled white suspended ceiling tile	Operations Center Office - 1,050 sq. ft.
DIAP-3-092	M09	6-inch dia. Pipe hard fitting	East HVAC - 17 fittings
DIAP-3-093	M09	6-inch dia. Pipe hard fitting	East HVAC - 17 fittings
DIAP-3-094	M09	4-inch dia. Pipe hard fitting	East HVAC - 40 fittings
DIAP-3-095	M09	4-inch dia. Pipe hard fitting	East HVAC - 40 fittings
DIAP-3-096	M09	White wall plaster	West HVAC - 4,500 sq. ft.
DIAP-3-097	M09	White/Tan Spray-on Fireproofing material	West HVAC - 6,000 sq. ft.
DIAP-R-098	101	White, speckled 12"x12" interlocking ceiling tile	Main Terminal C.T. - 26,000 sq. ft.
DIAP-R-099	--	White, speckled 12"x12" interlocking ceiling tile	Skyline Room C.T. - 12,000 sq. ft.
DIAP-R-100	--	Ceiling drywall	Skyline Room - 12,000 sq. ft.

Table 1  
Inventory of Suspect Materials  
Duluth International Airport  
4701 Grinden Drive - Duluth, Minnesota  
EMR Project#7124.001

Sample Number	Unique Room ID	Material Type	Homogenous Area Description
DIAP-1-101	--	3-inch dia. Pipe wrap and hard fitting	Customs Clearing area fittings - 30 fittings
DIAP-1-102	--	3-inch dia. Pipe wrap and hard fitting	Customs Clearing area fittings - 30 fittings

**Table 2.**  
**Inventory of Asbestos-Containing Materials**  
**Duluth International Airport**  
**4701 Grinden Drive - Duluth, Minnesota**  
**EMR Project #7124.001**

Sample #	Materials	Locations	Quantity	Asbestos Type and Percentage	Friable/Non-friable
DIAP-B-001 WHITE FLOOR TILE	White 12" x 12" Floor Tile	Basement Mechanical Room	100 ft <sup>2</sup>	7% Chrysotile	Category I Non-friable
DIAP-B-001 BLACK MASTIC	Black Mastic on White 12" x 12" Floor Tile	Basement Mechanical Room	100 ft <sup>2</sup>	10% Chrysotile	Category I Non-friable
DIAP-B-002 PIPE WRAP	White wrap on 4-inch hard fitting	Basement Mechanical Room	3 fittings	70% Chrysotile	Friable
DIAP-B-006 PIPE WRAP	White wrap on 4-inch hard fitting	Basement Boiler Room	50 fittings	60% Chrysotile	Friable
DIAP-B-009 PIPE WRAP	Tan wrap on 6-inch hard fitting	Basement Boiler Room	3 fittings	30% Chrysotile	Friable
DIAP-B-011 PIPE WRAP	Tan wrap on water heat converter #2	Basement Boiler Room	20 ft <sup>2</sup>	30% Chrysotile	Friable
DIAP-B-012 PIPE WRAP	Tan wrap on In-Service boiler exhaust (24-inch dia)	Basement Boiler Room	20 feet	5% Chrysotile	Friable
DIAP-B-013 PIPE WRAP	White wrap on Out-of-Service boiler exhaust (24-inch dia.)	Basement Boiler Room	20 feet	5% Chrysotile	Friable
DIAP-B-018 WHITE CEILING TILE	White 2' x 2' Suspended Ceiling Tile	Basement Bathroom and Hallway	300 ft <sup>2</sup>	3% Chrysotile	Friable
NOT SAMPLED FLOOR TILE	White 12" x 12" Floor Tile	Basement Maintenance Office	720 ft <sup>2</sup>	Assumed ACM	Category I Non-friable
NOT SAMPLED MASTIC	Black Mastic on White 12" x 12" Floor Tile	Basement Maintenance Office	720 ft <sup>2</sup>	Assumed ACM	Category I Non-friable
DIAP-B-020 PIPE WRAP	White wrap on 6-inch hard fitting - main water line inlet to terminal building	Maintenance Office Closet	1 fitting	70% Chrysotile	Friable
DIAP-B-022 PIPE WRAP	Tan wrap on 4-inch hard fitting	East Garage	15 fittings	70% Chrysotile	Friable

Table 2.  
Inventory of Asbestos-Containing Materials  
Duluth International Airport  
4701 Grinden Drive - Duluth, Minnesota  
EMR Project #7124.001

Sample #	Materials	Locations	Quantity	Asbestos Type and Percentage	Friable/Non-friable
DIAP-B-023 PIPE WRAP	White wrap on 6-inch hard fitting	East Garage	10 fittings	70% Chrysotile	Friable
DIAP-B-029 PIPE WRAP	Tan wrap on 4-inch hard fitting	West Garage	15 fittings	70% Chrysotile	Friable
DIAP-B-030 PIPE WRAP	Tan wrap on 6-inch hard fitting	West Garage	10 fittings	70% Chrysotile	Friable
DIAP-B-035 PIPE WRAP	Cream-colored wrap on 4-inch hard fitting	Basement Loading Ramp	2 fittings	50% Chrysotile	Friable
DIAP-1-050 FLOOR TILE	White 12" x 12" Floor Tile	N. Country Area Lobby and Office	700 ft <sup>2</sup>	3% Chrysotile	Category I Non-friable
DIAP-1-050 MASTIC	Black Mastic on White 12" x 12" Floor Tile	N. Country Area Lobby and Office	700 ft <sup>2</sup>	10% Chrysotile	Category I Non-friable
NOT SAMPLED FLOOR TILE	White 12" x 12" Floor Tile	Weather One and TSA Offices	2,640 ft <sup>2</sup>	Assumed ACM	Category I Non-friable
NOT SAMPLED MASTIC	Black Mastic on White 12" x 12" Floor Tile	Weather One and TSA Offices	2,640 ft <sup>2</sup>	Assumed ACM	Category I Non-friable
DIAP-1-052 PIPE WRAP	White wrap on 3-inch hard fitting	N. Country Area Lobby and Office	2 fittings	50% Chrysotile	Friable
DIAP-1-055 CEILING TILE	Beige/white 2' x 2' suspended ceiling tile	N. Country Area Bathrooms	85 ft <sup>2</sup>	3% Chrysotile	Friable
DIAP-1-057 PIPE WRAP	Beige wrap on 3-inch hard fitting	Weather One office	2 fittings	50% Chrysotile	Friable
DIAP-1-063 PIPE WRAP	White wrap on 3-inch hard fitting	East Tug Tunnel	1 fitting	70% Chrysotile	Friable
DIAP-1-064 FLOOR TILE	White 12" x 12" Floor Tile	Northwest Offices	2,100 ft <sup>2</sup>	5% Chrysotile	Category I Non-friable

Table 2.  
Inventory of Asbestos-Containing Materials  
Duluth International Airport  
4701 Grinden Drive - Duluth, Minnesota  
EMR Project #7124.001

Sample #	Materials	Locations	Quantity	Asbestos Type and Percentage	Friable/Non-friable
DIAP-1-064 MASTIC	Black mastic on White 12" x 12" Floor Tile	Northwest Offices	2,100 ft <sup>2</sup>	10% Chrysotile	Category I Non-friable
DIAP-1-068 PIPE WRAP	Tan wrap on 4-inch hard fitting	Northwest Cargo Area 104	21 fittings	45% Chrysotile	Friable
DIAP-2-074 FLOOR TILE	White 12" x 12" Floor Tile	West Concourse Bathroom and Janitor Closet	30 ft <sup>2</sup>	4% Chrysotile	Category I Non-friable
DIAP-2-074 MASTIC	Black Mastic on White 12" x 12" Floor Tile	West Concourse Bathroom and Janitor Closet	30 ft <sup>2</sup>	10% Chrysotile	Category I Non-friable
DIAP-2-078 MASTIC	Brown mastic on White 12" x 12" Floor Tile	Bar Area	1,500 ft <sup>2</sup>	3% Chrysotile	Category I Non-friable
DIAP-3-082 PIPE WRAP	White wrap on 6-inch hard fitting	West HVAC Room	5 fittings	80% Chrysotile	Friable
DIAP-3-083 PIPE WRAP	White wrap on 6-inch hard fitting	West HVAC Room	5 fittings	70% Chrysotile	Friable
DIAP-3-084 HARD FITTING	4-inch diameter hard fitting	West HVAC Room	40 fittings	3% Chrysotile	Friable
DIAP-3-084 PIPE WRAP	White wrap on 4-inch hard fitting	West HVAC Room	40 fittings	70% Chrysotile	Friable
DIAP-3-085 HARD FITTING	4-inch diameter hard fitting	West HVAC Room	40 fittings	3% Chrysotile	Friable
DIAP-3-085 PIPE WRAP	Tan wrap on 4-inch hard fitting	West HVAC Room	40 fittings	70% Chrysotile	Friable
DIAP-3-087 CEILING TILE	White/Tan 2' x 4' Suspended Ceiling Tile	Reception Area Coffee Room	90 ft <sup>2</sup>	3% Chrysotile	Friable
DIAP-3-088 FLOOR TILE	White 12" x 12" Floor Tile	Reception Area Coffee Room	72 ft <sup>2</sup>	5% Chrysotile	Category I Non-friable

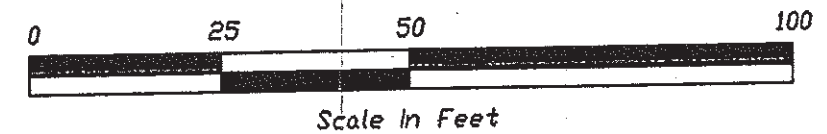
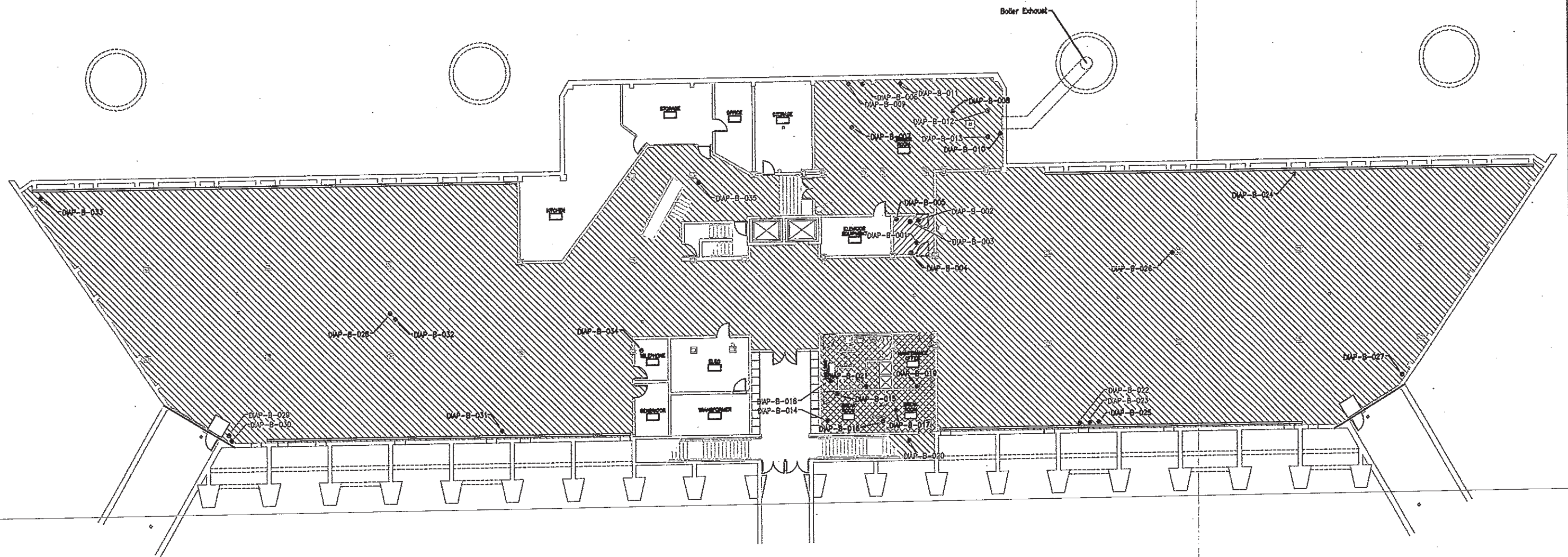
**Table 2.**  
**Inventory of Asbestos-Containing Materials**  
**Duluth International Airport**  
**4701 Grinden Drive - Duluth, Minnesota**  
**EMR Project #7124.001**

Sample #	Materials	Locations	Quantity	Asbestos Type and Percentage	Friable/Non-friable
DIAP-3-088 MASTIC	Brown mastic on White 12" x 12" Floor Tile	Reception Area Coffee Room	72 ft <sup>2</sup>	10% Chrysotile	Category I Non-friable
DIAP-3-092 HARD FITTING	6-inch diameter hard fitting	East HVAC Room	17 fittings	3% Chrysotile	Friable
DIAP-3-092 PIPE WRAP	Tan wrap on 6-inch hard fitting	East HVAC Room	17 fittings	65% Chrysotile	Friable
DIAP-3-093 HARD FITTING	6-inch diameter hard fitting	East HVAC Room	17 fittings	3% Chrysotile	Friable
DIAP-3-093 PIPE WRAP	White wrap on 6-inch hard fitting	East HVAC Room	17 fittings	70% Chrysotile	Friable
DIAP-3-094 HARD FITTING	4-inch diameter hard fitting	East HVAC Room	40 fittings	3% Chrysotile	Friable
DIAP-3-094 PIPE WRAP	White wrap on 4-inch hard fitting	East HVAC Room	40 fittings	70% Chrysotile	Friable
DIAP-3-095 PIPE WRAP	White wrap on 4-inch hard fitting	East HVAC Room	40 fittings	70% Chrysotile	Friable

## FIGURES

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# LEGEND

- ACM Sample Location
- Non-ACM Sample Location
- ▨ Extent of ACM White 12"x12" Floor Tile and Mastic
- ▨ Areas with ACM Pipe Fittings and Wrap
- ▨ Extent of ACM Ceiling Tile

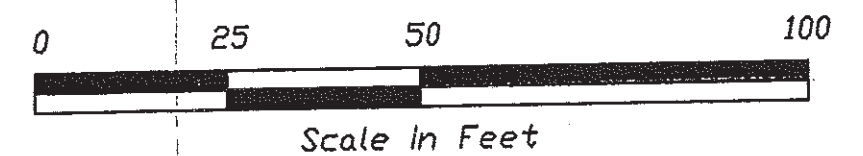
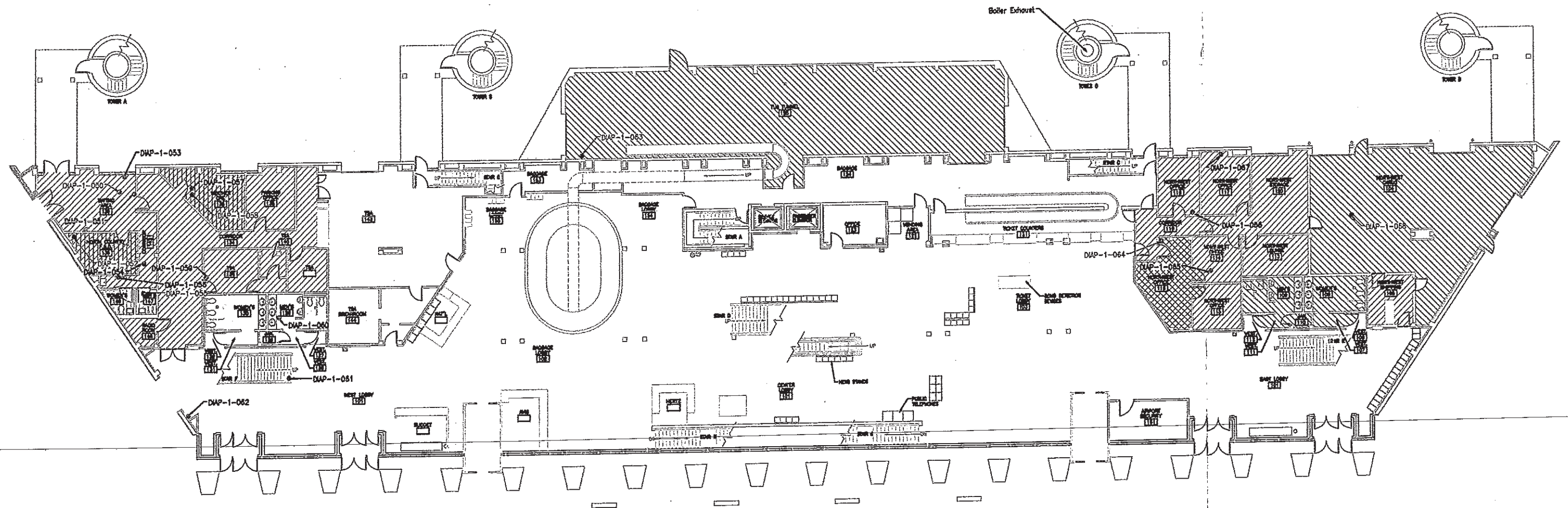
Reynolds, Smith and Hills, Inc.  
The Duluth International Airport  
Main Terminal Building

Figure 1. Basement Floor Plan with Sample Locations and ACM Areas  
Asbestos Inspection Report

DRAWN BY: CAD  
CHECKED BY: SJC  
PROJECT NO. 7124.001  
REVISION NO. 1  
DATE: January 10, 2006  
REFERENCE: RS&H, 11/05







# LEGEND

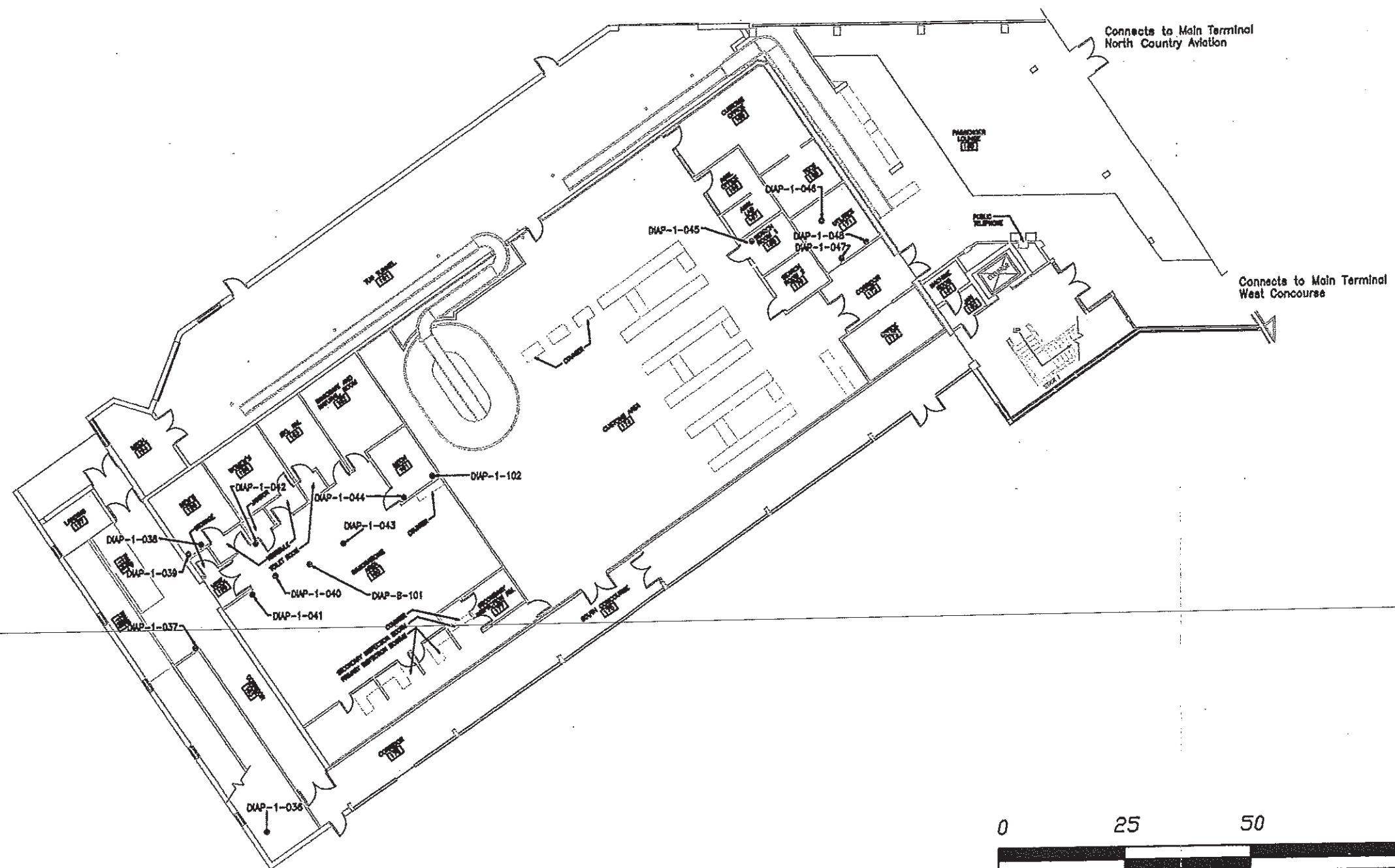
- ACM Sample Location
- Non-ACM Sample Location
- ▨ Extent of ACM White 12"x12" Floor Tile and Mastic
- ▩ Areas with ACM Pipe Fittings and Wrap
- ▤ Extent of ACM Ceiling Tile

Reynolds, Smith and Hills, Inc.  
The Duluth International Airport  
Main Terminal Building

Figure 2. First Floor Plan with Sample Locations and ACM Areas  
Asbestos Inspection Report

DRAWN BY: CAD  
CHECKED BY: SJC  
PROJECT NO. 7124.001  
REVISION NO. 1  
DATE: January 10, 2006  
REFERENCE: RS&H, 11/05





0 25 50 100  
Scale in Feet

#### LEGEND

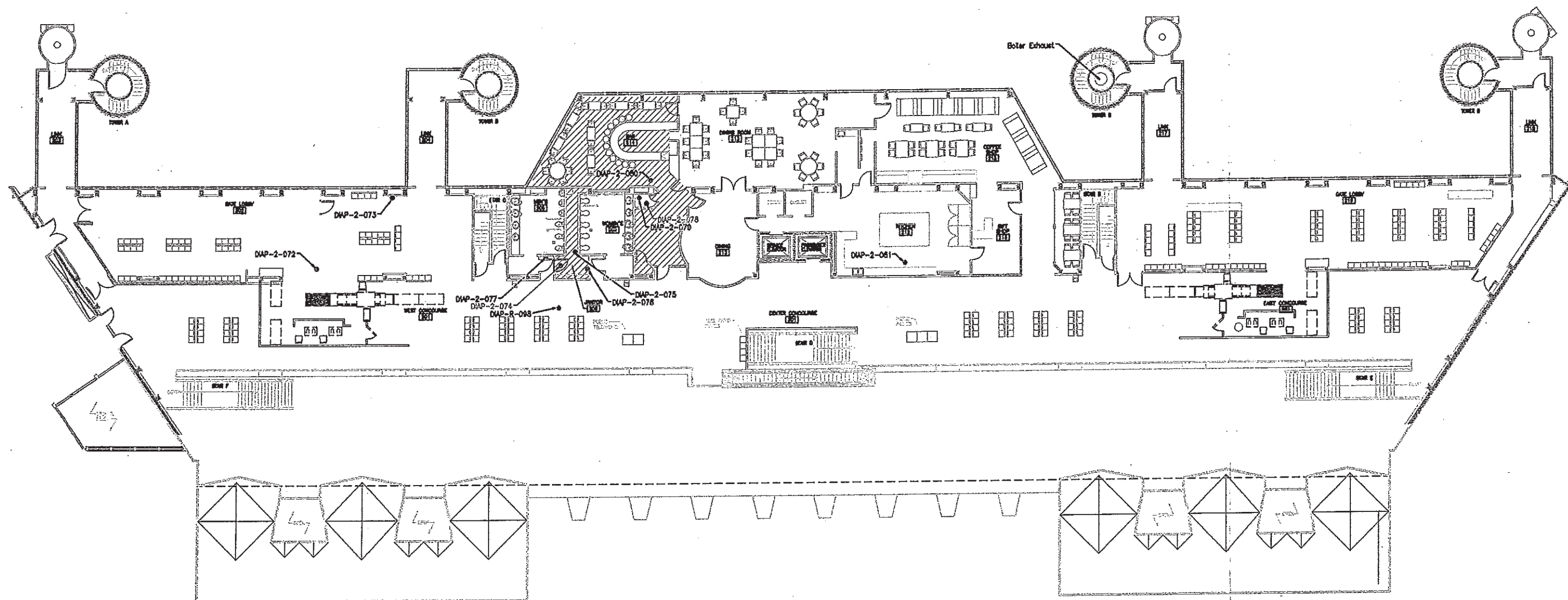
- Non-ACM Sample Location

Reynolds, Smith and Hills, Inc.  
The Duluth International Airport  
Main Terminal Building

Figure 3. First Floor Customs Area (West Addition) Plan with Sample Locations  
Asbestos Inspection Report

DRAWN BY: CAD  
CHECKED BY: SJC  
PROJECT NO. 7124.001  
REVISION NO. 1  
DATE: January 10, 2006  
REFERENCE: RS&H, 11/05





# LEGEND

- ACM Sample Location
- Non-ACM Sample Location
- ▨ Extent of ACM White 12"x12" Floor Tile and Mastic

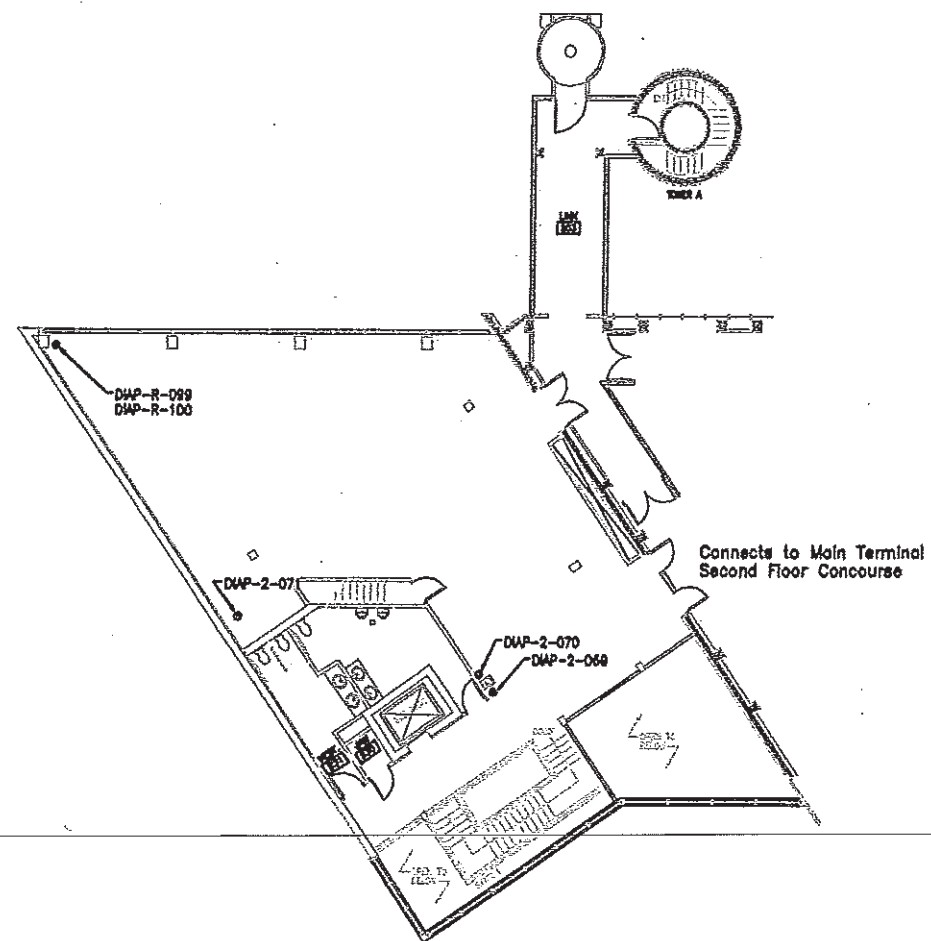
Reynolds, Smith and Hills, Inc.  
The Duluth International Airport  
Main Terminal Building

Figure 4. Second Floor Plan with Sample Locations and ACM Areas  
Asbestos Inspection Report

DRAWN BY: CAD  
CHECKED BY: SJC  
PROJECT NO. 7124.001  
REVISION NO. 1  
DATE: January 10, 2006  
REFERENCE: RS&H, 11/05







# LEGEND

- Non-ACM Sample Location

Reynolds, Smith and Hills, Inc.  
The Duluth International Airport  
Main Terminal Building

Figure 5. Second Floor Skyline Room (West Addition) Plan with Sample Locations  
Asbestos Inspection Report

DRAWN BY: CAD  
CHECKED BY: SJC  
PROJECT NO. 7124.001  
REVISION NO. 1  
DATE: January 10, 2006  
REFERENCE: RS&H, 11/05





**APPENDIX A**

**ASBESTOS INSPECTOR CERTIFICATIONS**

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*Robert A. Blongren*  
Director, Env. Health Div.



**ASBESTOS  
INSPECTOR**

Certified by:  
State of Minnesota  
Department of Health

**Expires: 12/14/2006**

Charles A Deye  
1401 N 55th St  
Superior, WI 54880

No. AI9479 Issued: 12/23/2005

**APPENDIX B**

**LABORATORY REPORTS**

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**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: minneapolislab@emsl.com

**EMSL**

Attn: **Chuck Deye**  
**EMR Inc, (Envir Mgt Res., Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

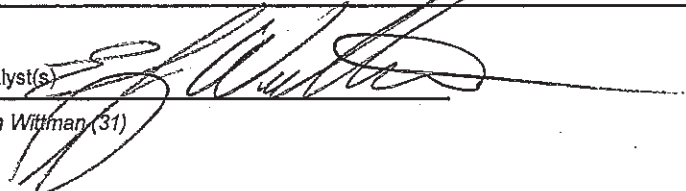
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Customer PO:  
Received: 11/21/05 9:15 AM  
EMSL Order: 350505305

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: Duluth IAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 12/13/05  
Report Date: 12/13/05

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-001 FLOOR TILE 350505305-0001	Mechanical Room F.T. 12x12 white	White Non-Fibrous  Layers: 2		93% Non-fibrous (other)	7% Chrysotile
DIAP-B-001 MASTIC 350505305-0026	Mechanical Room F.T. 12x12 white	Black Non-Fibrous  Layers: 2		90% Non-fibrous (other)	10% Chrysotile
DIAP-B-002 350505305-0002	Mechanical Room 4-inch hard fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	<1% Chrysotile
DIAP-B-003 INSULATION 350505305-0003	Mechanical Room 3-inch hard fitting	Cream Fibrous  layers: 2	65% Min. Wool	35% Non-fibrous (other)	<1% Chrysotile
DIAP-B-003 WRAP 350505305-0031	Mechanical Room 3-inch hard fitting	White Fibrous layers: 2	50% Synthetic	<1% Non-fibrous (other)	50% Chrysotile
DIAP-B-004 BASEBOARD 350505305-0004	Mechanical Room brown vinyl Baseboard	Brown Non-Fibrous  Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-B-004 MASTIC 350505305-0027	Mechanical Room brown vinyl Baseboard	Brown Non-Fibrous  Layers: 2		100% Non-fibrous (other)	None Detected

Analyst(s)   
Erin Wittman (31)



or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client.

Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: minneapolislab@emsl.com

**EMSL**

SM

Attn: **Chuck Deye**  
**EMR Inc, (Envir Mgt Res., Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO:  
Received: 11/21/05 9:15 AM  
EMSL Order: 350505305

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: Duluth IAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 12/13/05  
Report Date: 12/13/05

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-005 350505305-0005	Mechanical Room C.T. white	Beige/White Fibrous Heterogeneous	40% Min. Wool 40% Cellulose	10% Perlite 10% Non-fibrous (other)	None Detected
DIAP-B-014 FLOOR TILE 350505305-0006	Break Room F.T.	White Non-Fibrous Layers: 2		93% Non-fibrous (other)	7% Chrysotile
DIAP-B-014 MASTIC 350505305-0028	Break Room F.T.	Black Non-Fibrous Layers: 2		90% Non-fibrous (other)	10% Chrysotile
DIAP-B-015 BASEBOARD 350505305-0007	Break Room Vinyl baseboard	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-B-015 MASTIC 350505305-0029	Break Room Vinyl baseboard	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-B-016 350505305-0008	Break Room drywall	Brown/White Fibrous Heterogeneous	5% Glass 10% Cellulose	85% Non-fibrous (other)	None Detected
DIAP-B-017 350505305-0009	Break Room 2x4 C.T.	Beige Fibrous Heterogeneous	40% Min. Wool 40% Cellulose	10% Perlite 10% Non-fibrous (other)	None Detected

Analyst(s)

Erin Wittman (31)



or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client.

Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: minneapolislab@emsl.com

**EMSL**

Attn: **Chuck Deye**  
**EMR Inc, (Envir Mgt Res., Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMR150  
Customer PO:  
Received: 11/21/05 9:15 AM  
EMSL Order: 350505305

Fax: (218) 625-2201 Phone: (218) 625-2332

Project: Duluth IAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 12/13/05  
Report Date: 12/13/05

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-018 350505305-0010	Break Room hallway 2x2 C.T.	Beige Fibrous Heterogeneous	12% Synthetic 85% Min. Wool		3% Chrysotile
DIAP-B-019 BASEBOARD 350505305-0011	Maint. Office vinyl baseboard	Black Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-B-019 MASTIC 350505305-0030	Maint. Office vinyl baseboard	Cream Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-B-020 350505305-0012	Break Room water Main inlet hard fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-021 350505305-0013	Break Room Bathroom 4-inch fitting	Cream Fibrous Layers: 2	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-022 350505305-0014	East Garage 4- Inch fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-023 350505305-0016	East Garage 6- inch fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected

Analyst(s)   
Erin Wittman (21)



or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client.

Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: minneapolislab@emsl.com

**EMSL**

Attn: **Chuck Deye**  
**EMR Inc, (Envir Mgt Res., Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

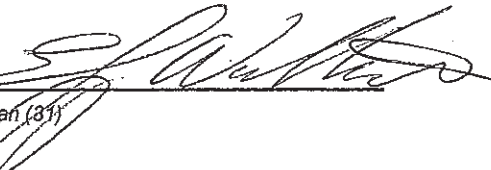
Customer ID: EMRI50  
Customer PO:  
Received: 11/21/05 9:15 AM  
EMSL Order: 350505305

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: Duluth IAP Asbestos 7124.001

EMSL Proj: .  
Analysis Date: 12/13/05  
Report Date: 12/13/05

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-024 350505305-0016	East Garage 6-inch fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-025 350505305-0017	East Garage Fireproofing	Beige Fibrous Heterogeneous	15% Cellulose	60% Non-fibrous (other) 25% Mica	None Detected
D 3-026 350505305-0018	East Garage Fireproofing	Beige Fibrous Heterogeneous	15% Cellulose	60% Non-fibrous (other) 25% Mica	None Detected
DIAP-B-027 350505305-0019	East Garage Fireproofing	Beige Fibrous Heterogeneous	15% Cellulose	60% Non-fibrous (other) 25% Mica	None Detected
DIAP-B-028 350505305-0020	West Garage 4-inch fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	<1% Chrysotile
DIAP-B-029 350505305-0021	West Garage 4-inch fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	<1% Chrysotile
DIAP-B-030 350505305-0022	West Garage 6-inch fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected

Analyst(s)   
Erin Wittman (31)



or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client.

Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: minneapolislab@emsl.com

**EMSL**

Attn: **Chuck Deye**  
**EMR Inc, (Envir Mgt Res., Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMR150  
Customer PO:  
Received: 11/21/05 9:15 AM  
EMSL Order: 350505305

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: Duluth IAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 12/13/05  
Report Date: 12/13/05

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	<u>Non-Asbestos</u>		<u>Asbestos</u>
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-031 350505305-0023	West Garage 6-inch fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-032 350505305-0024	West Garage Fireproofing	Beige Fibrous Heterogeneous	15% Cellulose	60% Non-fibrous (other) 25% Mica	None Detected
D-033 350505305-0025	West Garage Fireproofing	Beige Fibrous Heterogeneous	15% Cellulose	60% Non-fibrous (other) 25% Mica	None Detected

Results amended 12/13/05 to add a layer to #3 and change results on #29.

Analyst(s)

Erin Wittman (34)



or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client.

Analysis performed by EMSL Minneapolis (NVLAP #200019-0)



250505305



## Chain of Custody

### Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Company:	EMR Incorporated	Bill To:	EMR Inc
Address 1:	11 E. Superior Street	Address 1:	11 E. Superior Street
Address 2:	Suite 541	Address 2:	Suite 541
City, State:	Duluth, MN	City, State:	Duluth, MN
Zip/Post Code:	55802	Zip/Post Code:	55802
Country:	USA	Country:	USA
Contact Name:	Chuck Deye	Attn:	Scott Carney
Phone:	2186252332	Phone:	2186252332
Fax:	2186252201	Fax:	2186252201
Email:	cdeye@emr-inc.com	Email:	cdeye@emr-inc.com
EMSL Rep:		P.O. Number:	7124.001
Project Name/Number: Duluth IAP Asbestos 7124.001			

MATRIX			TURNAROUND			
<input type="checkbox"/> Air	<input type="checkbox"/> Soil	<input type="checkbox"/> Micro-Vac	<input type="checkbox"/> 3 Hours	<input type="checkbox"/> 6 Hours	<input type="checkbox"/> Same Day or 12 Hours*	<input type="checkbox"/> 24 Hours (1 day)
<input checked="" type="checkbox"/> Bulk	<input type="checkbox"/> Drinking Water		<input type="checkbox"/> 48 Hours (2 days)	<input type="checkbox"/> 72 Hours (3 days)	<input type="checkbox"/> 96 Hours (4 days)	<input checked="" type="checkbox"/> 120 Hours (5 days)
<input type="checkbox"/> Wipe	<input type="checkbox"/> Wastewater		<input type="checkbox"/> 144+ hours (6-10 days)			

TEM Air, 3 hours, 6 hours, Please call ahead to schedule. There is a premium charge for 3-hour lab, please call 1-800-220-3675 for price prior to sending samples. You will be asked to sign an authorization form for this service.

\*12 hours (must arrive by 11:00a.m. Mon-Fri.). Please Refer to Price Quote

<b>PCM - Air</b> <input type="checkbox"/> NIOSH 7400(A) Issue 2: August 1994 <input type="checkbox"/> OSHA w/TWA <input type="checkbox"/> Other:	<b>TEM Air</b> <input type="checkbox"/> AHERA 40 CFR, Part 763 Subpart E <input type="checkbox"/> NIOSH 7402 <input type="checkbox"/> EPA Level II	<b>TEM WATER</b> <input type="checkbox"/> EPA 100.1 <input type="checkbox"/> EPA 100.2 <input type="checkbox"/> NYS 198.2
<b>PLM - Bulk</b> <input checked="" type="checkbox"/> EPA 600/R-93/116 <input type="checkbox"/> EPA Point Count <input type="checkbox"/> NY Stratified Point Count <input type="checkbox"/> PLM NOB (Gravimetric) NYS 198.1 <input type="checkbox"/> NIOSH 9002: <input type="checkbox"/> EMSL Standard Addition:	<b>TEM BULK</b> <input type="checkbox"/> Drop Mount (Qualitative) <input type="checkbox"/> Chatfield SOP - 1988-02 <input type="checkbox"/> TEM NOB (Gravimetric) NYS 198.4 <input type="checkbox"/> EMSL Standard Addition:	<b>TEM Microvac/Wipe</b> <input type="checkbox"/> ASTM D 5755-95 (quantitative method) <input type="checkbox"/> Wipe Qualitative
<b>SEM Air or Bulk</b> <input type="checkbox"/> Qualitative <input type="checkbox"/> Quantitative	<b>PLM Soil</b> <input type="checkbox"/> EPA Protocol Qualitative <input type="checkbox"/> EPA Protocol Quantitative <input type="checkbox"/> EMSL MSD 9000 Method (fibers/grain)	<b>XRD</b> <input type="checkbox"/> Asbestos <input type="checkbox"/> Silica: NIOSH 7500  <b>OTHER</b> <input type="checkbox"/>

5305



# Chain of Custody

## Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Page 1 of 2

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) DIAP-B-001 to DIAP-B-015 + DIAP-B-014 to DIAP-B-033 Total Samples #: \_\_\_\_\_

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Received: K. Beem Date: 11/2/05 Time: 9:15

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-B-001	Mechanical Room F.T. 12x12 white	100 square feet
DIAP-B-002	Mechanical Room 4-inch hard fitting	
DIAP-B-003	Mechanical Room 3-inch hard fitting	
DIAP-B-004	Mechanical Room brown vinyl baseboard	
DIAP-B-005	Mechanical Room C.T. white	
DIAP-B-014	Brick Room F.T.	
DIAP-B-015	Brick Room vinyl baseboard	
DIAP-B-016	Brick Room drywall	
DIAP-B-017	Brick Room 2x4 C.T.	
DIAP-B-018	Brick Room hallway 2x2 C.T.	
DIAP-B-019	Maint. Office vinyl baseboard	
DIAP-B-020	Brick Room water main inlet hard fitting	1 fitting
DIAP-B-021	Brick Room Bathroom 4-inch fitting	
DIAP-B-022	East Garage 4-inch fitting	

5305



# Chain of Custody

## Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Page 2 of 2

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) DIAP-B-023 - DIAP-B-033

Total Samples #: \_\_\_\_\_

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-B-023	East Garage 6-inch fitting	
DIAP-B-024	East Garage 6-inch fitting	
DIAP-B-025	East Garage Fireproofing	
DIAP-B-026	East Garage Fireproofing	
DIAP-B-027	East Garage Fireproofing	
DIAP-B-028	West Garage 4-inch fitting	
DIAP-B-029	West Garage 4-inch fitting	
DIAP-B-030	West Garage 6-inch fitting	
DIAP-B-031	West Garage 6-inch fitting	
DIAP-B-032	West Garage Fireproofing	
DIAP-B-033	West Garage Fireproofing	



**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: minneapolislab@emsl.com

**EMSL**

Attn: **Chuck Deye**  
**EMR Inc, (Environmental Management Resources, Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

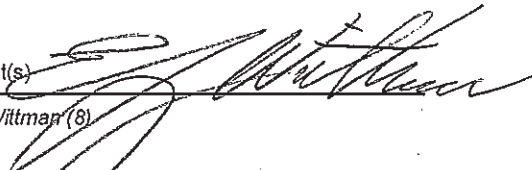
Customer ID: EMRI50  
Customer PO: 7124.001  
Received: 11/21/05 9:15 AM  
EMSL Order: 350505292

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: Duluth IAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 11/21/2005  
Report Date: 11/22/2005

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-006 350505292-0001	Hard Fittings 4-inch pipe Boiler Room 50 fittings	Gray Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-007 350505292-0002	Hard Fittings 4-inch pipe Boiler Room 50 fittings	Gray Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-008 350505292-0003	Hard Fitting Out-of-Service Boiler 3 fittings	Tan Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-009 350505292-0004	Hard Fitting 6-inch pipe Boiler Room 3 fittings	White Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-010 350505292-0005	Hard Fitting 6-inch pipe Boiler Room 3 fittings	White Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-011 350505292-0006	Hot Water Heat Converter #2 Boiler Room 10 square	White Fibrous Heterogeneous	15% Synthetic 5% Glass	80% Non-fibrous (other)	None Detected
DIAP-B-012 350505292-0007	Boiler Exhaust - Boiler Room 20 feet - 24inch diam	Tan Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected

Analyst(s)   
Erin Wittman (8)



or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client.

Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: [minneapolislab@emsl.com](mailto:minneapolislab@emsl.com)**EMSL**

S31

Attn: **Chuck Deye**  
**EMR Inc, (Environmental Management Resources, Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO: 7124.001  
Received: 11/21/05 9:15 AM  
EMSL Order: 350505292

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: Duluth IAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 11/21/2005  
Report Date: 11/22/2005

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	<u>Non-Asbestos</u>		<u>Asbestos</u>
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-013 350505292-0008	Out-of-Service Boiler - Boiler Room 20 feet-24 inc	Gray Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected

Analyst(s)

Erin Wittman (8)



or other approved signatory

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Analysis performed by EMSL Minneapolis (NVLAP #200019-0)



# Chain of Custody

## Asbestos Lab Services

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14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922

Fax: (763) 449-4924

<http://www.emsl.com>

Please print all information legibly.

<b>Company:</b> EMR Incorporated	<b>Bill To:</b> EMR Inc
<b>Address1:</b> 11 E. Superior Street	<b>Address1:</b> 11 E. Superior Street
<b>Address2:</b> Suite 541	<b>Address2:</b> Suite 541
<b>City, State:</b> Duluth, MN	<b>City, State:</b> Duluth, MN
<b>Zip/Post Code:</b> 55802	<b>Zip/Post Code:</b> 55802
<b>Country:</b> USA	<b>Country:</b> USA
<b>Contact Name:</b> Chuck Deye	<b>Attn:</b> Scott Carney
<b>Phone:</b> 2186252332	<b>Phone:</b> 2186252332
<b>Fax:</b> 2186252201	<b>Fax:</b> 2186252201
<b>Email:</b> cdeye@emr-inc.com	<b>Email:</b> cdeye@emr-inc.com
<b>EMSL Rep:</b>	<b>P.O. Number:</b> 7124.001
<b>Project Name/Number:</b> Duluth IAP Asbestos 7124.001	

MATRIX			TURNAROUND			
<input type="checkbox"/> Air	<input type="checkbox"/> Soil	<input type="checkbox"/> Micro-Vac	<input type="checkbox"/> 3 Hours	<input type="checkbox"/> 6 Hours	<input type="checkbox"/> Same Day or 12 Hours*	<input checked="" type="checkbox"/> 24 Hours (1 day)
<input checked="" type="checkbox"/> Bulk	<input type="checkbox"/> Drinking Water		<input type="checkbox"/> 48 Hours (2 days)	<input type="checkbox"/> 72 Hours (3 days)	<input type="checkbox"/> 96 Hours (4 days)	<input type="checkbox"/> 120 Hours (5 days)
<input type="checkbox"/> Wipe	<input type="checkbox"/> Wastewater		<input type="checkbox"/> 144+ hours (6-10 days)			

TEM AIR, 3 hours, 6 hours, Please call ahead to schedule. There is a premium charge for 3-hour tat, please call 1-800-220-3675 for price prior to sending samples. You will be asked to sign an authorization form for this service.

\*12 hours (must arrive by 11:00a.m. Mon -Fri.), Please Refer to Price Quote

<b>PCM - Air</b> <input type="checkbox"/> NIOSH 7400(A) Issue 2: August 1994 <input type="checkbox"/> OSHA w/TWA <input type="checkbox"/> Other:	<b>TEM Air</b> <input type="checkbox"/> AHERA 40 CFR, Part 763 Subpart E <input type="checkbox"/> NIOSH 7402 <input type="checkbox"/> EPA Level II	<b>TEM WATER</b> <input type="checkbox"/> EPA 100.1 <input type="checkbox"/> EPA 100.2 <input type="checkbox"/> NYS 198.2
<b>PLM - Bulk</b> <input checked="" type="checkbox"/> EPA 600/R-93/116 <input type="checkbox"/> EPA Point Count <input type="checkbox"/> NY Stratified Point Count <input type="checkbox"/> PLM NOB (Gravimetric) NYS 198.1 <input type="checkbox"/> NIOSH 9002: <input type="checkbox"/> EMSL Standard Addition:	<b>TEM BULK</b> <input type="checkbox"/> Drop Mount (Qualitative) <input type="checkbox"/> Chatfield SOP - 1988-02 <input type="checkbox"/> TEM NOB (Gravimetric) NYS 198.4 <input type="checkbox"/> EMSL Standard Addition:	<b>TEM Microvac/Wipe</b> <input type="checkbox"/> ASTM D 5755-95 (quantative method) <input type="checkbox"/> Wipe Qualitative
<b>SEM Air or Bulk</b> <input type="checkbox"/> Qualitative <input type="checkbox"/> Quantitative	<b>PLM Soil</b> <input type="checkbox"/> EPA Protocol Qualitative <input type="checkbox"/> EPA Protocol Quantitative <input type="checkbox"/> EMSL MSD 9000 Method fibers/gram	<b>XRD</b> <input type="checkbox"/> Asbestos <input type="checkbox"/> Silica NIOSH 7500  <b>OTHER</b> <input type="checkbox"/>

# 24-HOUR TURNAROUND



## Chain of Custody

### Asbestos Lab Services

350805292

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) DIAP-B-006 - DIAP-B-013Relinquished: Chuck Page Date: 11/18/05Received: K. Beam Date: 11/21/05

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Total Samples #: 8Time: 1200Time: 9:15

Time: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-B-006	Hard Fittings 4-inch pipe Boiler Room	50 fittings
DIAP-B-007	Hard Fittings 4-inch pipe Boiler Room	50 fittings
DIAP-B-008	Hard Fitting Out-of-service Boiler	3 fittings
DIAP-B-009	Hard Fitting 6-inch pipe Boiler Room	3 fittings
DIAP-B-010	Hard Fitting 6-inch pipe Boiler Room	3 fittings
DIAP-B-011	Hot Water Heat Converter #2 Boiler Room	10 square feet
DIAP-B-012	Boiler Exhaust - Boiler Room	20 feet - 24 inch diameter
DIAP-B-013	Out-of-service Boiler - Boiler Room	20 feet - 24 inch diameter

**EMSL Analytical, Inc.**

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Attn: **Chuck Deye**  
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Customer ID: EMRI50  
Customer PO: 7124.00  
Received: 12/06/05 9:30 AM  
EMSL Order: 350505472

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: 7124.001

EMSL Proj:  
Analysis Date: 12/12/2005  
Report Date: 12/12/2005

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos			Asbestos
			%	Fibrous	% Non-Fibrous	% Type
DIAP-B-034 350505472-0001	Telephone Room 2x4 C.T.	White/Beige Fibrous Heterogeneous	40%	Min. Wool Cellulose	10% Perlite 10% Non-fibrous (other)	None Detected
DIAP-B-035 INSULATION 3505472-0002	Loading Ramp 4- Inch hard fitting	Beige Fibrous Layers: 2	35%	Min. Wool Cellulose	55% Non-fibrous (other)	None Detected
DIAP-B-035 WRAP 350505472-0068	Loading Ramp 4- Inch hard fitting	Cream Fibrous Layers: 2	50%	Synthetic		50% Chrysotile
DIAP-1-036 350505472-0003	White ribbed 2x2 C.T. West Ramp	White/Beige Fibrous Heterogeneous	30%	Min. Wool Cellulose	10% Perlite 10% Non-fibrous (other)	None Detected
DIAP-1-037 BASEBOARD 350505472-0004	Brown Vinyl Baseboard West Ramp	Brown Non-Fibrous Layers: 2			100% Non-fibrous (other)	None Detected
DIAP-1-037 MASTIC 350505472-0069	Brown Vinyl Baseboard West Ramp	Cream Non-Fibrous Layers: 2			100% Non-fibrous (other)	None Detected
DIAP-1-038 VINYL 350505472-0005	White/Gray Linoleum Cust. Clear Bath	White Non-Fibrous Layers: 2			100% Non-fibrous (other)	None Detected

Analyst(s)

Erin Wittman (46)

Lynn Scott (20)

Rachel Travis (35)



or other approved signatory

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Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-038 MASTIC 350505472-0070	White/Gray Linoleum Cust. Clear Bath	Clear Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-039 BASEBOARD 350505472-0006	Tan Vinyl Baseboard cust. Clear Bath	Tan Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-039 MASTIC 350505472-0071	Tan Vinyl Baseboard cust. Clear Bath	Tan Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-040 350505472-0007	Speckled/Wormy 2x4 C.T.	Beige/White Fibrous Heterogeneous	40% Min. Wool 40% Cellulose	10% Perlite 10% Non-fibrous (other)	None Detected
DIAP-1-041 BASEBOARD 350505472-0008	Red Vinyl Baseboard	Red Non-Fibrous Layers: 3		100% Non-fibrous (other)	None Detected
DIAP-1-041 TAN MASTIC 350505472-0072	Red Vinyl Baseboard	Tan Non-Fibrous Layers: 3		100% Non-fibrous (other)	None Detected

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Sample	Location	Appearance	<u>Non-Asbestos</u>		<u>Asbestos</u>
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-041 BROWN MASTIC 350505472-0073	Red Vinyl Baseboard	Brown Non-Fibrous Layers: 3		100% Non-fibrous (other)	None Detected
DIAP-1-042 COMPOSITE 3505472-0009	Drywall Customs Cleaning Area	White/Brown Fibrous Layers: 2	10% Cellulose	90% Non-fibrous (other)	None Detected
DIAP-1-043 INSULATION 350505472-0010	3-inch Hard Fitting	Gray Fibrous Heterogeneous	35% Min. Wool 10% Cellulose	55% Non-fibrous (other)	None Detected
DIAP-1-043 WRAP 350505472-0074	3-inch Hard Fitting	Cream Fibrous Layers: 2	100% Cellulose		None Detected
DIAP-1-044 BASEBOARD 350505472-0011	Brown Vinyl Baseboard	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-044 MASTIC 350505472-0075	Brown Vinyl Baseboard	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-045 350505472-0012	3-inch Hard Fitting Search Room 1	Gray Fibrous Heterogeneous	35% Min. Wool 5% Cellulose	60% Non-fibrous (other)	None Detected

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Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-046 350505472-0013	Mastic and Underlayment 171	Tan/White Fibrous Heterogeneous	25% Synthetic	75% Non-fibrous (other)	None Detected
DIAP-1-047 BASEBOARD 350505472-0014	Gray Vinyl Baseboard 171	Gray Non-Fibrous  Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-047 MASTIC 350505472-0076	Gray Vinyl Baseboard 171	Gray Non-Fibrous  Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-048 350505472-0015	Drywall 171	Brown/White Fibrous Heterogeneous	5% Glass 10% Cellulose	85% Non-fibrous (other)	None Detected
DIAP-1-049 350505472-0016	Fireproofing Spray-on White	White Fibrous Heterogeneous	25% Cellulose	75% Non-fibrous (other)	None Detected
DIAP-1-050 FLOOR TILE 350505472-0017	12x12 Vinyl F.T. with black mastic	White Non-Fibrous  Layers: 2		97% Non-fibrous (other)	3% Chrysotile
DIAP-1-050 MASTIC 350505472-0077	12x12 Vinyl F.T. with black mastic	Black Non-Fibrous  Layers: 2		90% Non-fibrous (other)	10% Chrysotile

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Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-051 BASEBOARD 350505472-0018	Brown Vinyl Baseboard with Tan Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-051 MASTIC 3505472-0078	Brown Vinyl Baseboard with Tan Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-052 INSULATION 350505472-0019	3-inch Hard Fitting	Cream Fibrous Layers: 2	35% Min. Wool 10% Cellulose	55% Non-fibrous (other)	<1% Chrysotile
DIAP-1-052-WRAP 350505472-0079	3-inch Hard Fitting	White Fibrous Layers: 2	50% Synthetic		50% Chrysotile
DIAP-1-053 WHITE LAYER 350505472-0020	White Wall Plaster	White Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-053 GRAY LAYER 350505472-0080	White Wall Plaster	Gray Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-054 350505472-0021	N. Cntry. Hall Ceiling Tile	Beige/White Fibrous Heterogeneous	50% Min. Wool 30% Cellulose	10% Perlite 10% Non-fibrous (other)	None Detected

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Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-055 350505472-0022	N. Cntry Bath Ceiling Tile	Beige/White Fibrous Heterogeneous	85% Min. Wool	12% Non-fibrous (other)	3% Chrysotile
DIAP-1-056 BASEBOARD 350505472-0023	Brown Vinyl Baseboard with Brown Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-056 MASTIC 350505472-0081	Brown Vinyl Baseboard with Brown Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-058 350505472-0024	Fireproofing spray- on white	Beige Fibrous Heterogeneous	35% Cellulose	50% Non-fibrous (other) 15% Mica	None Detected
DIAP-1-058 INSULATION 350505472-0025	3-inch Hard Fitting Weather One	Beige Fibrous Layers: 2	35% Min. Wool	65% Non-fibrous (other)	None Detected
DIAP-1-058 WRAP 350505472-0082	3-inch Hard Fitting Weather One	Beige Fibrous Layers: 2	50% Synthetic	<1% Non-fibrous (other)	50% Chrysotile
DIAP-1-059 BASEBOARD 350505472-0026	Black Vinyl Baseboard with Brown Mastic	Black Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected

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Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-059 MASTIC 350505472-0083	Black Vinyl Baseboard with Brown Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-060 350505472-0027	2x2 Ceiling Tile	White/Beige Fibrous Heterogeneous	40% Min. Wool 40% Cellulose	10% Perlite 10% Non-fibrous (other)	None Detected
DIAP-1-061 350505472-0028	Gray Vinyl Stair Tread Wrap	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
DIAP-1-062 350505472-0029	Wall Plaster	White Non-Fibrous Heterogeneous	<1% Cellulose	100% Non-fibrous (other)	None Detected
DIAP-1-063 350505472-0030	3-inch Hard Fitting Tug Tunnel	Beige Fibrous Heterogeneous	35% Min. Wool <1% Cellulose	65% Non-fibrous (other)	<1% Chrysotile
DIAP-1-064 FLOOR TILE 350505472-0031	12x12 Floor Tile	White Non-Fibrous Layers: 2		95% Non-fibrous (other)	5% Chrysotile
DIAP-1-064 MASTIC 350505472-0084	12x12 Floor Tile	Black Non-Fibrous Layers: 2		90% Non-fibrous (other)	10% Chrysotile

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Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-065 350505472-0032	Speckled/Wormy 2x4 Ceiling Tile	Tan/White Fibrous Heterogeneous	30% Min. Wool 40% Cellulose	10% Perlite 20% Non-fibrous (other)	None Detected
DIAP-1-066 BASEBOARD 350505472-0033	Brown Vinyl Baseboard with Tan Mastic	Black Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-066 MASTIC 350505472-0085	Brown Vinyl Baseboard with Tan Mastic	Tan Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-067 WHITE LAYER 350505472-0034	Plaster 116	White Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-067 TAN LAYER 350505472-0086	Plaster 116	Tan Non-Fibrous Layers: 2	<1% Cellulose	100% Non-fibrous (other)	None Detected
DIAP-1-068 INSULATION 350505472-0035	4-inch Hard Fitting Cargo 104	Tan Fibrous Layers: 2	25% Cellulose	75% Non-fibrous (other)	<1% Chrysotile
DIAP-1-068 WRAP 350505472-0087	4-inch Hard Fitting Cargo 104	Tan Fibrous Layers: 2	40% Synthetic <1% Min. Wool	15% Non-fibrous (other)	45% Chrysotile

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Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-2-069 BASEBOARD 350505472-0036	Brown Vinyl Baseboard with Tan Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-2-069 MASTIC 350505472-0088	Brown Vinyl Baseboard with Tan Mastic	Cream Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-2-070 350505472-0037	Drywall and Mud- Skyline Lounge	Tan/White Fibrous Layers: 2	<1% Glass 10% Cellulose	90% Non-fibrous (other) <1% Mica	None Detected
DIAP-2-071 FLOOR TILE 350505472-0038	12x12 Vinyl Floor Tile with Tan Mastic	White Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-2-071 MASTIC 350505472-0089	12x12 Vinyl Floor Tile with Tan Mastic	Yellow Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-2-072 350505472-0039	Drywall - West Gate Lobby	Tan/White Fibrous Layers: 2	<1% Glass 10% Cellulose	90% Non-fibrous (other)	None Detected
DIAP-2-073 WHITE LAYER 350505472-0040	Wall Plaster - Observation Lounge	White Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected

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Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-2-073 TAN LAYER 350505472-0090	Wall Plaster - Observation Lounge	Tan Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-2-074 FLOOR TILE 350505472-0041	12x12 White Vinyl Floor Tile	White Non-Fibrous Layers: 2		96% Non-fibrous (other)	4% Chrysotile
DIAP-2-074 MASTIC 350505472-0091	12x12 White Vinyl Floor Tile	Black Non-Fibrous Layers: 2		90% Non-fibrous (other)	10% Chrysotile
DIAP-2-075 350505472-0042	3-inch Hard Fitting	Tan Fibrous Heterogeneous	25% Min. Wood <1% Cellulose	75% Non-fibrous (other)	None Detected
DIAP-2-076 WHITE LAYER 350505472-0043	Wall Plaster - Janitor Closet	White Non-Fibrous Layers: 2	<1% Fibrous (other)	100% Non-fibrous (other)	None Detected
DIAP-2-076 GRAY LAYER 350505472-0092	Wall Plaster - Janitor Closet	Gray Non-Fibrous Layers: 2	<1% Cellulose	100% Non-fibrous (other)	None Detected

Analyst(s)

Erin Wittman (46)

Jynn Scott (20)

Rachel Travis (35)



or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client.

Analysis performed by EMSL Minneapolis (NVLAP #200019-0)



**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: minneapolislab@emsl.com

**EMSL**

Attn: **Chuck Deye**  
**EMR Inc, (Envir Mgt Res., Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

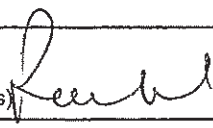
Customer ID: EMRI60  
Customer PO: 7124.00  
Received: 12/06/05 9:30 AM  
EMSL Order: 350505472

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: 7124.001

EMSL Proj:  
Analysis Date: 12/12/2005  
Report Date: 12/12/2005

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-2-077 BASEBOARD 350505472-0044	Black Vinyl Baseboard with Brown Mastic	Black Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-2-077 MASTIC 350505472-0093	Black Vinyl Baseboard with Brown Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-2-078 FLOOR TILE 350505472-0045	12x12 Vinyl Floor Tile Bar Closet 1	White Non-Fibrous Layers: 3		100% Non-fibrous (other)	None Detected
DIAP-2-078 BROWN MASTIC 350505472-0094	12x12 Vinyl Floor Tile Bar Closet 1	Brown Non-Fibrous Layers: 3		97% Non-fibrous (other)	3% Chrysotile
DIAP-2-078 YELLOW MASTIC 350505472-0095	12x12 Vinyl Floor Tile Bar Closet 1	Yellow Non-Fibrous Layers: 3		100% Non-fibrous (other)	None Detected
DIAP-2-079 350505472-0046	Fireproofing Bar Closet 1	Tan Fibrous Homogeneous	10% Cellulose	65% Non-fibrous (other) 25% Mica	None Detected
DIAP-2-080 350505472-0047	12x12 Ceiling Tile Bar	Gray/Tan Fibrous Heterogeneous	80% Min. Wool	20% Non-fibrous (other)	None Detected

Analyst(s)   
Erin Wittman (46)  
Lynn Scott (20)

  
Rachel Travis (35)

  
or other approved signatory

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Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: minneapolislab@emsl.com

**EMSL**

SM

Attn: **Chuck Deye**  
**EMR Inc, (Envir Mgt Res., Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO: 7124.00  
Received: 12/06/05 9:30 AM  
EMSL Order: 350505472

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: 7124.001

EMSL Proj:  
Analysis Date: 12/12/2005  
Report Date: 12/12/2005

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-2-081 350505472-0048	2x4 Ceiling Tile Kitchen	Tan/White Fibrous Heterogeneous	<1% Glass 10% Cellulose	90% Non-fibrous (other)	None Detected
DIAP-3-082 350505472-0049	6-inch Hard Fitting	Tan Fibrous Homogeneous	20% Min. Wool	80% Non-fibrous (other)	None Detected
DIAP-3-083 350505472-0050	6-inch Hard Fitting	Tan Fibrous Homogeneous	20% Min. Wool	80% Non-fibrous (other)	None Detected
DIAP-3-084 350505472-0051	4-inch Hard Fitting	Tan Fibrous Homogeneous	2% Synthetic 15% Min. Wool	80% Non-fibrous (other)	3% Chrysotile
DIAP-3-085 350505472-0052	4-inch Hard Fitting	Tan Fibrous Homogeneous	2% Synthetic 15% Min. Wool	80% Non-fibrous (other)	3% Chrysotile
DIAP-3-086 350505472-0053	Wall Plaster West HVAC	White Non-Fibrous Heterogeneous		100% Non-fibrous (other)	None Detected
DIAP-3-087 350505472-0054	2x4 Ceiling Tile	Tan Fibrous Heterogeneous	77% Min. Wool 5% Cellulose	15% Non-fibrous (other)	3% Chrysotile

Analyst(s)

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Lynn Scott (20)

or other approved signatory

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Analysis performed by EMSL Minneapolis (NVLAP #200019-0)



**EMSL Analytical, Inc.**

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Attn: **Chuck Deye**  
**EMR Inc, (Envir Mgt Res., Inc)**  
**11 E. Superior St.**  
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**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO: 7124.00  
Received: 12/06/05 9:30 AM  
EMSL Order: 350505472

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: 7124.001

EMSL Proj:  
Analysis Date: 12/12/2005  
Report Date: 12/12/2005

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	<u>Non-Asbestos</u>		<u>Asbestos</u>
			% Fibrous	% Non-Fibrous	% Type
DIAP-3-088 FLOOR TILE 350505472-0055	12x12 White Vinyl Floor Tile	Beige Non-Fibrous Layers: 2		95% Non-fibrous (other)	5% Chrysotile
DIAP-3-088 MASTIC 3505472-0096	12x12 White Vinyl Floor Tile	Black Non-Fibrous Layers: 2		90% Non-fibrous (other)	10% Chrysotile
DIAP-3-089 BASEBOARD 350505472-0056	Brown Vinyl Baseboard with Tan Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-3-089 MASTIC 350505472-0097	Brown Vinyl Baseboard with Tan Mastic	Tan Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-3-090 BASEBOARD 350505472-0057	Brown vinyl Baseboard with Tan Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-3-090 MASTIC 350505472-0098	Brown vinyl Baseboard with Tan Mastic	Yellow Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected

Analyst(s)

Erin Wittman (46)

Rachel Travis (35)

Lynn Scott (20)

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Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: [minneapolislab@emsl.com](mailto:minneapolislab@emsl.com)**EMSL**

511

Attn: **Chuck Deye**  
**EMR Inc, (Envir Mgt Res., Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO: 7124.00  
Received: 12/06/05 9:30 AM  
EMSL Order: 350505472

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: 7124.001

EMSL Proj:  
Analysis Date: 12/12/2005  
Report Date: 12/12/2005

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-3-091 350505472-0058	Ribbed/Speckled 3x4 Ceiling Tile	Tan/White Fibrous Heterogeneous	40% Glass 40% Cellulose	10% Perlite 10% Non-fibrous (other)	None Detected
DIAP-3-092 350505472-0059	6-inch Hard Fitting	Tan Fibrous Homogeneous	2% Synthetic 15% Min. Wool	80% Non-fibrous (other)	3% Chrysotile
DIAP-3-093 350505472-0060	6-inch Hard Fitting	Tan Fibrous Homogeneous	<1% Synthetic 15% Min. Wool	82% Non-fibrous (other)	3% Chrysotile
DIAP-3-094 350505472-0061	4-Inch Hard Fitting	Tan Fibrous Homogeneous	2% Synthetic 15% Min. Wool	80% Non-fibrous (other)	3% Chrysotile
DIAP-3-095 350505472-0062	4-inch Hard Fitting	Tan Fibrous Homogeneous	15% Min. Wool	85% Non-fibrous (other)	<1% Chrysotile
DIAP-3-096 WHITE LAYER 350505472-0063	Wall Plaster East HVAC	White Non-Fibrous  Layers: 2	<1% Fibrous (other)	100% Non-fibrous (other)	None Detected
DIAP-3-096 GRAY LAYER 350505472-0099	Wall Plaster East HVAC	Gray Non-Fibrous  Layers: 2		100% Non-fibrous (other)	None Detected

Analyst(s)

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Rachel Travis (35)

Ivonn Scott (20)

or other approved signatory

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Analysis performed by EMSL Minneapolis (NVLAP #200019-0)



# EMSL Analytical, Inc.

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**EMR Inc, (Envir Mgt Res., Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO: 7124.00  
Received: 12/08/05 9:30 AM  
EMSL Order: 350505472

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: 7124.001

EMSL Proj:  
Analysis Date: 12/12/05  
Report Date: 12/13/05

## Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-3-097 350505472-0064	Fireproofing East HVAC	Tan Fibrous Homogeneous	15% Cellulose	60% Non-fibrous (other) 25% Mica	None Detected
DIAP-R-098 350505472-0065	Main Terminal 12x12 Ceiling Tile	Grayish Fibrous Homogeneous	80% Min. Wool	20% Non-fibrous (other)	None Detected
P-R-099 350505472-0066	Skyline Room 12x12 Ceiling Tile	Grayish/Tan Fibrous Heterogeneous	80% Min. Wool	20% Non-fibrous (other)	None Detected
DIAP-R-100 350505472-0067	Skyline Room 12x12 Ceiling Tile	Tan/White Fibrous Heterogeneous	<1% Glass 10% Cellulose	90% Non-fibrous (other)	None Detected
DIAP-R-100 WHITE LAYER 350505472-0100	Roof Membrane	White Fibrous Layers: 2	15% Synthetic Not listed on COC.	85% Non-fibrous (other)	None Detected
DIAP-R-100 TAN LAYER 350505472-0101	Roof Membrane	Tan Fibrous Layers: 2	15% Synthetic Not listed on COC.	85% Non-fibrous (other)	None Detected

Report amended 12/13/05 to switch descriptions on samples #57 & #58.

Analyst(s)

Erin Wittman (46)  
Lynn Scott (20)

Rachel Travis (35)

or other approved signatory

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Analysis performed by EMSL Minneapolis (NVLAP #200019-0)



# Chain of Custody

## Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922

Fax: (763) 449-4924

<http://www.emsl.com>

Please print all information legibly.

<b>Company:</b>	Environmental Management Resources Inc. (EMR)	<b>Bill To:</b>	Environmental Management Resources Inc. (EMR)
<b>Address1:</b>	11 E. Superior St.	<b>Address1:</b>	11 E. Superior St.
<b>Address2:</b>	Suite 541	<b>Address2:</b>	Suite 541
<b>City, State:</b>	Duluth, MN	<b>City, State:</b>	Duluth, MN
<b>Zip/Post Code:</b>	55802	<b>Zip/Post Code:</b>	55802
<b>Country:</b>	USA	<b>Country:</b>	USA
<b>Contact Name:</b>	Chuck Deye	<b>Attn:</b>	Chuck Deye
<b>Phone:</b>	218-625-2332	<b>Phone:</b>	218-625-2332
<b>Fax:</b>	218-625-2201	<b>Fax:</b>	218-625-2201
<b>Email:</b>	cdeye@emr-inc.com	<b>Email:</b>	cdeye@emr-inc.com
<b>EMSL Rep:</b>		<b>P.O. Number:</b>	7124.001
<b>Project Name/Number:</b> 7124.001			

MATRIX			TURNAROUND			
<input type="checkbox"/> Air	<input type="checkbox"/> Soil	<input type="checkbox"/> Micro-Vac	<input type="checkbox"/> 3 Hours	<input type="checkbox"/> 6 Hours	<input type="checkbox"/> Same Day or 12 Hours*	<input type="checkbox"/> 24 Hours (1 day)
<input checked="" type="checkbox"/> Bulk	<input type="checkbox"/> Drinking Water		<input type="checkbox"/> 48 Hours (2 days)	<input type="checkbox"/> 72 Hours (3 days)	<input type="checkbox"/> 96 Hours (4 days)	<input checked="" type="checkbox"/> 120 Hours (5 days)
<input type="checkbox"/> Wipe	<input type="checkbox"/> Wastewater		<input type="checkbox"/> 144+ hours (6-10 days)			

TEM AIR, 3 hours, 6 hours, Please call ahead to schedule. There is a premium charge for 3-hour tat, please call 1-800-220-3675 for price prior to sending samples. You will be asked to sign an authorization form for this service.

\*12 hours (must arrive by 11:00a.m. Mon -Fri.), Please Refer to Price Quote

<b>PCM - Air</b> <input type="checkbox"/> NIOSH 7400(A) Issue 2: August 1994 <input type="checkbox"/> OSHA w/TWA <input type="checkbox"/> Other:	<b>TEM Air</b> <input type="checkbox"/> AHERA 40 CFR, Part 763 Subpart E <input type="checkbox"/> NIOSH 7402 <input type="checkbox"/> EPA Level II	<b>TEM WATER</b> <input type="checkbox"/> EPA 100.1 <input type="checkbox"/> EPA 100.2 <input type="checkbox"/> NYS 198.2
<b>PLM - Bulk</b> <input checked="" type="checkbox"/> EPA 600/R-93/116 <input type="checkbox"/> EPA Point Count <input type="checkbox"/> NY Stratified Point Count <input type="checkbox"/> PLM NOB (Gravimetric) NYS 198.1 <input type="checkbox"/> NIOSH 9002: <input type="checkbox"/> EMSL Standard Addition:	<b>TEM BULK</b> <input type="checkbox"/> Drop Mount (Qualitative) <input type="checkbox"/> Chatfield SOP - 1988-02 <input type="checkbox"/> TEM NOB (Gravimetric) NYS 198.4 <input type="checkbox"/> EMSL Standard Addition:	<b>TEM Microvac/Wipe</b> <input type="checkbox"/> ASTM D 5755-95 (quantative method) <input type="checkbox"/> Wipe Qualitative
<b>SEM Air or Bulk</b> <input type="checkbox"/> Qualitative <input type="checkbox"/> Quantitative	<b>PLM Soil</b> <input type="checkbox"/> EPA Protocol Qualitative <input type="checkbox"/> EPA Protocol Quantitative <input type="checkbox"/> EMSL MSD 9000 Method fibers/gram	<b>XRD</b> <input type="checkbox"/> Asbestos <input type="checkbox"/> Silica NIOSH 7500  <b>OTHER</b> <input type="checkbox"/>



# Chain of Custody

## Asbestos Lab Services

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Phone: (763) 449-4922  
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<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) 048 - 061

Total Samples #: 14

Relinquished: Chadley Date: 12/2/05

Time: 1600 hrs

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-1-048	Drywall 171	
DIAP-1-049	Fireproofing Spray-on White	
DIAP-1-050	12x12 Vinyl F.T. with black mastic	
DIAP-1-051	Brown Vinyl Baseboard with Tan Mastic	
DIAP-1-052	3-inch Hard Fitting	
DIAP-1-053	White Wall Plaster	
DIAP-1-054	N. Entry. Hall Ceiling Tile	
DIAP-1-055	N. Entry Bath Ceiling Tile	
DIAP-1-056	Brown Vinyl Baseboard with Brown Mastic	
DIAP-1-057	3-inch Hard Fitting Weather One	
DIAP-1-058	Fireproofing spray-on white	
DIAP-1-059	Black Vinyl Baseboard with Brown Mastic	
DIAP-1-060	2x2 Ceiling Tile	
DIAP-1-061	Gray Vinyl Stair Tread Wrap	

Switched descriptions  
per Chadley  
12/13/05  
EM

5472



# Chain of Custody

## Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) 062 - 075

Total Samples #: 14

Relinquished: Ch. H. Vey Date: 12/2/05

Time: 1600 hrs

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-1-062	Wall Plaster	
DIAP-1-063	3-inch Hard Fitting Tug Tunnel	
DIAP-1-064	12x12 Floor Tile	
DIAP-1-065	Speckled / Wormy 2x4 Ceiling Tile	
DIAP-1-066	Brown Vinyl Baseboard with Tan Mastic	
DIAP-1-067	Plaster 116	
DIAP-1-068	4-inch Hard Fitting Cargo 104	
DIAP-2-069	Brown Vinyl Baseboard with Tan Mastic	
DIAP-2-070	Drywall and Mud - Skylight Lounge	
DIAP-2-071	12x12 Vinyl Floor Tile with Tan Mastic	
DIAP-2-072	Drywall - West Gate Lobby	
DIAP-2-073	Wall Plaster - Observation Lounge	
DIAP-2-074	12x12 White Vinyl Floor Tile	
DIAP-2-075	3-inch Hard Fitting	



**Chain of Custody**  
**Asbestos Lab Services**

EMSL Analytical, Inc.  
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North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) 034 - 047

Total Samples #: 14

Relinquished: Chadley Date: 12/2/05

Time: 1600 hrs

Received: Beam FE Date: 12/5/05

Time: 9:30 am

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-B-034	Telephone Room 2x4 C.T	
DIAP-B-035	Loading Ramp 4-inch hard fittings	
DIAP-1-036	White ribbed 2x2 C.T. West Ramp	
DIAP-1-037	Brown Vinyl Baseboard West Ramp	
DIAP-1-038	White/Gray Linoleum Cust. Clear Bath	
DIAP-1-039	Tan Vinyl Baseboard Cust. Clear Bath	
DIAP-1-040	Speckled / Wormy 2x4 C.T.	
DIAP-1-041	Red Vinyl Baseboard	
DIAP-1-042	Drywall :: Customs Cleaning Area	
DIAP-1-043	3-inch Hard Fitting	
DIAP-1-044	Brown Vinyl Baseboard	
DIAP-1-045	3-inch Hard Fitting Search Room 1	
DIAP-1-046	Mastic and Underlayment 171	
DIAP-1-047	Gray Vinyl Baseboard 171	





**Chain of Custody**  
**Asbestos Lab Services**

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14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

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Fax: (763) 449-4924  
<http://www.emsl.com>

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Client Sample # (s) 076 - 089

Total Samples #: 14

Relinquished: Chubb Date: 12/2/05

Time: 1600 hrs

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-2-076	Wall Plaster - Janitor Closet	
DIAP-2-077	Black Vinyl Baseboard with Brown Mastic	
DIAP-2-078	12x12 Vinyl Floor Tile Bar Closet 1	
DIAP-2-079	Fireproofing Bar Closet 1	
DIAP-2-080	12x12 Ceiling Tile Bar	
DIAP-2-081	2x4 Ceiling Tile Kitchen	
DIAP-3-082	6-inch Hard Fitting	
DIAP-3-083	6-inch Hard Fitting	
DIAP-3-084	4-inch Hard Fitting	
DIAP-3-085	4-inch Hard Fitting	
DIAP-3-086	Wall Plaster West HVAC	
DIAP-3-087	2x4 Ceiling Tile	
DIAP-3-088	12x12 White Vinyl Floor Tile	
DIAP-3-089	Brown Vinyl Baseboard with Tan Mastic	



5472



# Chain of Custody Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
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Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) 090 - 100

Total Samples #: 11

Relinquished: Chick Page Date: 12/2/05

Time: 1600 hrs

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-3-090	Brown vinyl Baseboard with Tan Mastic	
DIAP-3-091	Ribbed / Speckled 2x4 Ceiling Tile	
DIAP-3-092	6-inch Hard Fitting	
DIAP-3-093	6-inch Hard Fitting	
DIAP-3-094	4-inch Hard Fitting	
DIAP-3-095	4-inch Hard Fitting	
DIAP-3-096	Wall Plaster East HVAC	
DIAP-3-097	Fireproofing East HVAC	
DIAP-R-098	Main Terminal 12x12 Ceiling Tile	
DIAP-R-099	Skyline Room 12x12 Ceiling Tile	
DIAP-R-100	Skyline Room Ceiling Drywall	

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: [minneapolislab@emsl.com](mailto:minneapolislab@emsl.com)

Attn: **Chuck Deye**  
**EMR Inc, (Environmental Management Resources, Inc)**  
**11 East Superior Street**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMR150  
Customer PO:  
Received: 01/04/06 9:30 AM  
EMSL Order: 350600024

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: DIAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 1/9/2006  
Report Date: 1/9/2006

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-002 350600024-0001	4-inch pipe wrap	White Fibrous Homogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-B-006 350600024-0002	4-inch pipe wrap	White Fibrous Heterogeneous	15% Synthetic 5% Glass	20% Non-fibrous (other)	60% Chrysotile
DIAP-B-009 350600024-0003	6-inch pipe wrap	Tan Fibrous Heterogeneous	10% Synthetic 5% Glass	55% Non-fibrous (other)	30% Chrysotile
DIAP-B-011 350600024-0004	Converter #2 Wrap	Tan Fibrous Heterogeneous	20% Synthetic 5% Glass	35% Non-fibrous (other) 10% Mica	30% Chrysotile
DIAP-B-012 INSULATION 350600024-0005	In-Service Boiler Exhaust Wrap	Tan Fibrous Layers: 2	5% Wollastonite 5% Min. Wool 20% Cellulose	60% Non-fibrous (other) 10% Mica	None Detected
DIAP-B-012 WRAP 350600024-0025	In-Service Boiler Exhaust Wrap	White Fibrous Layers: 2	10% Glass	85% Non-fibrous (other)	5% Chrysotile
DIAP-B-013 INSULATION 350600024-0006	Out-of-service Boiler Exhaust Wrap	Tan Fibrous Layers: 2	5% Wollastonite 5% Min. Wool 20% Cellulose	60% Non-fibrous (other) 10% Mica	None Detected

Analyst(s)

Rachel Travis (29)



or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method variations. Interpretation and use of test results are the responsibility of the client.

Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: [minneapolislab@emsl.com](mailto:minneapolislab@emsl.com)

Attn: **Chuck Deye**  
**EMR Inc, (Environmental Management Resources, Inc)**  
**11 East Superior Street**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO:  
Received: 01/04/06 9:30 AM  
EMSL Order: 350600024

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: DIAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 1/9/2006  
Report Date: 1/9/2006

**Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy**

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-013 WRAP 350600024-0026	Out-of-service Boiler Exhaust Wrap	White Fibrous Layers: 2	10% Glass	85% Non-fibrous (other)	5% Chrysotile
DIAP-B-020 350600024-0007	6-inch Water Main Pipe Wrap	White Fibrous Homogeneous	5% Glass	25% Non-fibrous (other)	70% Chrysotile
DIAP-B-022 350600024-0008	4-inch pipe wrap	Tan Fibrous Homogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-B-023 350600024-0009	6-inch pipe wrap	White Fibrous Homogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-B-029 350600024-0010	4-inch pipe wrap	Tan Fibrous Homogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-B-030 INSULATION 350600024-0011	6-inch pipe wrap	Tan Fibrous Layers: 2	20% Glass	80% Non-fibrous (other)	None Detected
DIAP-B-030 WRAP 350600024-0027	6-inch pipe wrap	Tan Fibrous Layers: 2	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile

Analyst(s)

Rachel Travis (29)



or other approved signatory

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Attn: **Chuck Deye**  
**EMR Inc, (Environmental Management Resources, Inc)**  
**11 East Superior Street**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO:  
Received: 01/04/06 9:30 AM  
EMSL Order: 350600024

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: DIAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 1/9/2006  
Report Date: 1/9/2006

**Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy**

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-045 350600024-0012	3-inch pipe wrap	Tan Fibrous Homogeneous	85% Cellulose	15% Non-fibrous (other)	None Detected
DIAP-1-063 350600024-0013	3-inch pipe wrap	White Fibrous Homogeneous	10% Glass	20% Non-fibrous (other)	70% Chrysotile
DIAP-2-075 350600024-0014	3-inch pipe wrap	Tan Fibrous Homogeneous	90% Cellulose	10% Non-fibrous (other)	None Detected
DIAP-3-082 350600024-0015	6-inch pipe wrap	White Fibrous Heterogeneous	10% Synthetic	10% Non-fibrous (other)	80% Chrysotile
DIAP-3-083 350600024-0016	6-inch pipe wrap	White Fibrous Heterogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-3-084 350600024-0017	4-inch pipe wrap	White Fibrous Heterogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-3-085 350600024-0018	4-inch pipe wrap	Tan Fibrous Heterogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile

Analyst(s)

Rachel Travis (29)



or other approved signatory

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Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

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Attn: **Chuck Deye**  
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Customer ID: EMRI50  
Customer PO:  
Received: 01/04/06 9:30 AM  
EMSL Order: 350600024

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: DIAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 1/9/2006  
Report Date: 1/9/2006

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-3-092 350600024-0019	6-inch pipe wrap	Tan Fibrous Heterogeneous	10% Synthetic 5% Glass	20% Non-fibrous (other)	65% Chrysotile
DIAP-3-093 350600024-0020	6-inch pipe wrap	White Fibrous Heterogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-3-094 350600024-0021	4-inch pipe wrap	White Fibrous Heterogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-3-095 350600024-0022	4-inch pipe wrap	White Fibrous Heterogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-1-101 WRAP 350600024-0023	3-inch pipe wrap and insulation	White Fibrous Layers: 2	90% Cellulose	10% Non-fibrous (other)	None Detected
DIAP-1-101 INSULATION 350600024-0028	3-inch pipe wrap and insulation	Tan Fibrous Layers: 2	20% Min. Wool	80% Non-fibrous (other)	None Detected
DIAP-1-102 WRAP 350600024-0024	3-inch pipe wrap and insulation	White Fibrous Layers: 2	90% Cellulose	10% Non-fibrous (other)	None Detected

Analyst(s)

Rachel Travis (29)



or other approved signatory

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Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: [minneapolislab@emsl.com](mailto:minneapolislab@emsl.com)

Attn: **Chuck Deye**  
**EMR Inc, (Environmental Management Resources, Inc)**  
**11 East Superior Street**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMR150  
Customer PO:  
Received: 01/04/06 9:30 AM  
EMSL Order: 350600024

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: DIAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 1/9/2006  
Report Date: 1/9/2006

**Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy**

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-102 INSULATION 350600024-0029	3-inch pipe wrap and insulation	Tan Fibrous  Layers: 2	20% Min. Wool	80% Non-fibrous (other)	None Detected

\*\*\*Amended 1/9/06 corrected sample numbers per COC.

Analyst(s)

Rachel Travis (29)



or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method variations. Interpretation and use of test results are the responsibility of the client.  
Analysis performed by EMSL Minneapolis (NVLAP #200019-0)



# Chain of Custody

## Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
http://www.emsl.com

Please print all information legibly.

Company:	EMR Incorporated	Bill To:	EMR Incorporated
Address1:	11 E. Superior Street	Address1:	11 E. Superior Street
Address2:	Suite 541	Address2:	Suite 541
City, State:	Duluth, MN	City, State:	Duluth, MN
Zip/Post Code:	55802	Zip/Post Code:	55802
Country:	USA	Country:	USA
Contact Name:	Chuck Deye	Attn:	Chuck Deye
Phone:	2186252332	Phone:	2186252332
Fax:	2186252201	Fax:	2186252201
Email:	cdeye@emr-inc.com	Email:	cdeye@emr-inc.com
EMSL Rep:		P.O. Number:	7124.001
Project Name/Number: DIAP Asbestos 7124.001			

MATRIX			TURNAROUND			
<input type="checkbox"/> Air	<input type="checkbox"/> Soil	<input type="checkbox"/> Micro-Vac	<input type="checkbox"/> 3 Hours	<input type="checkbox"/> 6 Hours	<input type="checkbox"/> Same Day or 12 Hours*	<input type="checkbox"/> 24 Hours (1 day)
<input checked="" type="checkbox"/> Bulk	<input type="checkbox"/> Drinking Water		<input type="checkbox"/> 48 Hours (2 days)	<input checked="" type="checkbox"/> 72 Hours (3 days)	<input type="checkbox"/> 96 Hours (4 days)	<input type="checkbox"/> 120 Hours (5 days)
<input type="checkbox"/> Wipe	<input type="checkbox"/> Wastewater		<input type="checkbox"/> 144+ hours (6-10 days)			

TEM AIR, 3 hours, 6 hours, Please call ahead to schedule. There is a premium charge for 3-hour turn, please call 1-800-220-3675 for price prior to sending samples. You will be asked to sign an authorization form for this service.

\*12 hours (must arrive by 11:00a.m. Mon-Fri.), Please Refer to Price Quote

<b>PCM - Air</b> <input type="checkbox"/> NIOSH 7400(A) Issue 2: August 1994 <input type="checkbox"/> OSHA w/TWA <input type="checkbox"/> Other:	<b>TEM Air</b> <input type="checkbox"/> AHERA 40 CFR, Part 763 Subpart E <input type="checkbox"/> NIOSH 7402 <input type="checkbox"/> EPA Level II	<b>TEM WATER</b> <input type="checkbox"/> EPA 100.1 <input type="checkbox"/> EPA 100.2 <input type="checkbox"/> NYS 198.2
<b>PLM - Bulk</b> <input checked="" type="checkbox"/> EPA 600/R-93/116 <input type="checkbox"/> EPA Point Count <input type="checkbox"/> NY Stratified Point Count <input type="checkbox"/> PLM NOB (Gravimetric) NYS 198.1 <input type="checkbox"/> NIOSH 9002: <input type="checkbox"/> EMSL Standard Addition:	<b>TEMBULK</b> <input type="checkbox"/> Drop Mount (Qualitative) <input type="checkbox"/> Chatfield SOP - 1988-02 <input type="checkbox"/> TEM NOB (Gravimetric) NYS 198.4 <input type="checkbox"/> EMSL Standard Addition:  <b>PLM Soil</b> <input type="checkbox"/> EPA Protocol Qualitative <input type="checkbox"/> EPA Protocol Quantitative <input type="checkbox"/> EMSL MSD 9000 Method fibers/gram	<b>TEM Microvac/Wipe</b> <input type="checkbox"/> ASTM D 5755-95 (quantitative method) <input type="checkbox"/> Wipe Qualitative  <b>XRD</b> <input type="checkbox"/> Asbestos <input type="checkbox"/> Silica NIOSH 7500  <b>OTHER</b> <input type="checkbox"/>



350600024



# Chain of Custody

## Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) DIAP-B-002 - DIAP-Z-075

Total Samples #: 14

Relinquished: Chaffey Date: 1/3/06

Time: 1500

Received: K Beam FG Date: 1/4/06

Time: 9:30 am

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-B-002	4-inch pipe wrap	
DIAP-B-006	4-inch pipe wrap	
DIAP-B-009	6-inch pipe wrap	
DIAP-B-011	Converter #2 Wrap	
DIAP-B-012	In-Service Boiler Exhaust Wrap	
DIAP-B-013	Out-of-Service Boiler Exhaust Wrap	
DIAP-B-020	6-inch Water Main Pipe Wrap	
DIAP-B-022	4-inch pipe wrap	
DIAP-B-023	6-inch pipe wrap	
DIAP-B-029	4-inch pipe wrap	
DIAP-B-030	6-inch wrap	
DIAP-1-045	3-inch pipe wrap	
DIAP-1-063	3-inch pipe wrap	
DIAP-2-075	3-inch pipe wrap	



350600024



# Chain of Custody

## Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) DIAP-3-082 - DIAP-1-102

Total Samples #: 10

Relinquished: Chad Page Date: 1/3/06

Time: 1500

Received: JBear FE Date: 1/4/06

Time: 9:30

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-3-082	6-inch pipe wrap	
DIAP-3-083	6-inch pipe wrap	
DIAP-3-084	4-inch pipe wrap	
DIAP-3-085	4-inch pipe wrap	
DIAP-3-092	6-inch pipe wrap	
DIAP-3-093	6-inch pipe wrap	
DIAP-3-094	4-inch pipe wrap	
DIAP-3-095	4-inch pipe wrap	
DIAP-1-101	3-inch pipe wrap and insulation	
DIAP-1-102	3-inch pipe wrap and insulation	

**APPENDIX C**

**HOMOGENEOUS AREA PHYSICAL ASSESSMENT FORMS**

---

# HOMOGENEOUS AREA PHYSICAL ASSESSMENT FORM

Prepared By: Chuck Deye :: EMR Incorporated Street Address: 11 E. Superior St. Ste. 541

City, State: Duluth, MN

Building Name: Duluth International Airport Terminal Building

Sample No: 001, 050, 064, 074, 088 Date: 1/10/2006 Color: White

Material Type: 12" x 12" Vinyl Floor Tile and Mastic

Gen'l. Area: Multiple areas on all floors

Category: ☐ TSI ☐ Surfacing ☒ Misc.

Amount: 7,800 ☒ S.F. ☐ L.F. ☐ M.J.

Status: ☒ In-Place ☐ Removed ☐ Removed-Partial

Class: ☐ Friable ☒ NF Category I ☐ NF Category II

Percent of Damage ☐ 0% ☒ <0-10% ☐ 10-25% ☐ >25%

Visible ☐ None ☐ <10% ☒ >10%

Mech. Vent. ☒ No ☐ Intake ☐ Exhaust

Extent of Damage ☐ Localized ☒ Distributed

Vibration ☐ None ☒ Light ☐ Moderate ☐ Heavy

Accessibility ☒ Accessible ☐ Difficult ☐ None

Air Erosion ☐ Yes ☒ No ☐ Potential

Physical Damage ☐ None ☒ Light ☐ Moderate ☐ Heavy

Barriers ☒ No ☐ Permanent ☐ Temporary

Exposure Factor ☐ None ☒ Low ☐ Moderate ☐ High

H2O Damage ☒ None ☐ Light ☐ Moderate ☐ Heavy

Activity ☐ None ☐ Light ☐ Moderate ☒ Heavy

Condition Assessment ☐ Good ☒ Damaged ☐ Significantly Damaged

## HOMOGENEOUS AREA F

Prepared By: Chuck Deye :: EMR Incorporated

**Building Name:** Duluth International Airport Terminal Building

**Color:** White

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Category: TSI ☐

**Misc.** 

**Class:** Friable

NF Category I ☐NF Category II ☐

**Visible**

No

Intake ☐chairist ☐

□ **LEARNING OBJECTIVES**

## Air Erosion

Yes ☐

3

Factor

one. In


<https://doi.org/10.1016/j.jmb.2020.105400>

☐ Moderate

# HOMOGENEOUS AREA PHYSICAL ASSESSMENT FORM

Prepared By: Chuck Deye :: EMR Incorporated Street Address: 11 E. Superior St. Ste. 541

Building Name: Duluth International Airport Terminal Building City, State: Duluth, MN

Sample No: DIAP-3-087 Date: 1/10/2006 Color: White

Material Type: 2' x 4' Suspended Ceiling Tile

Gen'l. Area: 3rd Floor Reception Area Coffee Room Category: TSI ☐ Surfacing ☐ Misc. ☒

Amount: 90 ☒ S.F. ☐ L.F. ☐ M.J.

Status: ☒ In-Place ☐ Removed ☐ Removed-Partial  
Class: ☒ Friable ☐ NF Category I ☐ NF Category II

Percent of Damage  
0% ☒  
<0-10% ☐  
10-25% ☐  
>25% ☐  
Deterioration  
None ☒  
Light ☐  
Moderate ☐  
Heavy ☐  
Visible  
None ☐  
<10% ☐  
>10% ☒  
Mech. Vent.  
No ☒  
Intake ☐  
Exhaust ☐

Extent of Damage  
Localized ☐  
Distributed ☐  
Vibration  
None ☐  
Light ☒  
Moderate ☐  
Heavy ☐  
Physical Damage  
None ☒  
Light ☐  
Moderate ☐  
Heavy ☐  
Accessibility  
Accessible ☒  
Difficult ☐  
None ☐  
Air Erosion  
Yes ☐  
No ☒  
Potential ☐

Condition Assessment  
Good ☒  
Damaged ☐  
Significantly Damaged ☐  
Barriers  
No ☒  
Permanent ☐  
Temporary ☐  
Exposure Factor  
None ☐  
Low ☒  
Moderate ☐  
High ☐  
Activity  
None ☐  
Light ☒  
Moderate ☐  
Heavy ☐

H2O Damage  
None ☒  
Light ☐  
Moderate ☐  
Heavy ☐

# HOMOGENEOUS AREA PHYSICAL ASSESSMENT FORM

Prepared By: Chuck Deye :: EMR Incorporated Street Address: 11 E. Superior St. Ste. 541  
 Building Name: Duluth International Airport Terminal Building City, State: Duluth, MN

Sample No: 02, 06, 09, 11, 12, 13, 20, 22, 23, 29, 30, 35, 52, 57, 63, 68 Color: White/Tan  
 Material Type: Fabric pipe wrap on TSI elbows Date: 1/10/2006  
 Gen'l. Area: Main Terminal Building (excluding customs additon) Floors B-2

Amount: 237 fittings ☐ S.F. ☐ L.F. ☒ M.J.  
 Status: ☒ In-Place ☐ Removed ☐ Removed-Partial  
 Class: ☒ Friable ☐ NF Category I ☐ NF Category II  
 Category: ☒ TSI ☐ Surfacing ☐ Misc.

Percent of Damage ☐ 0% ☒ <0-10% ☐ 10-25% ☐ >25%  
 Deterioration ☐ None ☒ Light ☐ Moderate ☐ Heavy  
 Visible ☐ None ☐ <10% ☒ >10%  
 Mech. Vent. ☒ No ☐ Intake ☐ Exhaust

Extent of Damage ☐ Localized ☒ Distributed  
 Vibration ☐ None ☒ Light ☐ Moderate ☐ Heavy  
 Accessibility ☒ Accessible ☐ Difficult ☐ None  
 Air Erosion ☐ Yes ☒ No ☐ Potential  
 Physical Damage ☐ None ☒ Light ☐ Moderate ☐ Heavy

Condition Assessment ☐ Good ☒ Damaged ☐ Significantly Damaged  
 Exposure Factor ☐ None ☒ Low ☐ Moderate ☐ High  
 Barriers ☒ No ☐ Permanent ☐ Temporary  
 Activity ☐ None ☒ Light ☐ Moderate ☐ Heavy  
 H2O Damage ☐ None ☒ Light ☐ Moderate ☐ Heavy

# HOMOGENEOUS AREA PHYSICAL ASSESSMENT FORM

Prepared By: Chuck Deye :: EMR Incorporated Street Address: 11 E. Superior St. Ste. 541

City, State: Duluth, MN

Building Name: Duluth International Airport Terminal Building

Sample No: 82, 83, 84, 85, 92, 93, 94, 95 Date: 1/10/2006 Color: White/Tan

Material Type: Fabric pipe wrap and insulation on TSI elbows

Gen'l. Area: Third Floor East and West HVAC Rooms

Amount: 102 Fittings ☐ S.F. ☐ L.F. ☒ M.J.

Status: ☒ In-Place ☐ Removed ☐ Removed-Partial

Category: ☒ TSI ☐ Surfacing ☐ Misc.

Class: ☒ Friable ☐ NF Category I ☐ NF Category II

Percent of Damage  
☐ 0% ☒ <0-10% ☐ 10-25% ☐ >25%

Deterioration  
☐ None ☒ Light ☐ Moderate ☐ Heavy

Visible  
☐ None ☐ <10% ☒ >10%

Mech. Vent.  
☒ No ☐ Intake ☐ Exhaust

Extent of Damage  
☐ Localized ☒ Distributed

Vibration  
☐ None ☒ Light ☐ Moderate ☐ Heavy

Accessibility  
☒ Accessible ☐ Difficult ☐ None

Air Erosion  
☐ Yes ☒ No ☐ Potential

Physical Damage  
☐ None ☒ Light ☐ Moderate ☐ Heavy

Condition Assessment  
☐ Good ☒ Damaged ☐ Significantly Damaged

Barriers  
☒ No ☐ Permanent ☐ Temporary

Exposure Factor  
☐ None ☒ Low ☐ Moderate ☐ High

H2O Damage  
☐ None ☒ Light ☐ Moderate ☐ Heavy

Activity  
☐ None ☒ Light ☐ Moderate ☐ Heavy

# HOMOGENEOUS AREA PHYSICAL ASSESSMENT FORM

Prepared By: Chuck Deye :: EMR Incorporated

Street Address: 11 E. Superior St. Ste. 541

Building Name: Duluth International Airport Terminal Building

City, State: Duluth, MN

Sample No: 012 and 013

Date: 1/10/2006

Color: White/Tan

Material Type: Fabric pipe wrap on boiler exhaust runs

Gen'l. Area: Basement boiler room

Category:

TSI ☒  
Surfacing ☐  
Misc. ☐

Amount: 40 ☐ S.F. ☒ L.F. ☐ M.J.

Status: ☒ In-Place  
☐ Removed  
☐ Removed-Partial

Class: ☒ Friable  
NF Category I ☐  
NF Category II ☐

Percent of Damage  
0% ☐  
<0-10% ☒  
10-25% ☐  
>25% ☐

Deterioration  
None ☐  
Light ☒  
Moderate ☐  
Heavy ☐

Visible  
None ☐  
<10% ☐  
>10% ☒

Mech. Vent.  
No ☒  
Intake ☐  
Exhaust ☐

Extent of Damage  
Localized ☐  
Distributed ☒

Vibration  
None ☐  
Light ☒  
Moderate ☐  
Heavy ☐

Accessibility  
Accessible ☒  
Difficult ☐  
None ☐

Air Erosion  
Yes ☐  
No ☒  
Potential ☐

Physical Damage  
None ☐  
Light ☒  
Moderate ☐  
Heavy ☐

Condition Assessment  
Good ☐  
Damaged ☒  
Significantly Damaged ☐

Barriers  
No ☒  
Permanent ☐  
Temporary ☐

Exposure Factor  
None ☐  
Low ☒  
Moderate ☐  
High ☐

H2O Damage  
None ☒  
Light ☐  
Moderate ☐  
Heavy ☐

Activity  
None ☐  
Light ☒  
Moderate ☐  
Heavy ☐



# HOMOGENEOUS AREA PHYSICAL ASSESSMENT FORM

Prepared By: Chuck Deye :: EMR Incorporated

Street Address: 11 E. Superior St. Ste. 541

Building Name: Duluth International Airport Terminal Building

City, State: Duluth, MN

Sample No: DIAP-B-011

Date: 1/10/2006

Color: White/Tan

Material Type: Fabric pipe wrap on water heat converter

Gen'l. Area: Basement boiler room

Category: TSI

Amount: 20 ☒ S.F. ☐ L.F. ☐ M.J.

Status: ☒ In-Place  
☐ Removed  
☐ Removed-Partial

Class: ☒ Friable  
☐ NF Category I  
☐ NF Category II

Percent of Damage  
☒ 0%  
☐ <0-10%  
☐ 10-25%  
☐ >25%

Deterioration  
☒ None  
☐ Light  
☐ Moderate  
☐ Heavy

Visible  
☐ None  
☐ <10%  
☒ >10%

Mech. Vent.  
☒ No  
☐ Intake  
☐ Exhaust

Extent of Damage  
☐ Localized  
☐ Distributed

Vibration  
☐ None  
☒ Light  
☐ Moderate  
☐ Heavy

Accessibility  
☒ Accessible  
☐ Difficult  
☐ None

Air Erosion  
☐ Yes  
☒ No  
☐ Potential

Physical Damage  
☒ None  
☐ Light  
☐ Moderate  
☐ Heavy

Condition Assessment  
☒ Good  
☐ Damaged  
☐ Significantly Damaged

Barriers  
☒ No  
☐ Permanent  
☐ Temporary

Exposure Factor  
☐ None  
☒ Low  
☐ Moderate  
☐ High

H2O Damage  
☒ None  
☐ Light  
☐ Moderate  
☐ Heavy

Activity  
☐ None  
☒ Light  
☐ Moderate  
☐ Heavy

## **Appendix F**

### **Bulk Asbestos Analysis Report**

Mr. Camron Vollbrecht  
Braun Intertec-Duluth  
4511 W. First Street, Suite 4  
Duluth, MN 55807

June 26, 2012

Work Order #: 1203549

RE: Duluth International Airport

DU-12-01858

Dear Camron Vollbrecht:

## **Bulk Asbestos Analysis Report**

The microscopy department of Braun Intertec Corporation received your analytical request on June 19, 2012. The objective of this analysis was to determine the presence of asbestos using polarized light microscopy (PLM) and to determine the percent of asbestos and non-asbestos fibrous components by calibrated visual area estimation. Analytical results are summarized on the following laboratory report.

## **Methodology**

Bulk asbestos analysis is conducted in accordance with the Environmental Protection Agency's (EPA) methods 40 CFR, Part 763, Ch. 1, Subpart F, Appendix A (7-1-87 Edition) and EPA/600/R-93/116. All analyses are in compliance with the quality control procedures specified by the methods. All samples are examined for homogeneity. If a sample contains more than one layer, each layer is analyzed individually. Total fibrous content is calculated for joint compound/wallboard systems by combining layer results according to their percentages of the total sample. All routine quality assurance procedures were followed, unless otherwise noted.

## **Remarks**

Braun Intertec is accredited by the National Institute of Standards and Technology's (NIST), National Voluntary Laboratory Accreditation Program (NVLAP) for selected test methods for bulk asbestos identification under Lab Code 101234-0. This report in no way constitutes or implies product certification, approval or endorsement by NVLAP or any other agency of the U.S. Government. This test report relates only to the items submitted for analysis.



June 26, 2012

Work Order #: 1203549

Samples are retained at our laboratory for a period of 30 days and will be disposed of unless otherwise instructed by the client.

This report is issued under terms of our General Conditions. It can not be copied, except in its entirety, without prior written permission from Braun Intertec.

We appreciate your decision to use Braun Intertec Corporation for this project. We are committed to being your vendor of choice to meet your analytical needs.

If you have any questions please contact me at 952-995-2688.

Sincerely,

**BRAUN INTERTEC CORPORATION**



Steve Felton

Project Manager

Client: **Braun Intertec-Duluth**  
 Log-In: 06/19/12  
 Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
 Lab Contact: Steve Felton  
 PO Number: DU-12-01858

Date Reported: 6/26/2012  
**Page 3 of 15**

Sample No: 1203549-01	Client ID: Br-100A
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Sheetrock</b>	3	100	1,2,3	Cellulose 5 Glass Fibers <1		None Detected		06/22/12
White powdery compound	(A)	5	1,2,3	None Detected		None Detected		
Brown paper	(B)	5	3	Cellulose 95		None Detected		
White chalky	(C)	90	1,3	Glass Fibers <1		None Detected		

Sample No: 1203549-02	Client ID: Br-100B
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Sheetrock</b>	3	100	1,3,6	Cellulose 5 Glass Fibers <1		None Detected		06/22/12
White granular compound	(A)	100	1,3,6	None Detected		None Detected		
Brown paper	(B)	5	3	Cellulose 95		None Detected		
White chalky	(C)	85	1,3	Glass Fibers <1		None Detected		

Sample No: 1203549-03	Client ID: Br-101
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray fibrous ceiling tile with paint</b>	1	100	3,6,11	Cellulose 60 Glass Fibers 20		None Detected		06/22/12

Client: **Braun Intertec-Duluth**  
Log-In: 06/19/12  
Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
Lab Contact: Steve Felton  
PO Number: DU-12-01858

Date Reported: 6/26/2012  
**Page 4 of 15**

Sample No:	1203549-04	Client ID:	Br-102
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Baseboard with adhesive</b>	2	100	-	-		-		06/22/12
Brown rubbery	(A)	>99	1,3,10	None Detected		None Detected		
Yellow adhesive	(B)	<1	1,7	None Detected		None Detected		

Sample No:	1203549-05	Client ID:	Br-103
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Green adhesive</b>	1	100	1,7	Cellulose <1 Glass Fibers <1		None Detected		06/22/12

Sample No:	1203549-06	Client ID:	Br-104
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray fibrous ceiling tile with paint</b>	1	100	3,6,11	Cellulose 60 Glass Fibers 10		None Detected		06/25/12

Sample No:	1203549-07	Client ID:	Br-105
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray fibrous ceiling tile with paint</b>	1	100	3,6,11	Cellulose 1 Glass Fibers 80		None Detected		06/25/12

Client: **Braun Intertec-Duluth**  
Log-In: 06/19/12  
Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
Lab Contact: Steve Felton  
PO Number: DU-12-01858

Date Reported: 6/26/2012  
**Page 5 of 15**

Sample No:	1203549-08	Client ID:	Br-106
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Sheetrock</b>	2	100	1,3	Cellulose 17		None Detected		06/25/12
Brown paper	(A)	15	3	Cellulose 95		None Detected		
White chalky	(B)	85	1,3	Cellulose 3		None Detected		

Sample No:	1203549-09	Client ID:	Br-107
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray vinyl</b>	1	100	1,3,9	None Detected		None Detected		06/25/12

Sample No:	1203549-10	Client ID:	Br-108
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Yellow adhesive</b>	1	100	1,7	Cellulose 3 Synthetic Fibers <1		None Detected		06/25/12

Sample No:	1203549-11	Client ID:	Br-109
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray fibrous ceiling tile with paint</b>	1	100	1,3,11,14	Cellulose 3 Glass Fibers 80		None Detected		06/25/12

Client: **Braun Intertec-Duluth**  
Log-In: 06/19/12  
Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
Lab Contact: Steve Felton  
PO Number: DU-12-01858

Date Reported: 6/26/2012  
**Page 6 of 15**

Sample No:	1203549-12	Client ID:	Br-110
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Yellow adhesive</b>	1	100	1,7	Cellulose <1 Synthetic Fibers <1		None Detected		06/25/12

Sample No:	1203549-13	Client ID:	Br-111
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Tan fabric with paint</b>	1	100	11	Cellulose 95		None Detected		06/25/12

Sample No:	1203549-14	Client ID:	Br-112
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Insulation</b>	2	100	-	-		-		06/25/12
White fibrous coating	(A)	60	1,3,11,14	Cellulose 5 Glass Fibers 10		Chrysotile 4		
Yellow fibrous	(B)	40	--	Glass Fibers 100		None Detected		

Sample No:	1203549-15	Client ID:	Br-113
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray fibrous ceiling tile with paint</b>	1	100	3,6,11	Cellulose 60 Glass Fibers 10		None Detected		06/25/12



Client:	<b>Braun Intertec-Duluth</b>	Laboratory:	<b>Braun Intertec Corporation</b>	Date Reported:	6/26/2012
Log-In:	06/19/12	Lab Contact:	Steve Felton	<b>Page 7 of 15</b>	
Client Reference:	Duluth International Airport	PO Number:	DU-12-01858		

Sample No: 1203549-16		Client ID: Br-114							
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date	
Gray fibrous ceiling tile with paint	1	100	3,6,11	Cellulose 60 Glass Fibers 10		None Detected		06/25/12	

Sample No: 1203549-17		Client ID: Br-115A							
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date	
Tan powdery compound with paint	1	100	1,3,11	None Detected		None Detected		06/25/12	

Sample No: 1203549-18		Client ID: Br-115B							
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date	
Tan powdery compound with paint	1	100	1,3,11	None Detected		None Detected		06/25/12	

Sample No: 1203549-19		Client ID: Br-115C							
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date	
Tan powdery compound with paint	1	100	1,3,11	None Detected		None Detected		06/25/12	

Client:	<b>Braun Intertec-Duluth</b>	Laboratory:	<b>Braun Intertec Corporation</b>	Date Reported:	6/26/2012
Log-In:	06/19/12	Lab Contact:	Steve Felton	<b>Page 8 of 15</b>	
Client Reference:	Duluth International Airport	PO Number:	DU-12-01858		

Sample No: 1203549-20		Client ID: Br-116							
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date	
Gray fibrous tacky	1	100	1,3,6	None Detected		Chrysotile 5		06/25/12	

Sample No: 1203549-21		Client ID: Br-117							
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date	
Tan fibrous micaceous	1	100	1,2,3	Cellulose 15		None Detected		06/25/12	

Sample No: 1203549-22		Client ID: Br-118							
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date	
Gray fibrous ceiling tile with paint	1	100	3,6,11	Cellulose 40 Glass Fibers 40		Chrysotile 2		06/25/12	

Sample No: 1203549-23		Client ID: Br-119							
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date	
Gray fibrous ceiling tile with paint	1	100	3,6,11	Cellulose 60 Glass Fibers 10		None Detected		06/25/12	

Client: **Braun Intertec-Duluth**  
Log-In: 06/19/12  
Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
Lab Contact: Steve Felton  
PO Number: DU-12-01858

Date Reported: 6/26/2012  
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Sample No: 1203549-24		Client ID: Br-120						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Baseboard with adhesive	2	100	-	-		-		06/25/12
Gray rubbery	(A)	97	1,3,10	None Detected		None Detected		
Yellow adhesive	(B)	3	1,7	Cellulose <1		None Detected		

Sample No: 1203549-25		Client ID: Br-121						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Gray fibrous micaceous	1	100	1,2,3	None Detected		None Detected		06/25/12

Sample No: 1203549-26		Client ID: Br-122						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Sheetrock	3	100	1,3	Cellulose 14 Glass Fibers <1		None Detected		06/25/12
White powdery compound	(A)	10	1,3	None Detected		None Detected		
Brown/white paper	(B)	15	3	Cellulose 95		None Detected		
White chalky	(C)	75	1,3	Cellulose <1		None Detected		

Sample No: 1203549-27		Client ID: Br-123						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Yellow adhesive	1	100	1,7	Cellulose <1		None Detected		06/25/12

Client:	<b>Braun Intertec-Duluth</b>	Laboratory:	<b>Braun Intertec Corporation</b>	Date Reported:	6/26/2012
Log-In:	06/19/12	Lab Contact:	Steve Felton	<b>Page 10 of 15</b>	
Client Reference:	Duluth International Airport	PO Number:	DU-12-01858		

Sample No: 1203549-28		Client ID: Br-124						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Gray rubbery	1	100	1,10	None Detected		None Detected		06/25/12

Sample No: 1203549-29		Client ID: Br-125						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Black granular tarry	1	100	1,8	None Detected		None Detected		06/25/12

Sample No: 1203549-30		Client ID: Br-126						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Black rubber, plastic and tar	1	100	8,10,12	None Detected		None Detected		06/25/12

Sample No: 1203549-31		Client ID: Br-127						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Brown rubbery	1	100	1,10	None Detected		None Detected		06/25/12

Sample No: 1203549-32		Client ID: Br-128						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Black tarry	1	100	8	None Detected		None Detected		06/25/12

Client: **Braun Intertec-Duluth**  
Log-In: 06/19/12  
Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
Lab Contact: Steve Felton  
PO Number: DU-12-01858

Date Reported: 6/26/2012

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Sample No:	1203549-33	Client ID:	Br-129
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Black tarry	1	100	1,8	None Detected		None Detected		06/25/12

Sample No:	1203549-34	Client ID:	Br-130
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Black tarry	1	100	1,8	Cellulose <1		Chrysotile 5		06/25/12

Sample No:	1203549-35	Client ID:	Br-131
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Black tarry	1	100	8	None Detected		None Detected		06/25/12

Sample No:	1203549-36	Client ID:	Br-132
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Brown fibrous	1	100	3	Cellulose 85		None Detected		06/25/12

Footnotes and Definitions

<	Less Than	* Key to Non-Fibrous Components			
>	Greater Than				
		1 = Rock/Mineral fragments	5 = Diatoms	9 = Vinyl	13 = Spores/Pollen
		2 = Mica/Vermiculite	6 = Perlite	10 = Foam/Rubber	14 = Foil
		3 = Binders	7 = Adhesive/Mastic	11 = Paint	
		4 = Opaques	8 = Tar	12 = Other	

Client: **Braun Intertec-Duluth**  
 Log-In: 06/19/12  
 Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
 Lab Contact: Steve Felton  
 PO Number: DU-12-01858

Date Reported: 6/26/2012  
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Sample	Material
1,2 Br-100A-B	Sheetrock / joint compound
3 Br-101	2'x2' CT
4 Br-102	Brown Vinyl B.B.
5 Br-103	Carpet Mastic
6 Br-104	2'x2' CT
7 Br-105	2'x4' CT
8 Br-106	Sheetrock Tie Buckle 8'x2'
9 Br-107	Vinyl Threshold
10 Br-108	Carpet Mastic
11 Br-109	2'x2' C.T.
12 Br-110	Carpet Mastic
13 Br-111	Insulating tape on air exchangers
14 Br-112	Duct insulation
15 Br-113	2'x2' CT step down
16 Br-114	2'x2' CT
17,18,19 Br-115A-C	Wall Texture
20 Br-116	Brown pipe wrap
21 Br-117	spray on insulation
22 Br-118	2'x4' C.T.
23 Br-119	2'x2' C.T.
24 Br-120	Vinyl B.B. grey
25 Br-121	Spray insulation
26 Br-122	Sheetrock / joint compound
27 Br-123	Carpet Mastic
28 Br-124	Caulk
29 Br-125	Terry Seabur
30 Br-126	Black roof underlayment
31 Br-127	Caulk

DU-12-01858  
 6-14/15/12

Client: **Braun Intertec-Duluth**  
Log-In: 06/19/12  
Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
Lab Contact: Steve Felton  
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Sample	Metformin
32 Br-128	Tam sealant
33 Br-129	Rest sealant
34 Br-130	Tam sealant
35 Br-131	Ex window caulk
36 Br-132	Expansion joint



Client: **Braun Intertec-Duluth**  
Log-In: 06/19/12  
Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
Lab Contact: Steve Felton  
PO Number: DU-12-01858

Date Reported: 6/26/2012  
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For Braun Intertec Use Only Braun Intertec Project No. <b>DU-12-01858</b> <b>1203549</b>		<b>BRAUN INTERTEC</b> Braun Intertec Corporation 11001 Hampshire Ave. S Minneapolis, MN 55438		<b>REQUEST FOR LABORATORY ANALYTICAL SERVICES</b> Bottle orders and sampling inquires: <b>labservices@braunintertec.com</b> Phone: 952-995-2600 Fax: 952-995-2601		<b>IMPORTANT</b> Date Results Requested: _____ Time _____ Rush Charges Authorized? ____ Yes ____ No Rush / Quote # _____	
<b>REPORT RESULTS TO</b>	Contact Name	<b>Camron Uolibrand</b>			Project ID/Project Name	<b>Duluth International Airport</b>	
	Company	<b>BI DU</b>			Contact Name		
	Mailing Address				Address		
	City, State, Zip				City, State, Zip		
	Telephone #				Telephone #		
	E-mail				Fax #		
<b>Special Instructions and/or Specific Regulatory Requirements:</b> (method, limit of detection, petrofund, reporting units)					<b>SEND INVOICE TO</b>	<b>ANALYSIS REQUESTED</b> (Enter an 'X' in the box below to indicate request)	
<b>CLIENT SAMPLE IDENTIFICATION</b>		<b>DATE SAMPLED</b>	<b>TIME SAMPLED</b>	<b>MATRIX/MEDIA</b>	<b>AIR VOLUME (specify units)</b>	<b>Number of Containers</b>	<b>Metals Field Filtered Y/N</b>
1	<b>See attached Table</b>	<b>6/15</b>	<b>9a-4p</b>	<b>Bulk</b>		<b>X</b>	
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
<b>CHAIN OF CUSTODY</b>	Collected by: (Print)	<b>Camron Uolibrand</b>			Collector's Signature: _____		
	Relinquished by:	_____			Date/Time	<b>6/17/12</b>	
	Relinquished by:	_____			Date/Time		
	Custody Seal Intact	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A			Received Contents Not Verified:		
On Ice	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Received Contents Verified:	<b>6/17/12</b>		
Temp Blank	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Comments:	<b>1430</b>		
Temp:	<b>21</b> °C						

Form # CS02.01 F:\Groups\QA-QC\Forms\clientservices\COCC-CS02 Effective Date: 7/22/05

## **Appendix G**

### **Asbestos Building Inspector Certificate**



Certificate No: 5LM07211114IR

Expiration Date: July 21, 2012

*This is to certify that*  
**Camron Vollbrecht**  
*has attended and successfully completed an*  
**ASBESTOS INSPECTOR**  
**REFRESHER TRAINING COURSE**

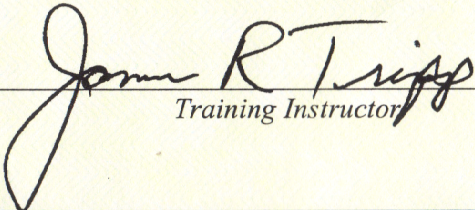
*permitted by*  
*the State of Minnesota under Minnesota Rules 4620.3702 to 4620.3722*  
*and meets the requirements of*  
*Section 206 of Title II of the Toxic Substances Control Act (TSCA)*  
*conducted by*

**Lake States Environmental, Ltd.**

*in*  
**White Bear Lake, MN on July 21, 2011**

**Examination Date: July 21, 2011**

Lake States Environmental, Ltd  
P. O. Box 645, Rice Lake, WI 54868  
(800) 254-9811

  
Training Instructor

MDH  
ASBESTOS  
INSPECTOR

Certified by:  
State of Minnesota  
Department of Health  
Expires: 07/21/2012  
Camron M Vollbrecht  
828 Chester Park Dr  
Duluth, MN 55812



No. A19598  
Issued: 10/19/2011  
Director, Env. Health Div



## **Appendix C**

### MDH Certification

*Expiration Date: January 18, 2013*

*This is to certify that*

## Gregg Kruse

*has attended and successfully completed an*

# ***ASBESTOS PROJECT DESIGNER REFRESHER TRAINING COURSE***

permitted by

*the State of Minnesota under Minnesota Rules 4620.3702 to 4620.3722*

*and meets the requirements of*

*Section 206 of Title II of the Toxic Substances Control Act (TSCA)*

*conducted by*

***Lake States Environmental, Ltd.***

*it*

***White Bear Lake, MN on January 18, 2012***

**Examination Date: January 18, 2012**

*Lake States Environmental, Ltd*  
*P. O. Box 645, Rice Lake, WI 54868*  
*(800) 254-9811*

Paul D. McNeill  
Training Instructor

Training Instructor



# **Hazardous Building Materials Inspection Report**

Duluth International Airport Terminal  
4701 Grinden Drive  
Duluth, Minnesota

*Prepared for*

**Reynolds, Smith and Hills, Inc.**

Project BL-12-01858  
July 5, 2012

Braun Intertec Corporation

July 5, 2012

Project DU-12-01858

Mr. John Hippchen  
Reynolds, Smith and Hills, Inc.  
4525 Airport Approach Road, Suite A  
Duluth, Minnesota 55811

Re: Hazardous Building Materials Inspection Report  
Duluth International Airport Terminal  
4701 Grinden Drive  
Duluth, Minnesota

Dear Mr. Hippchen:

The enclosed report provides the results of the hazardous materials inspection conducted June 15, 2012 at the Duluth International Airport Terminal, 4701 Grinden Drive, Duluth, Minnesota. Braun Intertec Corporation (Braun Intertec) was authorized to provide these services in accordance with our proposal DU-12-01858 dated May 8, 2012.

The following outline provides the structure of the report.


- Scope of Services
- Site Description
- Results
- Discussion
- Limitations

If you have any questions or need further assistance, please call Gregg Kruse at 952.995.2438.

Sincerely,

BRAUN INTERTEC CORPORATION

  
Enc: Camron M. Vollbrecht  
Project Scientist

  
Gregg D. Kruse  
Principal

Attachment:  
Hazardous Building Materials Inspection Report

Pre Demo HazMat Rpt - 7-6-2012

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### Appendices:

Appendix A: Table I. Asbestos Building Inspection Results

Appendix B: Table II. Bulk Asbestos Analytical Results

Appendix C: Table III. Lead-Based Paint Testing Results

Appendix D: Table IV. Miscellaneous Hazardous/Regulated Materials

Appendix E: Asbestos Inspection Report dated January 11, 2006, prepared by EMR, Inc.

Appendix F: Braun Intertec Bulk Asbestos Analysis Report

Appendix G: Asbestos Building Inspector Certificate



## A. Scope of Services

The scope of our services was limited to:

- Visually examine accessible areas and identify the locations of suspect asbestos-containing materials (ACM), lead, poly-chlorinated biphenyls (PCB), mercury, and other miscellaneous hazardous building materials.
- Collecting and analyzing representative bulk samples of materials suspected of containing asbestos. Examples of materials to be collected for analysis include, but are not limited to: floor tile, linoleum flooring, wall and ceiling plaster, suspended and acoustical ceiling tile, sheetrock, thermal system insulation, textured ceiling material and fireproofing.
- Conducting limited lead-based paint testing of deteriorated painted surfaces suspected of containing lead. Testing was accomplished using a Niton X-ray fluorescence (XRF) spectrum analyzer.
- Documenting the various materials' current conditions and ACM quantities.
- Generating a final report documenting the sample locations, analysis results, conditions, ACM quantities and recommendations.

A copy of the "Asbestos Inspection Report" dated January 11, 2006, prepared by EMR, Inc. (EMR) was provided for our review (refer to Appendix E). This report was used as an informational reference in the preparation of this report.

## B. Site Description

The subject site is Duluth International Airport Terminal, 4701 Grinden Drive, Duluth, Minnesota. The site consists of a three story Airport Terminal with basement. The Terminal Building was constructed in 1974. An addition was constructed on the west end of the Terminal in the mid-1980s. This addition currently houses the U.S. Customs and Border Patrol. The buildings are constructed of concrete floors, concrete block and poured walls, Steel roof supports, and sheet metal roof with rubber membrane.

The building's heating, ventilation and air conditioning (HVAC) system is a combination of steam heat from boilers in the basement and forced air from HVAC units on the second and third floors, as well as the west addition. Typical interior finishes include: plaster, gypsum board (sheetrock), vinyl baseboard, ceiling tile, carpet, floor tile and concrete.

## **C. Results**

### **C.1.1. Asbestos-Containing Materials**

The following is a summary of building materials found or assumed to contain greater than 1 percent asbestos (asbestos-containing materials by regulatory definition). These results are taken from sample data collected by Braun Intertec and also information from previous asbestos testing at the site.

#### **Terminal Building**

- White/beige/tan thermal system insulation (TSI) on pipe fittings
- Brown TSI on water pipe
- Tan TSI on boiler exhausts
- White TSI on water heat converters
- White TSI on air ducts
- White 2'x2' suspended ceiling tile
- White 2'x4' suspended ceiling tile
- White 12"x12" floor tile and black mastic
- Black asphalt sealant between building and sidewalk

#### **Customs and Border Patrol – West Addition**

- No accessible ACM was observed at the time of this inspection.

### **C.1.2. Non-Asbestos-Containing Materials**

The following is a summary of building materials found to contain no asbestos or materials that contain one percent or less asbestos (non-asbestos-containing materials by regulatory definition). These results are taken from sample data collected by Braun Intertec and also information from previous asbestos testing at the site.

- Spray-on insulation/fireproofing
- 12"x12" ceiling tiles
- 2'x2' textured ceiling tiles
- 2'x2' step down ceiling tiles
- 2'x2' ribbed pattern ceiling tiles
- 2'x4' worm pattern ceiling tiles
- 2'x4' ribbed pattern ceiling tiles
- Sheetrock and joint compound

### **C.1.2. Non-Asbestos-Containing Materials (continued)**

- Plaster
- Wall texture
- Vinyl baseboard
- Vinyl stair tread
- Vinyl flooring
- Carpet mastic
- Fiberglass Insulation
- Insulation tape near HVAC doors
- Window caulking
- Asphalt air vent sealant
- Asphalt plumbing vent sealant
- Roof underlayment
- Asphalt roof sealant
- Clear roof caulk
- Black roof caulking

Please refer to Appendix A - Table I. Asbestos Building Inspection Results, which lists individual functional spaces of the building, the suspect materials identified in that functional space, whether the suspect material was identified by analysis to be an asbestos-containing material, an estimated amount of each suspect material for the functional space, and includes condition and hazard ratings based on subjective observations made by our representatives.

Please refer to Appendix B - Table II. Bulk Asbestos Analytical Results, which lists the homogenous material sample numbers, sample locations, suspect material descriptions, and the analysis results for each sample. This table summarizes the results from the Bulk Asbestos Analysis Report found in Appendix F.

Bulk asbestos analysis was conducted in accordance with the Environmental Protection Agency's (EPA) Method 40 CFR, Chapter 1, Part 763, Subpart F, and Appendix A (7/1/87 Edition). Bulk samples are retained at our laboratory for 60 days and then disposed of, unless instructed otherwise. Detailed quality-control information is available upon request.

## **C.2. Lead-Based Paint**

Testing of deteriorated painted surfaces for lead was accomplished utilizing a Niton XL X-Ray Fluorescence (XRF) field portable analyzer, Model No. XLP303A - Serial No. 22287, equipped with a 40-milocurie CD-109 source - Serial No. TR0385, installed on December 29, 2011. Analysis decision-making protocols were based on compliance with the U.S. Environmental Protection Agency (EPA) and Minnesota Department of Health (MDH), which consider any XRF result of 1.0 milligram per square centimeter (mg/cm<sup>2</sup>) or greater to be "lead-based paint." The following is a list of deteriorated (peeling/flaking) lead-based paint at the site:

### **Terminal Building**

- White paint on rubber furnace fittings in the boiler room.
- Yellow paint on traffic and parking lines on the floor of the basement parking and driving area.
- Yellow floor paint in the east HVAC room on the 3<sup>rd</sup> floor of the terminal.
- Yellow paint on parking bollards located on the north and east sides of the terminal.
- Yellow paint on the overhead doors in the northwest corner of the terminal.

### **Customs and Border Patrol – West Addition**

- No accessible lead-based paint was observed at the time of this inspection.

Please refer to Appendix C - Table III. Lead-Based Paint Testing Results, which lists the sample numbers, sample locations, component descriptions, XRF field results and the paint condition for each sample.

## **C.3. Other Hazardous/Regulated Materials**

A visual inspection for miscellaneous hazardous/regulated materials that require separate handling and disposal prior to building demolition was also performed as part of this inspection. The following is a list of the items documented at the Site.

- |                                      |                        |
|--------------------------------------|------------------------|
| ▪ Fluorescent bulbs                  | ▪ Transformers         |
| ▪ Light ballasts                     | ▪ Exit signs           |
| ▪ Thermostats                        | ▪ Door closers         |
| ▪ Fire extinguishers                 | ▪ Electrical panels    |
| ▪ Smoke detectors                    | ▪ HVAC equipment       |
| ▪ Battery back-up emergency lighting | ▪ Overhead door motors |
| ▪ Elevator and hydraulic equipment   | ▪ Miscellaneous motors |
| ▪ HVAC equipment/refrigerant         | ▪ Water heaters        |

### **C.3. Other Hazardous/Regulated Materials (continued)**

- Refrigerators/Freezers
- Miscellaneous appliances
- Computer equipment
- 55-gallon drums of boiler conditioner
- 55-gallon drums of oil
- Diesel generator
- Drinking fountains
- Security system equipment
- Televisions/monitors
- Miscellaneous office equipment
- Lead-acid batteries
- 265-gallon diesel AST

Please refer to Appendix D - Table IV. Miscellaneous Hazardous/Regulated Materials, which lists the locations and descriptions for miscellaneous hazardous/regulated materials.

## **D. Discussion**

### **D.1. Asbestos-Containing Materials**

#### **Friable ACM**

The following ACM are classified as friable materials according to EPA 40 CFR Part 61 National Emission Standard for Hazardous Air Pollutants (NESHAPs).

#### **Terminal Building**

- White/beige/tan thermal system insulation (TSI) on pipe fittings
- Brown TSI on water pipe
- Tan TSI on boiler exhausts
- White TSI on water heat converters
- White TSI on air ducts
- White 2'x2' suspended ceiling tile
- White 2'x4' suspended ceiling tile

The above friable ACM was observed to be in good condition at the time of our assessment. These ACM should be maintained in good condition to prevent potential exposure to asbestos fibers. Friable ACMs are to be removed by an MDH certified asbestos abatement contractor prior to disturbance by demolition in accordance with applicable state and federal regulations.

### **Category I Non-Friable ACM**

The following asbestos-containing materials are classified as Category I non-friable materials according to EPA NESHAPs:

#### **Terminal Building**

- White 12"x12" floor tile and black mastic
- Black asphalt sealant between building and sidewalk

The above Category I non-friable ACMs were observed to be in good condition at the time of our assessment. These ACM should be maintained in good condition to prevent potential exposure to asbestos. Category I non-friable ACM is not considered a hazard unless cut, drilled, sanded or otherwise abraded. However, any Category I non-friable ACM that may become friable during demolition must be removed prior to that activity. Category I ACM in good condition may be left in place for demolition. However, if left in place, the crushing or recycling of demolition debris is strictly prohibited. In addition, all demolition debris containing Category I ACM must be disposed of at a landfill specifically permitted to accept this type of waste.

## **D.2. Lead-Based Paint**

Building components with lead coatings or lead paint are not required to be disposed of as lead or hazardous waste, as long as the paint is adhered to its substrate prior to disturbance from demolition. If lead-based paint (XRF result of 1.0 mg/cm<sup>2</sup> or greater) is peeling or flaking, the paint that is not attached to the substrate must be removed and disposed of as lead waste in accordance with state and federal regulations, prior to disturbance from demolition.

The following components were found to have peeling or flaking lead-based paint and must be stabilized and/or removed and disposed of as lead waste in accordance with state and federal regulations, prior to disturbance from demolition.

#### **Terminal Building**

- White paint on rubber furnace fittings in the boiler room.
- Yellow paint on traffic and parking lines on the floor of the basement parking and driving area.
- Yellow floor paint in the east HVAC room on the 3<sup>rd</sup> floor of the terminal.
- Yellow paint on parking bollards located on the north and east sides of the terminal.
- Yellow paint on the overhead doors in the northwest corner of the terminal.

The U.S. Occupational Safety and Health Administration (OSHA) Lead in Construction Standard 29 CFR 1926.62 applies to all situations where employees are engaged in the disturbance of lead-containing coatings, regardless of the quantity of lead involved. Therefore, any XRF result above 0.0 mg/cm<sup>2</sup> is considered "lead-containing coatings" in order to be in compliance with the OSHA standard. Demolition of the building may involve disturbing lead-containing coatings. Contractors should be informed of the presence of lead coatings and that they will be required to comply with the OSHA lead standard.

### **D.3. Other Hazardous/Regulated Materials**

In the case of building demolition, all of the hazardous/regulated materials listed in Section C.3 must be removed and recycled or disposed of in accordance with state and federal guidelines.

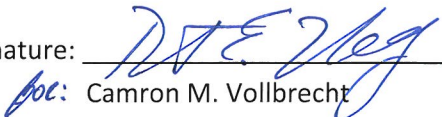
## **E. Limitations**

In any building the potential exists for hazardous building materials to be located inside walls, above ceilings, under floors, buried underground, and other inaccessible areas. This inspection attempted to identify hazardous building materials in these inaccessible areas. However, it was not feasible to inspect 100 percent of these areas. Therefore, Braun Intertec cannot be held responsible for the presence of any such hidden materials. The demolition contractor and other contractors involved in the project should be made aware of this potential. If previously unidentified suspect hazardous building materials are exposed during their activities they should be sampled and analyzed for content prior to any disturbance.

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

## **F. Asbestos Building Inspector Certification**

I, the undersigned, do hereby certify that I am an accredited Asbestos Building Inspector in the State of Minnesota. A photocopy of my current asbestos inspector certificate is attached to this section.

Signature:  Date: July 5, 2012  
for: Camron M. Vollbrecht  
Environmental Technician  
Minnesota Department of Health Asbestos Inspector No: AI9598

## **Appendix A**

### **Table I. Asbestos Building Inspection Results**



## Table I. Asbestos Building Inspection Results

Client: Reynolds, Smith, and Hills, Inc.

Location: Duluth International Airport, Duluth, MN

Date of Inspection: June 15, 2012

Project No.: DU-12-01858

Functional Space	Homogenous Material Description	Contains Asbestos (Yes/No)	Ref. Client Sample No. (see Table II)	Estimated Quantity/ Units	Material Condition <sup>1</sup>	Hazard Category <sup>2</sup>
Skyline Room	Ceiling Sheetrock	No	DIAP-R-100	12,000 sf	ND	0
Skyline Room	12"x12" Ceiling Tile	No	DIAP-R-099	800 sf	ND	0
Skyline Room	Sheetrock/Joint Compound	No	BR-100A-C	2,500 sf	ND	0
Skyline Room (bathrooms)	2'x2' Ceiling Tiles	No	BR-101	200 sf	ND	0
Skyline Room	Tan Vinyl Baseboard with Adhesive	No	BR-102	200 lf	ND	0
Skyline Room	Carpet Adhesive	No	BR-103	2,500 sf	ND	0
Skyline Room (janitor closet)	2'x2' Ceiling Tile	No	BR-104	5 sf	ND	0
Gates 3 and 4	Sheetrock/Joint Compound	No	DIAP-1-072	5,000 sf	ND	0
Gates 3 and 4	12"x12" Ceiling Tile	No	DIAP-R-098	5,000 sf	ND	0
Gates 3 and 4	Tan Vinyl Baseboard with Adhesive	No	DIAP-1-039	500 lf	ND	0
Gates 3 and 4	Carpet Adhesive	No	DIAP-1-046	5,000 sf	ND	0
Gates 3 and 4	Spray-on Insulation	No	DIAP-1-049	5,000 sf	ND	0
Gates 3 and 4	Plaster	No	DIAP-2-076	500 sf	ND	0
Gates 1 and 2	Sheetrock/Joint Compound	No	DIAP-2-072	5,000 sf	ND	0
Gates 1 and 2	12"x12" Ceiling Tile	No	DIAP-2-098	5,000 sf	ND	0
Gates 1 and 2	Tan Vinyl Baseboard with Adhesive	No	DIAP-1-039	500 lf	ND	0
Gates 1 and 2	Carpet Adhesive	No	DIAP-1-046	5,000 sf	ND	0
Gates 1 and 2	Spray-on Insulation	No	DIAP-1-049	5,000 sf	ND	0
Gates 1 and 2	Plaster	No	DIAP-2-073	500 sf	ND	0
2nd Floor West End Janitor Closet	2'x4' Ceiling Tile	No	BR-105	35 sf	ND	0
2nd Floor West End Janitor Closet	Sheetrock Tile Backer	No	BR-106	100 sf	ND	0
2nd Floor West End Janitor Closet	3" Pipe Hard Fitting	No	DIAP-2-075	5 fittings	ND	0
2nd Floor West End Janitor Closet	12"x12" White Floor Tile and Mastic	Yes	DIAP-2-074	30 sf	ND	1
2nd Floor West End Janitor Closet	Plaster	No	DIAP-2-076	30 sf	ND	0
2nd Floor West End Janitor Closet	Black Vinyl Baseboard	No	DIAP-2-077	15 lf	ND	0

**Table I. Asbestos Building Inspection Results**

Duluth International Airport

DU-12-01858

Page 2

Functional Space	Homogenous Material Description	Contains Asbestos (Yes/No)	Ref. Client Sample No. (see Table II)	Estimated Quantity/ Units	Material Condition <sup>1</sup>	Hazard Category <sup>2</sup>
West 2nd Floor Bathroom	2'x4' Ceiling Tile	No	BR-105	100 sf	ND	0
West 2nd Floor Bathroom	2'x2' Ceiling Tile	No	BR-101	250 sf	ND	0
Afterburner Bar	Door Threshold	No	BR-107	1 door	ND	0
Afterburner Bar	Carpet Adhesive	No	BR-108	1,200 sf	ND	0
Afterburner Bar	12"x12" White Floor Tile and Mastic	Yes	DIAP-2-078	2,000 sf	ND	1
Afterburner Bar	Sheetrock/Joint Compound	No	DIAP-1-042	2,000 sf	ND	0
Afterburner Bar	12"x12" Ceiling Tile	No	DIAP-2-080	2,000 sf	ND	0
Afterburner Kitchen	12"x12" Ceiling Tile	No	DIAP-2-080	200 sf	ND	0
Afterburner Kitchen	2'x4' Ceiling Tile	No	DIAP-2-081	2,000 sf	ND	0
Afterburner Kitchen	Gray Vinyl Baseboard with Adhesive	No	DIAP-1-047	50 lf	ND	0
Coffee Shop	12"x12" Ceiling Tile	No	DIAP-R-098	200 sf	ND	0
Coffee Shop	Sheetrock/Joint Compound	No	DIAP-2-072	1,000 sf	ND	0
Coffee Shop	2'x2' Ceiling Tiles	No	BR-109	60 sf	ND	0
2nd Floor Concourse	Carpet Adhesive	No	BR-110	Unknown	ND	0
2nd Floor Concourse	Sheetrock/Joint Compound	No	DIAP-2-072	15,000 sf	ND	0
2nd Floor Concourse	12"x12" Ceiling Tile	No	DIAP-R-098	30,000 sf	ND	0
2nd Floor Concourse	Brown Vinyl Baseboard with Adhesive	No	DIAP-2-069	350 lf	ND	0
2nd Floor Concourse	Black Vinyl Baseboard with Adhesive	No	DIAP-2-077	20 lf	ND	0
Gift Shop	Sheetrock/Joint Compound	No	DIAP-2-072	500 sf	ND	0
Gift Shop	12"x12" Ceiling Tile	No	DIAP-R-098	250 sf	ND	0
East HVAC Room	4" Pipe Hard Fitting	Yes	DIAP-3-094/095	38 Fittings	ND	2
East HVAC Room	6" Pipe Hard Fitting	Yes	DIAP-3-092/093	20 Fittings	ND	2
East HVAC Room	12"x12" Ceiling Tile	No	DIAP-R-098	10,000 sf	ND	0
East HVAC Room	Sheetrock/Joint Compound	No	DIAP-1-042	6,000 sf	ND	0
East HVAC Room	Insulating Tape near doors of the HVAC units	No	BR-111	Unknown	ND	0
East HVAC Room	Insulation on Air Vents	Yes	BR-112	10,000 sf	ND	2
West HVAC Room	4" Pipe Hard Fitting	Yes	DIAP-3-094/095	38 Fittings	ND	2
West HVAC Room	6" Pipe Hard Fitting	Yes	DIAP-3-092/093	20 Fittings	ND	2
West HVAC Room	12"x12" Ceiling Tile	No	DIAP-R-098	10,000 sf	ND	0
West HVAC Room	Sheetrock/Joint Compound	No	DIAP-1-042	6,000 sf	ND	0
West HVAC Room	Insulating Tape near doors of the HVAC units	No	BR-111	Unknown	ND	0

**Table I. Asbestos Building Inspection Results**

Functional Space	Homogenous Material Description	Contains Asbestos (Yes/No)	Ref. Client Sample No. (see Table II)	Estimated Quantity/ Units	Material Condition <sup>1</sup>	Hazard Category <sup>2</sup>
West HVAC Room	Insulation on Air Vents	Yes	BR-112	10,000 sf	ND	2
3rd Floor Conference Room	12"x12" Ceiling Tile	No	DIAP-R-098	300 sf	ND	0
3rd Floor Conference Room	Sheetrock/Joint Compound	No	DIAP-1-042	1,000 sf	ND	0
3rd Floor Conference Room	Carpet Adhesive	No	BR-110	300 sf	ND	0
3rd Floor Offices	Plaster	No	DIAP-3-086	5,000 sf	ND	0
3rd Floor Offices	12"x12" White Floor Tile and Mastic	Yes	DIAP-3-088	90 sf	ND	1
3rd Floor Offices	2'x4' Ceiling Tile	Yes	DIAP-3-087	90 sf	ND	2
3rd Floor Offices	Brown Vinyl Baseboard with Adhesive	No	DIAP-3-089	20 sf	ND	0
3rd Floor Ops Room	2'x4' Ceiling Tile	No	DIAP-3-091	90 sf	ND	0
3rd Floor Ops Room	2'x2' Step Down Ceiling Tiles	No	BR-113	100 sf	ND	0
3rd Floor Ops Room	2'x2' Ceiling Tiles	No	BR-114	30 sf	ND	0
3rd Floor Ops Room	Brown Vinyl Baseboard with Adhesive	No	DIAP-3-089	20 lf	ND	0
3rd Floor Main Hallway	Wall Texture	No	BR-115A-C	1,000 sf	ND	0
Basement Telephone Room	2'x4' Ceiling Tile	No	DIAP-B-034	60 sf	ND	0
Basement Generator Room	4" Pipe Hard Fitting	Yes	DIAP-B-002	1 Fitting	ND	2
Basement Kitchen Area	2'x4' Ceiling Tile	No	DIAP-B-017	500 sf	ND	0
Basement Kitchen Area	Brown Pipe Wrap	Yes	BR-116	6 lf	ND	2
Basement Kitchen Area	Spray-on Insulation	No	BR-117	Unknown	ND	0
Mechanical Room	12"x12" White Floor Tile with black Mastic	Yes	DIAP-B-001	100 sf	ND	1
Mechanical Room	4" Pipe Hard Fitting	Yes	DIAP-B-002	1 Fitting	ND	2
Mechanical Room	3" Pipe Hard Fitting	No	DIAP-B-003	2 Fittings	ND	0
Mechanical Room	Brown Vinyl Baseboard with Adhesive	No	DIAP-B-004	40 lf	ND	0
Mechanical Room	2'x4' Ceiling Tile	No	DIAP-B-005	100 sf	ND	0
Boiler Room	4" Pipe Hard Fitting	Yes	DIAP-B-006/007	50 Fittings	ND	2
Boiler Room	4" Pipe Hard Fitting on out of service boiler	No	DIAP-B-008	20 lf	ND	0
Boiler Room	6" Pipe Hard Fitting	Yes	DIAP-B-009/010	6 Fittings	ND	2
Boiler Room	Converter #2 Hard Insulation	Yes	DIAP-B-011	20 sf	ND	2
Boiler Room	24" Boiler Exhaust Insulation	Yes	DIAP-B-012	20 lf	ND	2
Boiler Room	24" Boiler Exhaust Insulation on out of service boiler	Yes	DIAP-B-013	20 lf	ND	2
Break Room	12"x12" White Floor Tile with black Mastic	Yes	DIAP-B-014	720 sf	ND	1
Break Room	Brown Vinyl Baseboard with mastic	No	DIAP-B-015	150 lf	ND	0
Break Room	Sheetrock/Joint Compound	No	DIAP-B-016	170 sf	ND	0

**Table I. Asbestos Building Inspection Results**

Functional Space	Homogenous Material Description	Contains Asbestos (Yes/No)	Ref. Client Sample No. (see Table II)	Estimated Quantity/ Units	Material Condition <sup>1</sup>	Hazard Category <sup>2</sup>
Break Room	2'x4' Ceiling Tile	No	DIAP-B-017	600 sf	ND	0
Break Room	2'x2' Ceiling Tiles	Yes	DIAP-B-018	200 sf	ND	2
Break Room	6" Pipe Hard Fitting	Yes	DIAP-B-020	1 Fitting	ND	2
Break Room	4" Pipe Hard Fitting	Yes	DIAP-B-021	4 Fittings	ND	2
East Garage	4" Pipe Hard Fitting	Yes	DIAP-B-022	15 Fittings	ND	2
East Garage	6" Pipe Hard Fitting	Yes	DIAP-B-023	10 Fittings	ND	2
East Garage	6" Pipe Hard Fitting	Yes	DIAP-B-024	10 Fittings	ND	2
Basement Parking Area	Spray-on Insulation	No	DIAP-B-025	20,500 sf	ND	0
Basement Parking Area	Spray-on Insulation	No	DIAP-B-026	20,500 sf	ND	0
Basement Parking Area	Spray-on Insulation	No	DIAP-B-027	20,500 sf	ND	0
Basement Parking Area	Spray-on Insulation	No	DIAP-B-032	20,500 sf	ND	0
Basement Parking Area	Spray-on Insulation	No	DIAP-B-033	20,500 sf	ND	0
West Garage	4" Pipe Hard Fitting	Yes	DIAP-B-028	15 Fittings	ND	2
West Garage	4" Pipe Hard Fitting	Yes	DIAP-B-029	15 Fittings	ND	2
West Garage	6" Pipe Hard Fitting	Yes	DIAP-B-030	10 Fittings	ND	2
West Garage	6" Pipe Hard Fitting	Yes	DIAP-B-031	10 Fittings	ND	2
Weather One Office Area	2'x4' Ceiling Tile	Yes	BR-118	2,100 sf	ND	2
Weather One Office Area	12"x12" White Floor Tile and Mastic	Yes	DIAP-1-064	2,100 sf	ND	1
Weather One Office Area	Brown Vinyl Baseboard with mastic	No	DIAP-1-066	400 lf	ND	0
Weather One Office Area	Plaster	No	DIAP-1-067	5,000 sf	ND	0
Loading Ramp	4" Pipe Hard Fitting	Yes	DIAP-1-035	2 Fittings	ND	2
Weather One	3" Pipe Hard Fitting	Yes	DIAP-1-057	2 Fittings	ND	2
Weather One	Spray-on Insulation	No	DIAP-1-058	20,500 sf	ND	0
N. Country Area	12"x12" White Floor Tile and Mastic	Yes	DIAP-1-050	2,100 sf	ND	1
N. Country Area	Brown Vinyl Baseboard	No	DIAP-1-051	200 lf	ND	0
N. Country Area	Plaster	No	DIAP-1-053	4,600 sf	ND	0
N. Country Area	2'x4' Ceiling Tile	No	DIAP-1-054	300 sf	ND	0
N. Country Area Hallway	Brown Vinyl Baseboard with Adhesive	No	DIAP-1-056	150 lf	ND	0
N. Country Bathrooms	2'x4' Ceiling Tile	Yes	DIAP-1-055	85 sf	ND	2
1st Floor Customs Clearing Area	2'x2' Ribbed Ceiling Tile	No	DIAP-1-036	1,500 sf	ND	0
1st Floor Customs Clearing Area	Brown Vinyl Baseboard with Adhesive	No	DIAP-1-037	80 lf	ND	0
Customs Clearing Bathroom	White/grey floor linoleum	No	DIAP-1-038	400 sf	ND	0
Customs Clearing Bathroom	Tan Vinyl Baseboard with Adhesive	No	DIAP-1-039	80 lf	ND	0

**Table I. Asbestos Building Inspection Results**

Functional Space	Homogenous Material Description	Contains Asbestos (Yes/No)	Ref. Client Sample No. (see Table II)	Estimated Quantity/ Units	Material Condition <sup>1</sup>	Hazard Category <sup>2</sup>
Customs Clearing Area	2'x4' Wormy Ceiling Tile	No	DIAP-1-040	2,300 sf	ND	0
Customs Clearing Area	Red Vinyl Baseboard with Adhesive	No	DIAP-1-041	500 lf	ND	0
Customs Clearing Area	Sheetrock/Joint Compound	No	DIAP-1-042	60,000 sf	ND	0
Customs Clearing Area	3" Pipe Hard Fitting	No	DIAP-1-043	30 Fittings	ND	0
Customs Electrical Room	Brown Vinyl Baseboard with Adhesive	No	DIAP-1-044	80 lf	ND	0
Customs Search Room	3" Pipe Hard Fitting	No	DIAP-1-045	3 Fittings	ND	0
Customs Area (janitors Closet)	2'x2' Textured Ceiling Tile	No	BR-119	10 sf	ND	0
Utility Room	Carpet Adhesive	No	DIAP-1-046	600 sf	ND	0
Utility Room	Gray Vinyl Baseboard with Adhesive	No	DIAP-1-047	120 lf	ND	0
Utility Room	Sheetrock/Joint Compound	No	DIAP-1-048	9,000 sf	ND	0
TSA Area	2'x4' Ceiling Tile	No	DIAP-1-065	35sf	ND	0
TSA Area	Grey Vinyl Baseboard/Tan Mastic	No	BR-120	50 lf	ND	0
X-Ray Room	Spray Insulation	No	BR-121	5,000 sf	ND	0
X-Ray Room	Sheetrock/Joint Compound	No	BR-122	5,000 sf	ND	0
NW Offices	12"x12" White Floor Tile with Black Mastic	Yes	DIAP-1-064	2,100 sf	ND	1
NW Offices	2'x4' Wormy Ceiling Tile	No	DIAP-1-065	2,100 sf	ND	0
NW Offices	Brown Vinyl Baseboard with Adhesive	No	DIAP-1-066	400 lf	ND	0
NW Offices	Carpet Adhesive	No	BR-123	2,100 sf	ND	0
NW Offices	Plaster	No	DIAP-1-067	5,000 sf	ND	0
NW Cargo Area	4" Pipe Hard Fitting	Yes	DIAP-1-068	21 Fittings	ND	2
E. Tug Tunnel	3" Pipe Hard Fitting	Yes	DIAP-1-063	1 Fitting	ND	2
Main Floor Concourse	12"x12" Ceiling Tile	No	DIAP-R-099	26,000 sf	ND	0
Main Floor Concourse	Sheetrock/Joint Compound	No	DIAP-R-100	12,000 sf	ND	0
Main Floor Concourse	Stair Treads	No	DIAP-1-061	300 sf	ND	0
Main Floor Concourse	Plaster	No	DIAP-1-062	20,000 sf	ND	0
Main Floor Concourse	3" Pipe Hard Fitting	Yes	DIAP-1-052	3 Fittings	ND	2
East Roof	Clear Caulking	No	BR-124	2,000 lf	ND	0
East Roof	Asphalt Sealant on Main Roof	No	BR-125	2,000 lf	ND	0
East Roof	Roof Underlayment	No	BR-126	50,000 sf	ND	0
Customs Area Roof	Clear Caulk	No	BR-127	2,000 lf	ND	0
Customs Area Roof	Asphalt Air Vent Sealant	No	BR-128	250 sf	ND	0
Customs Area Roof	Asphalt Plumbing Vent Sealant	No	BR-129	2 sf	ND	0

**Table I. Asbestos Building Inspection Results**

Functional Space	Homogenous Material Description	Contains Asbestos (Yes/No)	Ref. Client Sample No. (see Table II)	Estimated Quantity/ Units	Material Condition <sup>1</sup>	Hazard Category <sup>2</sup>
Exterior	Asphalt Sealant between building and sidewalk near sw corner of main terminal	Yes	BR-130	3 sf	ND	1
Exterior	Window Calking	No	BR-131	Unknown	ND	0
Exterior	Expansion Joint between building and sidewalk	No	BR-132	Unknown	ND	0
Loading Towers	Brown Vinyl Baseboard with mastic	No	DIAP-2-069	50 lf	ND	0
Loading Towers	12"x12" Floor Tile and Mastic with Mastic	Yes	DIAP-B-001	500 sf	ND	1

**1. Condition of ACM**

ND = Not Damaged

D = Damaged

SD = Significantly Damaged

**2. Hazard Category**

0 — No hazard - material does not contain asbestos.

1 — ACM with potential for damage.

2 — ACM with potential for significant damage.

3 — Damaged or significantly damaged asbestos-containing miscellaneous material.

4 — Damaged or significantly damaged friable asbestos-containing thermal system insulation.

5 — Damaged or significantly damaged friable asbestos-containing surfacing material.

sf = square feet

lf = lineal feet

## **Appendix B**

### **Table II. Bulk Asbestos Analytical Results**

## Table II. Bulk Asbestos Analytical Results

Client: Reynolds, Smith, and Hills, Inc.  
 Location: Duluth International Airport, Duluth, MN  
 Date of Inspection: June 15, 2012  
 Project No.: DU-12-01858

Sample No.	Sample Location	Material	Asbestos Content (%) <sup>1</sup>
BR-100A-C	Skyline Room	Sheetrock/Joint Compound	N.D. <sup>2</sup>
BR-101	Skyline Room (bathrooms)	2'x2' Ceiling Tile	N.D.
BR-102	Skyline Room	Tan Vinyl Baseboard with Adhesive	N.D.
BR-103	Skyline Room	Carpet Adhesive	N.D.
BR-104	Skyline Room (janitor closet)	2'x2' Ceiling Tile	N.D.
BR-105	2nd Floor West End Janitor Closet	2'x4' Ceiling Tile	N.D.
BR-106	2nd Floor West End Janitor Closet	Sheetrock Tile Backer	N.D.
BR-107	Afterburner Bar	Door Threshold	N.D.
BR-108	Afterburner Bar	Carpet Adhesive	N.D.
BR-109	Coffee Shop	2'x2' Ceiling Tile	N.D.
BR-110	2nd Floor Concourse	Carpet Mastic	N.D.
BR-111	West HVAC Room	Insulating Tape near doors of the HVAC units	N.D.
BR-112	West HVAC Room	Insulation on Air Vents	Chrysotile 4%
BR-113	3rd Floor Ops Room	2'x2' Step Down Ceiling Tile	N.D.
BR-114	3rd Floor Ops Room	2'x2' Ceiling Tile	N.D.
BR-115A-C	3rd Floor Main Hallway	Wall Texture	N.D.
BR-116	Basement Kitchen Area	Brown Pipe Wrap	Chrysotile 5%
BR-117	Basement Kitchen Area	Spray-on Insulation	N.D.
BR-118	NW Offices	2'x4' Suspended Ceiling Panels	Chrysotile 2%
BR-119	Customs Area (janitors Closet)	2'x2' Textured Ceiling Tile	N.D.
BR-120	TSA Area	Gray Vinyl Baseboard with Adhesive	N.D.
BR-121	X-Ray Room	Spray Insulation	N.D.
BR-122	X-Ray Room	Sheetrock/Joint Compound	N.D.
BR-123	Northwest Offices	Carpet Adhesive	N.D.
BR-124	East Roof	Clear Caulking	N.D.
BR-125	East Roof	Asphalt Sealant on Main Roof	N.D.
BR-126	East Roof	Roof Underlayment	N.D.
BR-127	Customs Area Roof	Clear Caulk	N.D.
BR-128	Customs Area Roof	Asphalt Air Vent Sealant	N.D.
BR-129	Customs Area Roof	Asphalt Plumbing Vent Sealant	N.D.
BR-130	Exterior	Black Asphalt Sealant between building and sidewalk in sw corner of main terminal	Chrysotile 5%
BR-131	Exterior	Window Calking	N.D.
BR-132	Exterior	Expansion Joint between building and sidewalk	N.D.
DIAP-B-001	Mechanical Room	12"x12" White Floor Tile with Black Mastic	Floor Tile: 7% Chrysotile, Mastic: 10% Chrysotile
DIAP-B-002	Mechanical Room	4" Pipe Hard Fitting	70% Chrysotile
DIAP-B-003	Mechanical Room	3" Pipe Hard Fitting	<1% Chrysotile

1. Asbestos content is indicated as an approximate percent by area.

2. N.D. = None Detected



**Table II. Bulk Asbestos Analytical Results**

Sample No.	Sample Location	Material	Asbestos Content (%) <sup>1</sup>
DIAP-B-004	Mechanical Room	Brown Vinyl Baseboard with mastic	N.D.
DIAP-B-005	Mechanical Room	2'x4' Ceiling Tile	N.D.
DIAP-B-006	Boiler Room	4" Pipe Hard Fitting	60% Chrysotile
DIAP-B-007	Boiler Room	4" Pipe Hard Fitting	N.D.
DIAP-B-008	Boiler Room	4" Pipe Hard Fitting on out of service boiler	N.D.
DIAP-B-009	Boiler Room	6" Pipe Hard Fitting	30% Chrysotile
DIAP-B-010	Boiler Room	6" Pipe Hard Fitting	N.D.
DIAP-B-011	Boiler Room	Converter #2 Hard Insulation	30% Chrysotile
DIAP-B-012	Boiler Room	24" Boiler Exhaust Insulation	5% Chrysotile
DIAP-B-013	Boiler Room	24" Boiler Exhaust Insulation on out of service boiler	5% Chrysotile
DIAP-B-014	Break Room	12"x12" White Floor Tile with Black Mastic	Floor Tile: 7% Chrysotile, Mastic: 10% Chrysotile
DIAP-B-015	Break Room	Brown Vinyl Baseboard with mastic	N.D.
DIAP-B-016	Break Room	Sheetrock/Joint Compound	N.D.
DIAP-B-017	Break Room	2'x4' Ceiling Tile	N.D.
DIAP-B-018	Break Room	2'x2' Ceiling Tile	3% Chrysotile
DIAP-B-019	Maint. Office	Brown Vinyl Baseboard with mastic	N.D.
DIAP-B-020	Maint. Office	6" Pipe Hard Fitting	70% Chrysotile
DIAP-B-021	Break Room Bath	4" Pipe Hard Fitting	N.D.
DIAP-B-022	East Garage	4" Pipe Hard Fitting	70% Chrysotile
DIAP-B-023	East Garage	6" Pipe Hard Fitting	70% Chrysotile
DIAP-B-024	East Garage	6" Pipe Hard Fitting	N.D.
DIAP-B-025	Basement Parking Area	Spray-on Insulation	N.D.
DIAP-B-026	Basement Parking Area	Spray-on Insulation	N.D.
DIAP-B-027	Basement Parking Area	Spray-on Insulation	N.D.
DIAP-B-028	West Garage	4" Pipe Hard Fitting	<1% Chrysotile
DIAP-B-029	West Garage	4" Pipe Hard Fitting	70% Chrysotile
DIAP-B-030	West Garage	6" Pipe Hard Fitting	70% Chrysotile
DIAP-B-031	West Garage	6" Pipe Hard Fitting	N.D.
DIAP-B-032	Basement Parking Area	Spray-on Insulation	N.D.
DIAP-B-033	Basement Parking Area	Spray-on Insulation	N.D.
DIAP-B-034	Telephone Room	2'x4' Worm Pattern Ceiling Tile	N.D.
DIAP-B-035	Loading Ramp	4" Pipe Hard Fitting	50% Chrysotile
DIAP-1-036	1st Floor Customs Clearing Area	2'x2' Ribbed Ceiling Tile	N.D.
DIAP-1-037	1st Floor Customs Clearing Area	Brown Vinyl Baseboard with Adhesive	N.D.
DIAP-1-038	Customs Clearing Bathroom	White/grey floor linoleum	N.D.
DIAP-1-039	Customs Clearing Bathroom	Tan Vinyl Baseboard	N.D.
DIAP-1-040	Customs Clearing Area	2'x4' Wormy Ceiling Tile	N.D.
DIAP-1-041	Customs Clearing Area	Red Vinyl Baseboard	N.D.
DIAP-1-042	Customs Clearing Area	Sheetrock/Joint Compound	N.D.
DIAP-1-043	Customs Clearing Area	3" Pipe Hard Fitting	N.D.

1. Asbestos content is indicated as an approximate percent by area.

2. N.D. = None Detected

**Table II. Bulk Asbestos Analytical Results**

Sample No.	Sample Location	Material	Asbestos Content (%) <sup>1</sup>
DIAP-1-044	Customs Electrical Room	Brown Vinyl Baseboard with mastic	N.D.
DIAP-1-045	Customs Search Room	3" Pipe Hard Fitting	N.D.
DIAP-1-046	Utility Room	Carpet Adhesive	N.D.
DIAP-1-047	Utility Room	Gray Vinyl Baseboard	N.D.
DIAP-1-048	Utility Room	Sheetrock/Joint Compound	N.D.
DIAP-1-049	W Passenger Lounge	Spray-on Insulation	N.D.
DIAP-1-050	N. Country Area	12"x12" White Floor Tile with Black Mastic	Floor Tile: 3% Chrysotile, Mastic: 10% Chrysotile
DIAP-1-051	N. Country Area	Brown Vinyl Baseboard with mastic	N.D.
DIAP-1-052	N. Country Area	3" Pipe Hard Fitting	50% Chrysotile
DIAP-1-053	N. Country Area	Plaster	N.D.
DIAP-1-054	N. Country Area Hallway	Ceiling Tile	N.D.
DIAP-1-055	N. Country Bathrooms	Ceiling Tile	3% Chrysotile
DIAP-1-056	N. Country Area Hallway	Brown Vinyl Baseboard with mastic	N.D.
DIAP-1-057	Weather One	3" Pipe Hard Fitting	50% Chrysotile
DIAP-1-058	Weather One	Spray-on Insulation	N.D.
DIAP-1-059	TSA Area	Black Vinyl Baseboard with mastic	N.D.
DIAP-1-060	W. Passenger Area Bathroom	2'x2' Ceiling Tile	N.D.
DIAP-1-061	Stair Case	Vinyl Stair Tread	N.D.
DIAP-1-062	W. Passenger Area	Plaster	N.D.
DIAP-1-063	E. Tug Tunnel	3" Pipe Hard Fitting	70% Chrysotile
DIAP-1-064	NW Offices	12"x12" White Floor Tile with Black Mastic	Tile: 5% Chrysotile, Mastic: 10% Chrysotile
DIAP-1-065	NW Offices	2'x4' Worm Pattern Ceiling Tile	N.D.
DIAP-1-066	NW Offices	Brown Vinyl Baseboard with mastic	N.D.
DIAP-1-067	NW Offices	Plaster	N.D.
DIAP-1-068	NW Cargo Area	4" Pipe Hard Fitting	45% Chrysotile
DIAP-2-069	Skyline Lounge	Brown Vinyl Baseboard with mastic	N.D.
DIAP-2-070	Skyline Lounge	Sheetrock/Joint Compound	N.D.
DIAP-2-071	Skyline Lounge	12"x12" White Speckled Floor Tile with tan Mastic	N.D.
DIAP-2-072	West Gate Lobby	Sheetrock/Joint Compound	N.D.
DIAP-2-073	W. Concourse Observ/Lounge	Plaster	N.D.
DIAP-2-074	W Concourse Janitor Closet	12"x12" White Speckled Floor Tile with Tan Mastic	Floor Tile: 4% Chrysotile, Mastic: 10% Chrysotile
DIAP-2-075	W Concourse Janitor Closet	3" Hard Pipe Fitting	N.D.
DIAP-2-076	W Concourse Janitor Closet	Plaster	N.D.
DIAP-2-077	W Concourse Bathroom Area	Black Vinyl Baseboard with mastic	N.D.
DIAP-2-078	Bar Closet	12"x12" White Floor Tile with Black Mastic	Floor Tile: N.D. Mastic: 3% Chrysotile
DIAP-2-079	Bar Closet	Spray-on Insulation	N.D.

1. Asbestos content is indicated as an approximate percent by area.

2. N.D. = None Detected

**Table II. Bulk Asbestos Analytical Results**

Sample No.	Sample Location	Material	Asbestos Content (%) <sup>1</sup>
DIAP-2-080	Bar	12"x12" Ceiling Tile	N.D.
DIAP-2-081	Kitchen	2'x4' Ceiling	N.D.
DIAP-3-082	West HVAC Room	6" Hard Pipe Fitting	80% Chrysotile
DIAP-3-083	West HVAC Room	6" Hard Pipe Fitting	70% Chrysotile
DIAP-3-084	West HVAC Room	4" Hard Pipe Fitting	Fitting: 3% Chrysotile, Wrap: 70% Chrysotile
DIAP-3-085	West HVAC Room	4" Hard Pipe Fitting	Fitting: 3% Chrysotile, Wrap: 70% Chrysotile
DIAP-3-086	West HVAC Room	Plaster	N.D.
DIAP-3-087	Reception Area Coffee Room	2'x4' Ceiling Tile	3% Chrysotile
DIAP-3-088	Reception Area Coffee Room	White 12"x12" Vinyl Floor Tile with Black Mastic	Floor Tile: 5% Chrysotile, Mastic: 10% Chrysotile
DIAP-3-089	Reception Area Coffee Room	Brown Vinyl Baseboard with Adhesive	N.D.
DIAP-3-090	Operations Center Office	Brown Vinyl Baseboard with Adhesive	N.D.
DIAP-3-091	Operations Center Office	2'x4' ribbed/speckled white Ceiling Tile	N.D.
DIAP-3-092	East HVAC Room	6" Hard Pipe Fitting	Fitting: 3% Chrysotile, Wrap: 65% Chrysotile
DIAP-3-093	East HVAC Room	6" Hard Pipe Fitting	Fitting: 3% Chrysotile, Wrap: 70% Chrysotile
DIAP-3-094	East HVAC Room	4" Hard Pipe Fitting	Fitting: 3% Chrysotile, Wrap: 70% Chrysotile
DIAP-3-095	East HVAC Room	4" Hard Pipe Fitting	Chrysotile 70%
DIAP-3-096	West HVAC Room	Plaster	N.D.
DIAP-3-097	West HVAC Room	Spray-on Insulation	N.D.
DIAP-3-098	Main Terminal	12"x12" Ceiling Tile	N.D.
DIAP-3-099	Skyline Room	12"x12" Ceiling Tile	N.D.
DIAP-3-100	Skyline Room	Ceiling Sheetrock	N.D.
DIAP-1-101	Customs Clearing Area	3" Pipe Hard Fitting	N.D.
DIAP-1-102	Customs Clearing Area	3" Pipe Hard Fitting	N.D.

1. Asbestos content is indicated as an approximate percent by area.

2. N.D. = None Detected

## **Appendix C**

### **Table III. Lead-Based Paint Testing Results**

### Table III. Lead Based Paint Testing Results

Client: Reynolds, Smith, and Hills, Inc.

Location: Duluth International Airport, Duluth, MN

Date of Inspection: June 15, 2012

Project No.: DU-12-01858

Sample No.	Sample Location	Component Description	Lead Content (mg/cm <sup>2</sup> )	Lead-Based Paint (Yes/No)	Paint Condition
1	Basement Mech Room	Red Paint	0.29	No	Peeling
2	Basement Mech Room	White Paint on Rubber Pipe Fittings	18.90	Yes	Peeling
3	Basement Mech Room	White Paint on Sewer Pipe	0.00	No	Peeling
4	Basement Parking Area	Tan HVAC Vent Paint	0.00	No	Peeling
5	Basement Parking Area	Yellow Floor Paint	18.00	Yes	Peeling
6	Basement Parking Area	Yellow Parking Line Paint	25.00	Yes	Peeling
7	Concourse 1st Floor	White Paint on Ceiling Beam	0.00	No	Peeling
8	Concourse 1st Floor	White Wall Paint	0.00	No	Peeling
9	1st Floor Baggage Claim	White Wall Paint	0.00	No	Peeling
10	1st Floor West Entrance	White Wall Paint	0.00	No	Peeling
11	1st Floor Tug Tunnel	Yellow Paint on Bollards	0.00	No	Peeling
12	2nd Floor Skylights	Pink Paint	0.00	No	Peeling
13	3rd Floor West HVAC	White Wall Paint	0.00	No	Peeling
14	3rd Floor West HVAC	White Equipment Paint	0.01	No	Peeling
15	3rd Floor East HVAC	Yellow Floor Paint	2.40	Yes	Peeling
16	3rd Floor East HVAC	White Wall Paint	0.00	No	Peeling
17	3rd Floor East HVAC	White Equipment Paint	0.00	No	Peeling
18	3rd Floor Operations Office	White Beam Paint	0.00	No	Peeling
19	Concrete Beams on the Exterior of Terminal	Tan Paint	0.00	No	Peeling
20	Concrete Beams on the Exterior of Terminal	White Paint	0.01	No	Peeling
21	Metal Roof	Brown Paint	0.00	No	Peeling
22	Generator Exhaust Pipe	Brown Paint	0.01	No	Peeling
23	Metal Railing on West e0.00 of Terminal	Black Paint	0.00	No	Peeling
24	Concrete Curb	Yellow Paint	0.02	No	Peeling
25	Bollards Near East OH Doors	Yellow Paint	9.60	Yes	Peeling
26	Mechanical Piping on N side of Terminal	Grey Paint	0.00	No	Peeling
27	Northwest OH Doors	Yellow Paint	1.10	Yes	Peeling

The U.S. Environmental Protection Agency, MN Pollution Control Agency and MN Department of Health consider any XRF result of 1.0 milligrams per square centimeter (mg/cm<sup>2</sup>) or greater to be "lead-based paint".

## **Appendix D**

### **Table IV. Miscellaneous Hazardous/Regulated Materials**

**Table IV. Miscellaneous Hazardous/Regulated Materials**
*Providing engineering and environmental solutions since 1957*

Client: Reynolds, Smith and Hills, Inc.  
 Location: Duluth International Airport  
 Date of Inspection: 6/15/12  
 Project No.: DU-12-01858

Location	Identification
Gates 3 and 4	Electric switches
	Door Closers
	Overhead Door Motor
	Thermostat
	Fluorescent Light Ballast and Bulbs
	Computer Equipment
	Security Equipment
	Exit Signs
Gates 1 and 2	Electric switches
	Door Closers
	Overhead Door Motor
	Thermostat
	Fluorescent Light Ballast and Bulbs
	Computer Equipment
	Exit Signs
	Security Equipment
Skyline Room	Electric Switches and Panel
	Air Handling Motor
	Door Closers
	Fluorescent Light Bulbs and Ballast
Afterburner Bar and Kitchen	Door Closers
	Fluorescent Light Bulb and Ballast
	Thermostat
	Kitchen Appliances
	Ansul® System
	Fan Motors
2 <sup>nd</sup> Floor Concourse and Bathrooms	Door Closers
	Thermostats
	Fluorescent Light Bulbs and Ballasts
East HVAC Room	Air Handling Units
	Electrical Panels
East HVAC Room	Electrical Switches
	Door Closers
	Emergency Lights
	Electrical Motors
	Fluorescent Light Bulbs and Ballasts
	Exit Signs
	Air Handling Units
West HVAC Room	Electrical Panels
	Electrical Switches
	Door Closers
	Emergency Lights

Location	Identification
West HVAC Room	Electrical Motors
	Fluorescent Light Bulbs and Ballasts
	Gallon Jugs of Antifreeze
	Exit Signs
3 <sup>rd</sup> Floor Offices, Conference Room and Operations Room	Door Closers
	Electrical Switches
	Emergency Lights
	Fluorescent Light Bulbs and Ballasts
	Thermostats
	Sound Systems
Basement Electrical Room, Telephone Room and Generator Room	Telephone Switching Gear
Basement Electrical Room, Telephone Room and Generator Room	Electrical Switching Gear
	Generator
	Lead Acid Batteries
	Door Closers
	Fluorescent Lights and Ballasts
	265-gallon Diesel AST
	Exit Signs
Basement Kitchen Prep and Storage Area	Fluorescent Lights and Ballasts
	Door Closers
	Extra Fluorescent Light Bulbs and Ballasts
	Electric Motors
	Overhead Door Opener
Basement Mechanical and Boiler Room	Fluorescent Lights and Ballasts
	Door Closers
	Electrical Switches and Panels
	Thermostats
	55-gallon Drums of Boiler Fluid
	Electrical Motors
	Sump pump
	Emergency Lights
	Water Heater
	Boiler Equipment
Basement Breakroom	Fluorescent Lights and Ballasts
	Appliances
	Thermostats
	Electrical Switches
	Emergency Lights
	Exit Signs
Basement Parking Areas	Electrical Transformers
	Emergency Lights
	Overhead Door Openers
	Door Closers
	Fluorescent Lights and Ballasts
	Exit Signs
Basement Storage Area	Overhead Door Openers



Location	Identification
Basement Storage Area	Emergency Lights
	Fluorescent Lights and Ballasts
	Door Closers
	Gasoline Cans
	Miscellaneous Small Containers of Various Hazardous Materials (oil, paint, etc.)
	Exit Signs
North Country, Monoco Air, TSA and Weather One Areas	Fluorescent Lights and Ballasts
	Emergency Lights
	Electrical Switches/Panels
	Door Closers
	Exit Signs
	Security Equipment
Customs Area	Exit Signs
	Door Closers
	Emergency Lights
	Electrical Switches/Panels
	Door Closers
	Fluorescent Lights and Ballasts
X-Ray and Tunnel	Elevator Equipment
	X-Ray Equipment
	Overhead Door Openers
	Exit Signs
	Door Closers
	Emergency Lighting
NW Office and Cargo Area	Exit Lights
	Emergency Lights
	Door Closers
	Electrical Panels
	Thermostats
	Office Machines
	55-gallon Drums of Oil
	Various Small Containers of Miscellaneous Hazardous Materials (oil, paint, etc)
	Lead-Acid Batteries
Main Floor Concourse	Exit Signs
	Door Closers
	Emergency Lights
	Thermostat
	Miscellaneous Electronic Equipment

Table IV – Duluth Int. Airport, Duluth, MN

## **Appendix E**

**Asbestos Inspection Report prepared by EMR, Inc.**

# ASBESTOS INSPECTION REPORT

*at*

**The Duluth International Airport**

4701 Grinden Drive

Duluth, Minnesota

EMR Project #7124.001

*Prepared for:*

Reynolds, Smith and Hills, Inc.

900 Diehl Road – Suite 101

Naperville, IL 60563

*Prepared by:*

**EMR, Inc.**

11 East Superior Street, Suite #541

Duluth, Minnesota

JANUARY 11, 2006



**ENVIRONMENTAL MANAGEMENT RESOURCES**

**Asbestos Inspection Report**

*at*

**The Duluth International Airport**  
4701 Grinden Drive  
Duluth, Minnesota

*Prepared for:*

Reynolds, Smith and Hills, Inc.  
900 Diehl Road – Suite 101  
Naperville, IL 60563

*Prepared by:*

**EMR, Inc.**

11 East Superior Street, Suite #541  
Duluth, Minnesota

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JANUARY 11, 2006

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Figure 2. First Floor Plan with Sample Locations and ACM Areas

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Figure 4. Second Floor Plan with Sample Locations and ACM Areas

Figure 5. Second Floor Skyline Room (West Addition) Plan with Sample Locations

Figure 6. Third Floor Plan with Sample Locations and ACM Areas

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## **APPENDICIES**

Appendix A. Asbestos Inspector Certifications

Appendix B. Laboratory Reports

Appendix C. Homogenous Area Physical Assessment Forms

## EXECUTIVE SUMMARY

EMR, Inc. (EMR) was retained by Reynolds, Smith and Hills, Inc. (RS&H) to conduct a pre-renovation asbestos inspection of the Duluth International Airport Terminal Building, located at 4701 Grinden Drive in Duluth, Minnesota. The inspection was conducted between November 7, 2005 and January 3, 2006 by Chuck Deye of EMR who possesses current Minnesota Department of Health asbestos inspection certifications.

During the inspection, bulk samples were collected from the building materials suspected to contain asbestos. These samples were submitted to an accredited laboratory for polarized light microscopy (PLM) analysis. Laboratory analysis of the bulk samples collected from the site has indicated building materials with asbestos concentrations above regulated levels including: floor tile and mastic; ceiling tile; pipe wrap and hard fitting insulation. Additional materials were sampled during the inspection and were determined to be non-detect for asbestos content. Listed below is a summary of the types of asbestos-containing materials (ACM) in the building.

- White 12" x 12" Floor Tile and Mastic
- White 2' x 2' Suspended Ceiling Tile
- White 2' x 4' Suspended Ceiling Tile
- White Thermal System Insulation on Pipe Elbows
- White/Beige/Tan TSI Wrap on Pipe Elbows

The Environmental Protection Agency's (EPA) National Emission Standard for Hazardous Air Pollutants (NESHAP) regulations require that all friable ACM, and Category II Non-Friable ACM be removed from the building prior to renovation/demolition activities. Minnesota Pollution Control Agency (MPCA) guidelines state that if building materials are to be recycled during demolition or renovation, all Category 1 Non-Friable ACM must be removed prior to demolition of renovation.

EMR understands that the building is scheduled for renovation. Destructive investigation methods were not employed on the interior of the building during the time of the inspection due to the facility being open and operational. Additionally, destructive methods were not employed in order to not damage the appearance and aesthetics of the building. Ceiling cavities were accessed above suspended ceilings and unfinished wall cavities were accessed above plaster and sheetrock where possible in an attempt to verify the location of all suspect materials. Suspect materials were noted on both the interior and exterior of the building. Vertical pipe runs between the basement and third floor

HVAC rooms were partially encased in wall cavities, therefore portions of these pipe runs were not accessible at the time of inspection.



## **1.0 INTRODUCTION**

### **1.1 INTRODUCTION**

EMR, Inc., (EMR) was contacted by Reynolds, Smith and Hills, Inc. (RS&H) to conduct an asbestos inspection at the Duluth International Airport Terminal Building, located at 4701 Grinden Drive in Duluth, Minnesota. The inspection was authorized by Mr. Mark Wilcer, senior aviation architect, for RS&H.

The inspection was conducted between November 7, 2005 and January 3, 2006 by Chuck Deye (MN Certification #AI9479) (Appendix A). The inspection was conducted prior to planned renovations, but destructive investigation techniques were not employed since the facility was inhabited by employees and the general public during the inspection.

The purpose of the inspection was to locate and sample suspect asbestos-containing materials (ACM) throughout the building. Suspect materials were sampled and analyzed following the Environmental Protection Agency (EPA) "Asbestos Hazard Emergency Response Act" (AHERA) sampling protocol. This inspection also included quantifying the suspect ACM.

The survey was conducted by an EPA-AHERA accredited and Minnesota Department of Health (MDH) licensed inspector (Appendix A). Samples were analyzed using Polarized Light Microscopy (PLM) procedures by EMSL Analytical, Inc (EMSL) in Minneapolis, Minnesota.

This report summarizes EMR's methods, results, and observations; and it provides recommendations regarding the management of the identified and assumed ACM to ensure compliance with local, state, and federal regulations. Table 1 contains a listing of all suspect materials inventoried and sampled. Table 2 contains a listing of the identified ACM, homogenous materials identified, quantities, asbestos types, location, and percentage present in each ACM. The locations of bulk samples and the extent of identified ACM are found in Figures 1 through 6.

### **1.2 BUILDING CONSTRUCTION**

The Duluth International Airport Terminal Building (Terminal) is a three-story building with basement that is constructed with a combination of concrete block and poured concrete exterior walls and basement, engineered-stud construction interior walls, and steel roof supports. The Terminal was expanded to the west in the mid-1980s to include Customs and Immigrations offices, as well as a passenger lounge and gate for international flights (herein referred to as Customs Area). All levels feature concrete floors, concrete and plaster exterior walls and either un-insulated ceilings (in the original part of the Terminal) or fiberglass insulated ceilings (in the newer addition Customs

Area). The Terminal's main roof as well as the Customs Area roof is sheet metal and a white rubber membrane covers the parking aprons on the front side of the Terminal.

The Terminal features steam heat provided by boilers contained in the basement that are used in concert with a forced-air Heating, Ventilation and Air Conditioning (HVAC) system. The forced-air HVAC serves the second and third floors of the main terminal as well as the western Customs Area addition. Boiler-fed radiators were observed on the first floor. Multiple suspect materials were observed on HVAC system components. The boiler exhaust exits underground to an exhaust tower on the runway side of the Terminal. The underground portion of this exhaust line could not be inspected and was not sampled, however samples taken from the accessible portions of the boiler exhaust line did show regulated levels of asbestos.

## **2.0 METHODS**

### **2.1 PROCEDURES**

The asbestos inspection was conducted by Chuck Deye (AI9479) and who is EPA-certified and MDH-licensed asbestos inspector. The asbestos inspection included all wall and ceiling cavities of the Terminal that could be accessed through non-destructive techniques. Homogenous areas and suspect materials were identified during the inspection. Field drawings were prepared of the building to identify the homogenous areas and random sample collection sites. The field drawings have been reproduced and are presented in Figures 1 through 6.

Destructive investigation techniques were not employed since the facility was inhabited by employees and the general public during the inspection. Prior to conducting sampling, the area was thoroughly wetted using an airless sprayer and water. Material was then carefully removed with additional wetting being employed as necessary. All material removed was contained in the sample bag, ensuring that no sampling debris was created in the process.

### **2.2 SAMPLE COLLECTION**

Bulk samples of suspect materials were collected randomly. Similar systems and materials were grouped into "homogenous (sample) areas."

Representative samples of suspect materials (thermal system insulation, surfacing materials, miscellaneous materials, etc.) were collected by carefully removing a small portion of the wetted suspect material and sealing it in a plastic bag. Friable material sample locations were sealed with a latex caulk to prevent post-sampling fiber releases. Samples were collected from inconspicuous or damaged locations whenever possible.

Each bulk sample was labeled with unique sample identifications such as DIAP-B-001. The sample name consists of "DIAP" for the Duluth International Airport, while the "B" designates which level the samples were collected (B -- Basement, 1 -- First Floor, 2 -- Second Floor, 3 -- Third Floor) and "001" the order in which designates the order in which the samples were collected.

### **2.3 BULK ASBESTOS ANALYSIS**

The samples were analyzed by EMSL, a National Voluntary Laboratory Accreditation Program (NVLAP) certified laboratory using PLM procedures and EPA 600/R-93/116 method to verify the presence or absence of asbestos fibers and asbestos types including: actinolite, amosite, anthophyllite, chrysotile, crocidolite, and tremolite. All analyses were in compliance with the quality control procedures specified by the method. Complete laboratory reports and chain of custody forms are found in Appendix B.

## **3.0 RESULTS**

### **3.1 INVENTORY OF SUSPECT ASBESTOS CONTAINING MATERIALS**

The following suspect materials were identified and sampled in the Terminal and International Flight Area. (Table 1):

- White, Drywall with Joint Compound
  - White, Wall Plaster Surfacing
  - White/Tan, Spray-On Structural Fire Proofing
  - White, 12" x 12" Floor Tile with Black Mastic
  - White, 12" x 12" Floor Tile with Brown Mastic
  - White/Gray, Linoleum Floor Sheeting
  - Brown, Vinyl Baseboard with White Mastic
  - Brown, Vinyl Baseboard with Tan Mastic
  - Brown, Vinyl Baseboard with Brown Mastic
  - Black, Vinyl Baseboard with Brown Mastic
- 
- Tan, Vinyl Baseboard with Tan Mastic
  - Red, Vinyl Baseboard with Tan Mastic
  - Gray, Vinyl Baseboard with Gray Mastic
  - Tan/White, Carpet Mastic and Underlayment
  - White, 2' x 4' Suspended Ceiling Tile
  - White, 2' x 2' Suspended Ceiling Tile
  - White, Interlocking 12" x 12" Ceiling Tile
  - Hard, White Thermal System Insulation (TSI) Elbows
  - Hard, White TSI Boiler Exhaust

- Hard, White TSI on Water Heat Converters
- Tan/Beige, Fabric Pipe Wrap on TSI Elbows
- White/Black, Roof Moisture Barrier

All suspect materials that were sampled are listed in Table 1, "Inventory of Suspect Materials". The Inventory of Suspect Materials provides a listing of the bulk sample numbers used throughout the report, for each sample and location collected. The location of all bulk samples are found on Figures 1 through 6.

### 3.2 SAMPLE RESULTS

Table 2 – "Inventory of Asbestos Containing Materials" summarizes the complete list of materials sampled that are classified as ACM. The following materials are considered ACM since they contain regulated amounts of asbestos (> 1% asbestos):

- White 12" x 12" Floor Tile and Mastic
- White 2' x 2' Suspended Ceiling Tile
- White 2' x 4' Suspended Ceiling Tile
- White Thermal System Insulation Elbows
- Beige/Tan TSI Wrap on Elbows
- Boiler Exhaust 24-inch diameter pipe wrap
- Tan TSI Wrap on Water Heat Converters

No ACM was identified in the first floor International Flight Area (Figure 3) or in the second floor Skyline Room (Figure 5).

The condition and quantity of each suspect material was noted during the inspection and recorded on a Homogenous Physical Assessment Form. In addition the suspect materials were classified as either Friable (able to be reduced to powder with hand pressure) or Non-Friable (not able to be reduced to powder with hand pressure). The condition of the identified ACM is discussed in Section 4.0 and the Homogenous Physical Assessment forms for the above-discussed ACM are found in Appendix C.

### 3.3 QUANTITY OF ASBESTOS-CONTAINING MATERIALS

The type and approximate quantity of friable and non-friable ACM identified during the inspection consist of the following (Table 2):

- White 12" x 12" Floor Tile and Mastic ..... 7,800 ft<sup>2</sup>
- White 2' x 2' Suspended Ceiling Tile ..... 385 ft<sup>2</sup>
- White 2' x 4' Suspended Ceiling Tile ..... 90 ft<sup>2</sup>
- White Thermal System Insulation Elbows..... 102 fittings
- Beige/Tan TSI Wrap on Elbows..... 237 fittings
- Boiler Exhaust 24-inch diameter pipe wrap..... 40 feet
- Tan TSI Wrap on Water Heat Converters..... 20 ft<sup>2</sup>

Please note that the quantities of TSI and TSI Elbows include all observed, interior and exterior above-ground piping. The quantities do not account for any underground insulated piping that may be encountered during excavation or demolition.

## **4.0 DISCUSSION**

Materials classified as asbestos containing were found at the Duluth International Airport Terminal and are categorized as follows:

### **Thermal System Insulation**

- White/Tan Fabric TSI Pipe Wrap
- Hard White Pipe Elbow Insulation
- Boiler Exhaust 24-inch diameter pipe wrap
- Tan TSI Wrap on Water Heat Converters

Asbestos was detected in multiple TSI pipe wrap samples from pipe elbows and fittings throughout the Terminal. Analytical results indicate that only the fabric wrap on hard pipe fittings contains asbestos. The ACM elbow and fitting wrap was found on fiberglass insulated steam piping and boiler exhaust duct fittings and elbows in the basement, and first and second floors. In several areas the ACM wrapped fittings were mixed with plastic shelled, fiberglass insulated elbows and fitting that do not contain asbestos. All hard, woven-fabric covered elbows and fittings in the basement, and first and second floors are considered ACM. Figures 1, 2, 4, 5, and 6 show the areas that contain TSI elbows and fittings. The ACM pipe wrap is considered to be in damaged condition since <10% of the pipe wrap has distributed damage.

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Asbestos was detected in TSI elbow/fittings samples collected in the third floor HVAC rooms (East and West), indicating that the hard, white elbow and fitting insulation and the associated White/Tan fabric wrap contained regulated levels of asbestos. All hard insulated (non-fiberglass), fabric wrapped elbows and fittings in the West and East HVAC rooms are considered ACM (Figure 6). The ACM pipe wrap and associated insulation is considered to be in damaged condition since <10% of the pipe wrap and insulation has distributed damage.

Asbestos was detected in TSI pipe wrap samples collected from the fabric wrap on the 24-inch diameter boiler exhaust runs. This ACM pipe wrap is considered to be in damaged condition since <10% of the pipe wrap has distributed damage.

Asbestos was detected in the TSI fabric wrap on the water heat converters in the basement boiler room. There are two cylindrical water heat converts present in the boiler room. This ACM fabric wrap is considered to be in good condition.



It is assumed that any elbows and fittings on the underground portion of the boiler exhaust piping are asbestos containing. Any such elbows or fittings that are encountered during demolition or subsequent construction should be treated as ACM.

No asbestos was detected in TSI samples collected in the Customs Area, which is west of the Terminal.

#### **Miscellaneous Materials**

- White 12" x 12" Vinyl Floor Tile and Mastic
- White 2' x 2' Suspended Ceiling Tile
- White 2' x 4' Suspended Ceiling Tile

Asbestos was detected in white 12" x 12" floor tile samples collected throughout the building (i.e. DIAP-B-001). The floor tile (Category I non-friable material) is considered damaged, since less than 10% was damaged and the observed damage was distributed.

Asbestos was detected in 2' x 2' suspended ceiling tiles located in the basement maintenance office's bathroom and hallway, and in North Country Aviation's bathrooms. This ceiling tile is categorized as friable and is considered to be in good condition.

Asbestos was detected in 2' x 4' suspended ceiling tiles located in the 3<sup>rd</sup> floor coffee room and bathroom near the reception area. This ceiling tile is categorized as friable is considered to be in good condition.

| Homogenous Area Physical Assessment Forms for the above-described ACM are found in Appendix D.

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## **5.0 GENERAL RECOMMENDATIONS**

The information and findings of EMR's asbestos building inspection have been used to prepare this report and may be used as part of a management development process to determine response actions necessary to protect human health and the environment. Proper handling procedures on identified or assumed ACM will prevent the release of asbestos fibers. These materials require special handling procedures by certified asbestos professionals.

The United States EPA's NESHAP regulation and MDH rules require that all friable ACM and non-friable (Category II) ACM that may become friable during renovation or demolition must be removed from structures prior to demolition or renovation activities. Examples of Category II, non-friable ACM are: plaster, sheetrock, transite board, etc. If building materials are to be recycled, MPCA guidelines state that all Category I ACM (roofing material, resilient floor covering, etc) is to be removed since the recycling process could result the non-friable Category I materials becoming friable. All ACM abatement should be conducted by a reputable and certified asbestos abatement contractor.

Friable TSI pipe wrap was observed on the boiler exhaust pipe elbows and fittings within the boiler room. This pipe run extended outside of the basement walls and continued below ground. Pre-demolition abatement should include all insulated exterior and underground piping hard, fabric covered elbows and fittings that will or may be disturbed during demolition and or subsequent construction.

## 6.0 STANDARD OF CARE

The data generated and conclusions provided are based upon the scope of work performed. All work was conducted in a manner consistent with customary principles in the fields of science and engineering. EMR is not responsible for the independent conclusions, opinions, or recommendations made by others based on the data presented in this report. No other warranty, expressed or implied, is made.

The results reported and any opinions reached by EMR are for the benefit of the client and unless agreed to by EMR in writing, are not to be disclosed to or relied upon by any third party. The results and opinions set forth by EMR in this report will be valid as of the date of the report. EMR assumes no obligation to advise you of any changes that may later be brought to our attention.

EMR, Inc., as environmental consultants, respectfully submits this report.

The preceding report was prepared and reviewed by the following EMR personnel.

Author:




Chuck Deye

MDH Asbestos Inspector #AI9479

1/13/06

Date

Reviewed By:



Scott Carney

MDH Asbestos Inspector #AI3627

1/13/06

Date

## TABLES

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Table 1  
Inventory of Suspect Materials  
Duluth International Airport  
4701 Grinden Drive - Duluth, Minnesota  
EMR Project#7124.001

Sample Number	Unique Room ID	Material Type	Homogenous Area Description
DIAP-B-001	--	White 12"x12" F.T. with black mastic	Mech. Room F.T. 100 square feet
DIAP-B-002	--	4-inch dia. Pipe hard fitting	Mech. Room 1 fitting on 4-inch pipe
DIAP-B-003	--	3-inch dia. Pipe hard fitting	Mech. Room 2 fittings on 3-inch pipe
DIAP-B-004	--	Brown vinyl baseboard with white mastic	Mech. Room - 40 linear feet of baseboard
DIAP-B-005	--	White 2'x4' suspended ceiling tile	Mech. Room C.T. 100 square feet
DIAP-B-006	--	4-inch dia. Pipe hard fitting	Boiler Room 50 fittings on 4-inch pipe
DIAP-B-007	--	4-inch dia. Pipe hard fitting	Boiler Room 50 fittings on 4-inch pipe
DIAP-B-008	--	4-inch dia. Pipe hard fitting on out-of-service boiler	Boiler Room 50 fittings on 4-inch pipe
DIAP-B-009	--	6-inch dia. Pipe hard fitting	Boiler Room 3 fittings on 6-inch pipe
DIAP-B-010	--	6-inch dia. Pipe hard fitting	Boiler Room 3 fittings on 6-inch pipe
DIAP-B-011	--	Converter #2 hard insulation	Boiler Room water heat conv. #2 - 20 sq. ft.
DIAP-B-012	--	24-inch dia. In-Service Boiler exhaust	Boiler Room boiler exhst. 20 linear feet
DIAP-B-013	--	24-inch dia. Out-Of-Service Boiler exhaust	Boiler Room boiler exhst. 20 linear feet
DIAP-B-014	--	White 12"x12" F.T. with black mastic	Break Room F.T. 720 square feet
DIAP-B-015	--	Brown vinyl baseboard with tan mastic	Break Room - 150 linear feet of baseboard
DIAP-B-016	--	Drywall	Break Room drywall - 170 square feet
DIAP-B-017	--	White 2'x4' suspended ceiling tile	Break Room C.T. 600 square feet
DIAP-B-018	--	White 2'x2' suspended ceiling tile	Break Rm. Hallway/Bathroom 300 sq. ft.
DIAP-B-019	--	Brown vinyl baseboard with tan/clear mastic	Maint. Office - 80 linear feet
DIAP-B-020	--	6-inch dia. Water main inlet to bldg. Hard fitting	Maint. Office closet - 1 hard fitting
DIAP-B-021	--	4-inch dia. Pipe hard fitting	Break Room Bathroom - 4 hard fittings
DIAP-B-022	--	4-inch dia. Pipe hard fitting	East Garage - 15 hard fittings
DIAP-B-023	--	6-inch dia. Pipe hard fitting	East Garage - 10 hard fittings
DIAP-B-024	--	6-inch dia. Pipe hard fitting	East Garage - 10 hard fittings
DIAP-B-025	--	White/Tan Spray-on Fireproofing material	Basement/Parking Garage - 20,500 sq. ft.
DIAP-B-026	--	White/Tan Spray-on Fireproofing material	Basement/Parking Garage - 20,500 sq. ft.
DIAP-B-027	--	White/Tan Spray-on Fireproofing material	Basement/Parking Garage - 20,500 sq. ft.
DIAP-B-028	--	4-inch dia. Pipe hard fitting	West Garage - 15 hard fittings
DIAP-B-029	--	4-inch dia. Pipe hard fitting	West Garage - 15 hard fittings
DIAP-B-030	--	6-inch dia. Pipe hard fitting	West Garage - 10 hard fittings
DIAP-B-031	--	6-inch dia. Pipe hard fitting	West Garage - 10 hard fittings
DIAP-B-032	--	White/Tan Spray-on Fireproofing material	Basement/Parking Garage - 20,500 sq. ft.
DIAP-B-033	--	White/Tan Spray-on Fireproofing material	Basement/Parking Garage - 20,500 sq. ft.
DIAP-B-034	--	White speckled/wormy suspended 2'x4' ceiling tile	Telephone Room C.T. - 120 square feet
DIAP-B-035	--	4-inch dia. Pipe hard fitting	Loading Ramp 2 fittings on 4-inch pipe
DIAP-1-036	193, 196, 197, 198	White ribbed 2'x2' suspended ceiling tile	1st Floor Customs Ramp C.T. 1,500 sq. ft.
DIAP-1-037	193, 196, 197, 198	Brown vinyl baseboard	1st Floor Customs Ramp BB - 80 linear ft.
DIAP-1-038	186, 190	White/Gray Floor Linoleum	Customs Clearing bathrooms - 400 sq. ft.
DIAP-1-039	186, 190	Tan vinyl baseboard	Customs Clearing bathrooms - 150' linear
DIAP-1-040	174, 180	White speckled/wormy suspended 2'x4' ceiling tile	Customs Clearing area C.T. 2,300 sq. ft.
DIAP-1-041	174, 180	Red vinyl baseboard	Customs Clearing area BB - 500 linear ft.
DIAP-1-042	174, 180	Drywall	Customs Clearing area drywall - 60,000 sq. ft.
DIAP-1-043	174, 180	3-inch dia. Pipe hard fitting	Customs Clearing area fittings - 30 fittings
DIAP-1-044	181	Brown vinyl baseboard	Cust. Electrical Room BB - 80 linear feet
DIAP-1-045	169	3-inch dia. Pipe hard fitting	Cust. Search Rm. 1 fitting - 3 fittings
DIAP-1-046	171, 173	Carpet mastic/underlayment	Utility Room 171 - 600 sq. ft.
DIAP-1-047	171, 173	Gray vinyl baseboard	Utility Room 171 - 120 linear ft.
DIAP-1-048	171, 173	Drywall	Utility Room 171 - 9,000 sq. ft.
DIAP-1-049	160	White/Tan Spray-on Fireproofing material	W. Pass. Lounge - 20,500 sq. ft.
DIAP-1-050	136, 139	White 12"x12" F.T. with black mastic	N. Cntry area - 700 sq. ft.

Table 1  
Inventory of Suspect Materials  
Duluth International Airport  
4701 Grinden Drive - Duluth, Minnesota  
EMR Project#7124.001

Sample Number	Unique Room ID	Material Type	Homogenous Area Description
DIAP-1-051	136, 139	Brown vinyl baseboard with tan mastic	N. Cntry area - 200 linear feet
DIAP-1-052	136, 139	3-inch dia. Pipe hard fitting	N. Cntry area - 2 hard fittings
DIAP-1-053	136, 139	White wall plaster	N. Cntry area - 4,600 square feet
DIAP-1-054	142	Suspended Ceiling Tile	N. Cntry hallway ceiling tile - 300 sq. ft.
DIAP-1-055	146, 147	Suspended Ceiling Tile	N. Cntry bathrooms - 85 sq. ft.
DIAP-1-056	142	Brown vinyl baseboard with brown mastic	N. Cntry hallway - 150 linear feet
DIAP-1-057	135	3-inch dia. Pipe hard fitting	Weather One - 2 hard fittings
DIAP-1-058	135	White/Tan Spray-on Fireproofing material	Weather One - 20,500 sq. ft.
DIAP-1-059	138	Black vinyl baseboard with brown mastic	TSA office - 60 linear feet
DIAP-1-060	126, 130	2'x2' suspended ceiling tile	W. Pass. Area bathrooms - 800 sq. ft.
DIAP-1-061	101	Gray vinyl stair tread wrap	2 stair cases - 300 sq. ft.
DIAP-1-062	101	White wall plaster	W. Pass. Area plaster
DIAP-1-063	125	3-inch dia. Pipe hard fitting	E. Tug Tunnel (west end) - 1 hard fitting
DIAP-1-064	113-120	White 12"x12" Vinyl Floor Tile	NW Offices - 2,100 sq.ft
DIAP-1-065	113-120	White speckled/wormy suspended 2'x4' ceiling tile	NW Offices - 2,100 sq.ft
DIAP-1-066	113-120	Brown vinyl baseboard with tan mastic	NW Offices - 400 linear feet
DIAP-1-067	113-120	White wall plaster	NW Offices - 5,000 square feet
DIAP-1-068	104	4-inch dia. Pipe hard fitting	NW Cargo Area (104) - 21 hard fittings
DIAP-2-069	--	Brown vinyl baseboard with tan mastic	Skyline Lounge - 250 linear feet
DIAP-2-070	--	Drywall	Skyline Lounge - 60,000 sq. ft.
DIAP-2-071	--	12"x12" white speckled floor tile with tan mastic	Skyline Lounge - 1,000 sq. ft.
DIAP-2-072	202	Drywall	West Gate Lobby - 3,000 sq.ft.
DIAP-2-073	--	White wall plaster	West Conc. Obsrv. Lnge. - 1,500 sq. ft.
DIAP-2-074	208	12"x12" white speckled floor tile	West Conc. Janitor Closet - 30 sq. ft.
DIAP-2-075	208	3-inch dia. Pipe hard fitting	West Conc. Janitor Closet - 5 fittings
DIAP-2-076	208	White wall plaster	West Conc. Janitor Closet - 600 sq. ft.
DIAP-2-077	201	Black vinyl baseboard with brown mastic	West Conc. Bathroom area - 100 linear ft.
DIAP-2-078	--	12"x12" white vinyl floor tile	Bar Closet 1 - 25 sq. ft.
DIAP-2-079	--	White/Tan Spray-on Fireproofing material	Bar Closet 1 - 41,000 sq. ft.
DIAP-2-080	214	White (w/ gray paint) 12"x12" suspended ceiling tile	Bar - 2,000 square feet
DIAP-2-081	212	White 2'x4' suspended ceiling tile	Kitchen - 2,400 square feet
DIAP-3-082	M02	6-inch dia. Pipe hard fitting	West HVAC - 5 fittings
DIAP-3-083	M02	6-inch dia. Pipe hard fitting	West HVAC - 5 fittings
DIAP-3-084	M02	4-inch dia. Pipe hard fitting	West HVAC - 40 fittings
DIAP-3-085	M02	4-inch dia. Pipe hard fitting	West HVAC - 40 fittings
DIAP-3-086	M02	White wall plaster	West HVAC - 4,500 sq. ft.
DIAP-3-087	M05	White 2'x4' suspended ceiling tile	Reception Area coffee room - 90 sq. ft.
DIAP-3-088	M05	White 12"x12" Vinyl Floor Tile	Reception Area coffee room - 72 sq. ft.
DIAP-3-089	M05	Brown vinyl baseboard with tan mastic	Reception Area coffee room - 30 linear ft.
DIAP-3-090	--	Brown vinyl baseboard with tan mastic	Operations Center Office - 350 linear ft.
DIAP-3-091	--	2'x4' ribbed/speckled white suspended ceiling tile	Operations Center Office - 1,050 sq. ft.
DIAP-3-092	M09	6-inch dia. Pipe hard fitting	East HVAC - 17 fittings
DIAP-3-093	M09	6-inch dia. Pipe hard fitting	East HVAC - 17 fittings
DIAP-3-094	M09	4-inch dia. Pipe hard fitting	East HVAC - 40 fittings
DIAP-3-095	M09	4-inch dia. Pipe hard fitting	East HVAC - 40 fittings
DIAP-3-096	M09	White wall plaster	West HVAC - 4,500 sq. ft.
DIAP-3-097	M09	White/Tan Spray-on Fireproofing material	West HVAC - 6,000 sq. ft.
DIAP-R-098	101	White, speckled 12"x12" interlocking ceiling tile	Main Terminal C.T. - 26,000 sq. ft.
DIAP-R-099	--	White, speckled 12"x12" interlocking ceiling tile	Skyline Room C.T. - 12,000 sq. ft.
DIAP-R-100	--	Ceiling drywall	Skyline Room - 12,000 sq. ft.

Table 1  
Inventory of Suspect Materials  
Duluth International Airport  
4701 Grinden Drive - Duluth, Minnesota  
EMR Project#7124.001

Sample Number	Unique Room ID	Material Type	Homogenous Area Description
DIAP-1-101	--	3-inch dia. Pipe wrap and hard fitting	Customs Clearing area fittings - 30 fittings
DIAP-1-102	--	3-inch dia. Pipe wrap and hard fitting	Customs Clearing area fittings - 30 fittings



**Table 2.**  
**Inventory of Asbestos-Containing Materials**  
**Duluth International Airport**  
**4701 Grinden Drive - Duluth, Minnesota**  
**EMR Project #7124.001**

Sample #	Materials	Locations	Quantity	Asbestos Type and Percentage	Friable/Non-friable
DIAP-B-001 WHITE FLOOR TILE	White 12" x 12" Floor Tile	Basement Mechanical Room	100 ft <sup>2</sup>	7% Chrysotile	Category I Non-friable
DIAP-B-001 BLACK MASTIC	Black Mastic on White 12" x 12" Floor Tile	Basement Mechanical Room	100 ft <sup>2</sup>	10% Chrysotile	Category I Non-friable
DIAP-B-002 PIPE WRAP	White wrap on 4-inch hard fitting	Basement Mechanical Room	3 fittings	70% Chrysotile	Friable
DIAP-B-006 PIPE WRAP	White wrap on 4-inch hard fitting	Basement Boiler Room	50 fittings	60% Chrysotile	Friable
DIAP-B-009 PIPE WRAP	Tan wrap on 6-inch hard fitting	Basement Boiler Room	3 fittings	30% Chrysotile	Friable
DIAP-B-011 PIPE WRAP	Tan wrap on water heat converter #2	Basement Boiler Room	20 ft <sup>2</sup>	30% Chrysotile	Friable
DIAP-B-012 PIPE WRAP	Tan wrap on In-Service boiler exhaust (24-inch dia)	Basement Boiler Room	20 feet	5% Chrysotile	Friable
DIAP-B-013 PIPE WRAP	White wrap on Out-of-Service boiler exhaust (24-inch dia.)	Basement Boiler Room	20 feet	5% Chrysotile	Friable
DIAP-B-018 WHITE CEILING TILE	White 2' x 2' Suspended Ceiling Tile	Basement Bathroom and Hallway	300 ft <sup>2</sup>	3% Chrysotile	Friable
NOT SAMPLED FLOOR TILE	White 12" x 12" Floor Tile	Basement Maintenance Office	720 ft <sup>2</sup>	Assumed ACM	Category I Non-friable
NOT SAMPLED MASTIC	Black Mastic on White 12" x 12" Floor Tile	Basement Maintenance Office	720 ft <sup>2</sup>	Assumed ACM	Category I Non-friable
DIAP-B-020 PIPE WRAP	White wrap on 6-inch hard fitting - main water line inlet to terminal building	Maintenance Office Closet	1 fitting	70% Chrysotile	Friable
DIAP-B-022 PIPE WRAP	Tan wrap on 4-inch hard fitting	East Garage	15 fittings	70% Chrysotile	Friable

Table 2.  
Inventory of Asbestos-Containing Materials  
Duluth International Airport  
4701 Grinden Drive - Duluth, Minnesota  
EMR Project #7124.001

Sample #	Materials	Locations	Quantity	Asbestos Type and Percentage	Friable/Non-friable
DIAP-B-023 PIPE WRAP	White wrap on 6-inch hard fitting	East Garage	10 fittings	70% Chrysotile	Friable
DIAP-B-029 PIPE WRAP	Tan wrap on 4-inch hard fitting	West Garage	15 fittings	70% Chrysotile	Friable
DIAP-B-030 PIPE WRAP	Tan wrap on 6-inch hard fitting	West Garage	10 fittings	70% Chrysotile	Friable
DIAP-B-035 PIPE WRAP	Cream-colored wrap on 4-inch hard fitting	Basement Loading Ramp	2 fittings	50% Chrysotile	Friable
DIAP-1-050 FLOOR TILE	White 12" x 12" Floor Tile	N. Country Area Lobby and Office	700 ft <sup>2</sup>	3% Chrysotile	Category I Non-friable
DIAP-1-050 MASTIC	Black Mastic on White 12" x 12" Floor Tile	N. Country Area Lobby and Office	700 ft <sup>2</sup>	10% Chrysotile	Category I Non-friable
NOT SAMPLED FLOOR TILE	White 12" x 12" Floor Tile	Weather One and TSA Offices	2,640 ft <sup>2</sup>	Assumed ACM	Category I Non-friable
NOT SAMPLED MASTIC	Black Mastic on White 12" x 12" Floor Tile	Weather One and TSA Offices	2,640 ft <sup>2</sup>	Assumed ACM	Category I Non-friable
DIAP-1-052 PIPE WRAP	White wrap on 3-inch hard fitting	N. Country Area Lobby and Office	2 fittings	50% Chrysotile	Friable
DIAP-1-055 CEILING TILE	Beige/white 2' x 2' suspended ceiling tile	N. Country Area Bathrooms	85 ft <sup>2</sup>	3% Chrysotile	Friable
DIAP-1-057 PIPE WRAP	Beige wrap on 3-inch hard fitting	Weather One office	2 fittings	50% Chrysotile	Friable
DIAP-1-063 PIPE WRAP	White wrap on 3-inch hard fitting	East Tug Tunnel	1 fitting	70% Chrysotile	Friable
DIAP-1-064 FLOOR TILE	White 12" x 12" Floor Tile	Northwest Offices	2,100 ft <sup>2</sup>	5% Chrysotile	Category I Non-friable



Table 2.  
Inventory of Asbestos-Containing Materials  
Duluth International Airport  
4701 Grinden Drive - Duluth, Minnesota  
EMR Project #7124.001

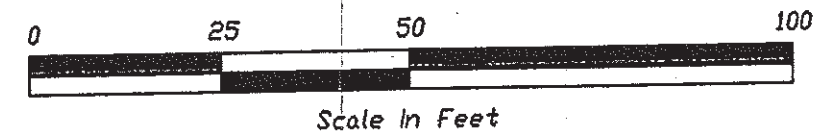
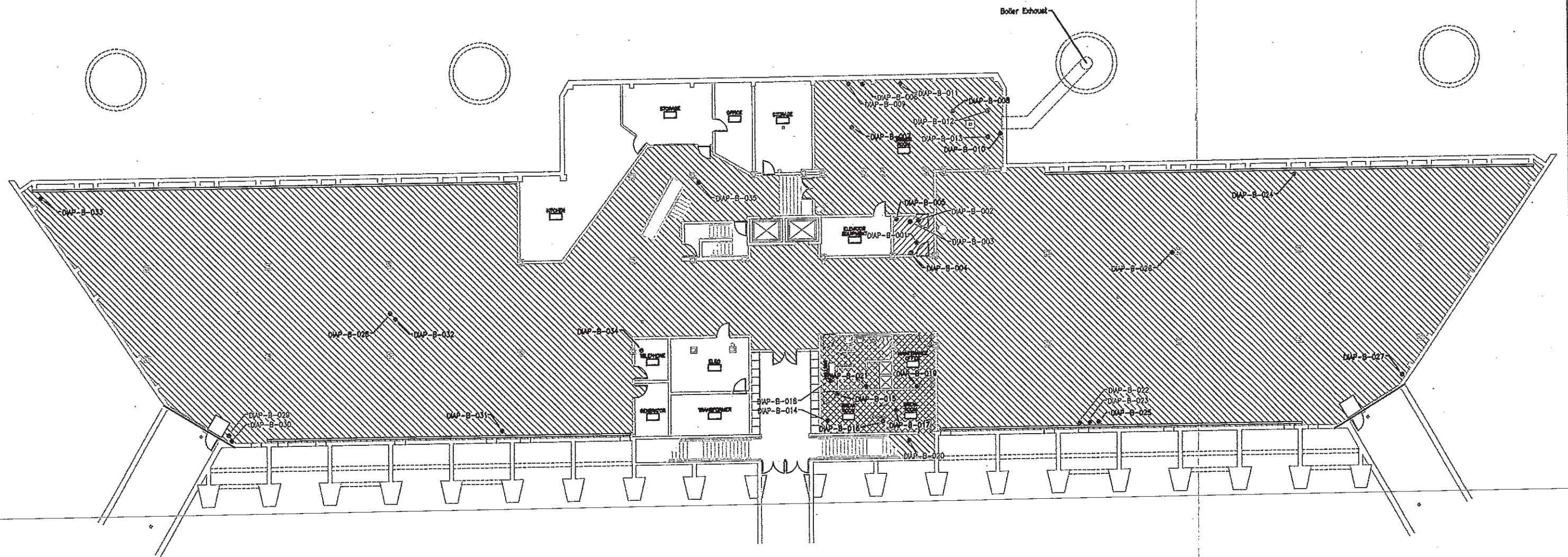
Sample #	Materials	Locations	Quantity	Asbestos Type and Percentage	Friable/Non-friable
DIAP-1-064 MASTIC	Black mastic on White 12" x 12" Floor Tile	Northwest Offices	2,100 ft <sup>2</sup>	10% Chrysotile	Category I Non-friable
DIAP-1-068 PIPE WRAP	Tan wrap on 4-inch hard fitting	Northwest Cargo Area 104	21 fittings	45% Chrysotile	Friable
DIAP-2-074 FLOOR TILE	White 12" x 12" Floor Tile	West Concourse Bathroom and Janitor Closet	30 ft <sup>2</sup>	4% Chrysotile	Category I Non-friable
DIAP-2-074 MASTIC	Black Mastic on White 12" x 12" Floor Tile	West Concourse Bathroom and Janitor Closet	30 ft <sup>2</sup>	10% Chrysotile	Category I Non-friable
DIAP-2-078 MASTIC	Brown mastic on White 12" x 12" Floor Tile	Bar Area	1,500 ft <sup>2</sup>	3% Chrysotile	Category I Non-friable
DIAP-3-082 PIPE WRAP	White wrap on 6-inch hard fitting	West HVAC Room	5 fittings	80% Chrysotile	Friable
DIAP-3-083 PIPE WRAP	White wrap on 6-inch hard fitting	West HVAC Room	5 fittings	70% Chrysotile	Friable
DIAP-3-084 HARD FITTING	4-inch diameter hard fitting	West HVAC Room	40 fittings	3% Chrysotile	Friable
DIAP-3-084 PIPE WRAP	White wrap on 4-inch hard fitting	West HVAC Room	40 fittings	70% Chrysotile	Friable
DIAP-3-085 HARD FITTING	4-inch diameter hard fitting	West HVAC Room	40 fittings	3% Chrysotile	Friable
DIAP-3-085 PIPE WRAP	Tan wrap on 4-inch hard fitting	West HVAC Room	40 fittings	70% Chrysotile	Friable
DIAP-3-087 CEILING TILE	White/Tan 2' x 4' Suspended Ceiling Tile	Reception Area Coffee Room	90 ft <sup>2</sup>	3% Chrysotile	Friable
DIAP-3-088 FLOOR TILE	White 12" x 12" Floor Tile	Reception Area Coffee Room	72 ft <sup>2</sup>	5% Chrysotile	Category I Non-friable

Table 2.  
Inventory of Asbestos-Containing Materials  
Duluth International Airport  
4701 Grinden Drive - Duluth, Minnesota  
EMR Project #7124.001

Sample #	Materials	Locations	Quantity	Asbestos Type and Percentage	Friable/Non-friable
DIAP-3-088 MASTIC	Brown mastic on White 12" x 12" Floor Tile	Reception Area Coffee Room	72 ft <sup>2</sup>	10% Chrysotile	Category I Non-friable
DIAP-3-092 HARD FITTING	6-inch diameter hard fitting	East HVAC Room	17 fittings	3% Chrysotile	Friable
DIAP-3-092 PIPE WRAP	Tan wrap on 6-inch hard fitting	East HVAC Room	17 fittings	65% Chrysotile	Friable
DIAP-3-093 HARD FITTING	6-inch diameter hard fitting	East HVAC Room	17 fittings	3% Chrysotile	Friable
DIAP-3-093 PIPE WRAP	White wrap on 6-inch hard fitting	East HVAC Room	17 fittings	70% Chrysotile	Friable
DIAP-3-094 HARD FITTING	4-inch diameter hard fitting	East HVAC Room	40 fittings	3% Chrysotile	Friable
DIAP-3-094 PIPE WRAP	White wrap on 4-inch hard fitting	East HVAC Room	40 fittings	70% Chrysotile	Friable
DIAP-3-095 PIPE WRAP	White wrap on 4-inch hard fitting	East HVAC Room	40 fittings	70% Chrysotile	Friable

## FIGURES

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# LEGEND

- ACM Sample Location
- Non-ACM Sample Location
- ▨ Extent of ACM White 12"x12" Floor Tile and Mastic
- ▨ Areas with ACM Pipe Fittings and Wrap
- ▨ Extent of ACM Ceiling Tile

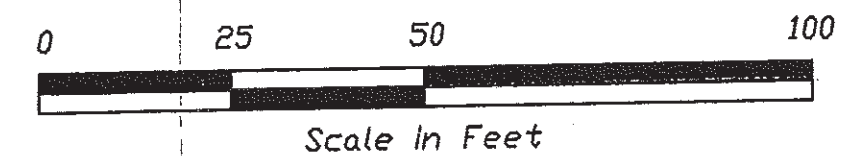
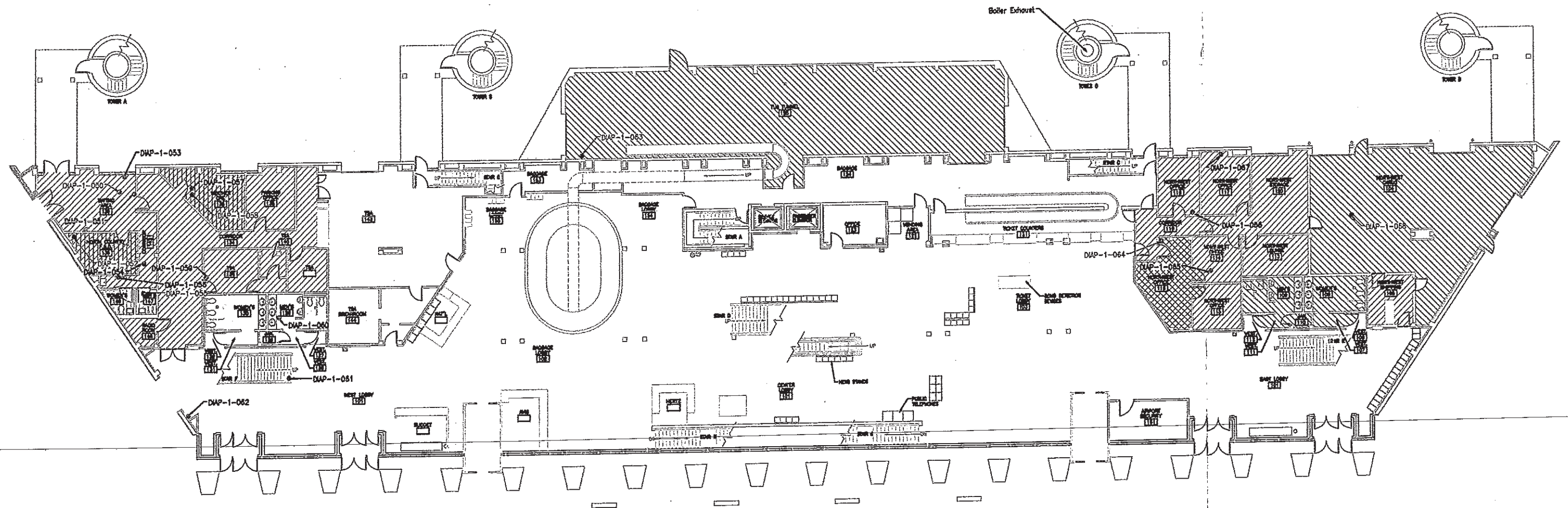
Reynolds, Smith and Hills, Inc.  
The Duluth International Airport  
Main Terminal Building

Figure 1. Basement Floor Plan with Sample Locations and ACM Areas  
Asbestos Inspection Report

DRAWN BY: CAD  
CHECKED BY: SJC  
PROJECT NO. 7124.001  
REVISION NO. 1  
DATE: January 10, 2006  
REFERENCE: RS&H, 11/05







# LEGEND

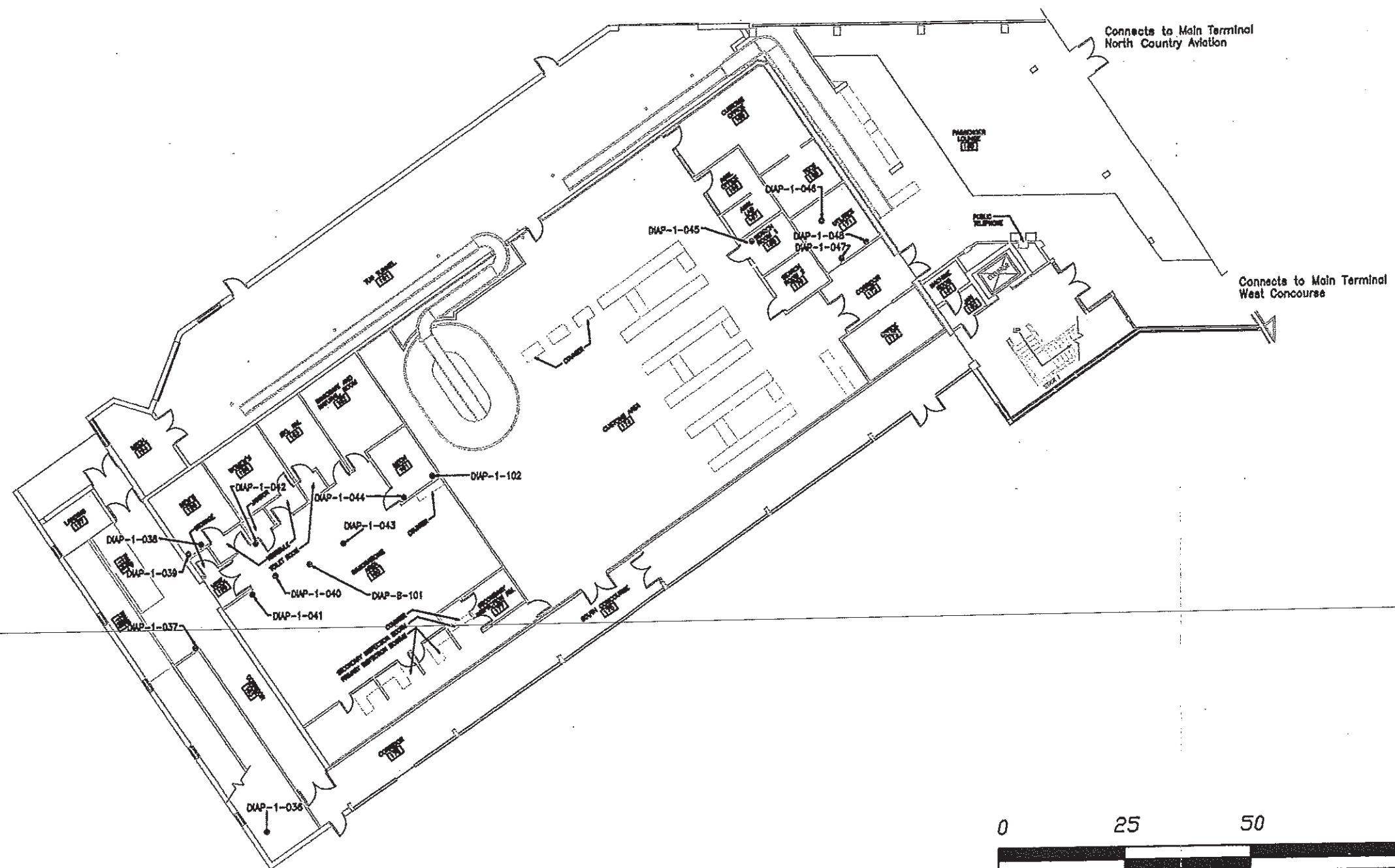
- ACM Sample Location
- Non-ACM Sample Location
- ▨ Extent of ACM White 12"x12" Floor Tile and Mastic
- ▩ Areas with ACM Pipe Fittings and Wrap
- ▤ Extent of ACM Ceiling Tile

Reynolds, Smith and Hills, Inc.  
The Duluth International Airport  
Main Terminal Building

Figure 2. First Floor Plan with Sample Locations and ACM Areas  
Asbestos Inspection Report

DRAWN BY: CAD  
CHECKED BY: SJC  
PROJECT NO. 7124.001  
REVISION NO. 1  
DATE: January 10, 2006  
REFERENCE: RS&H, 11/05





# LEGEND

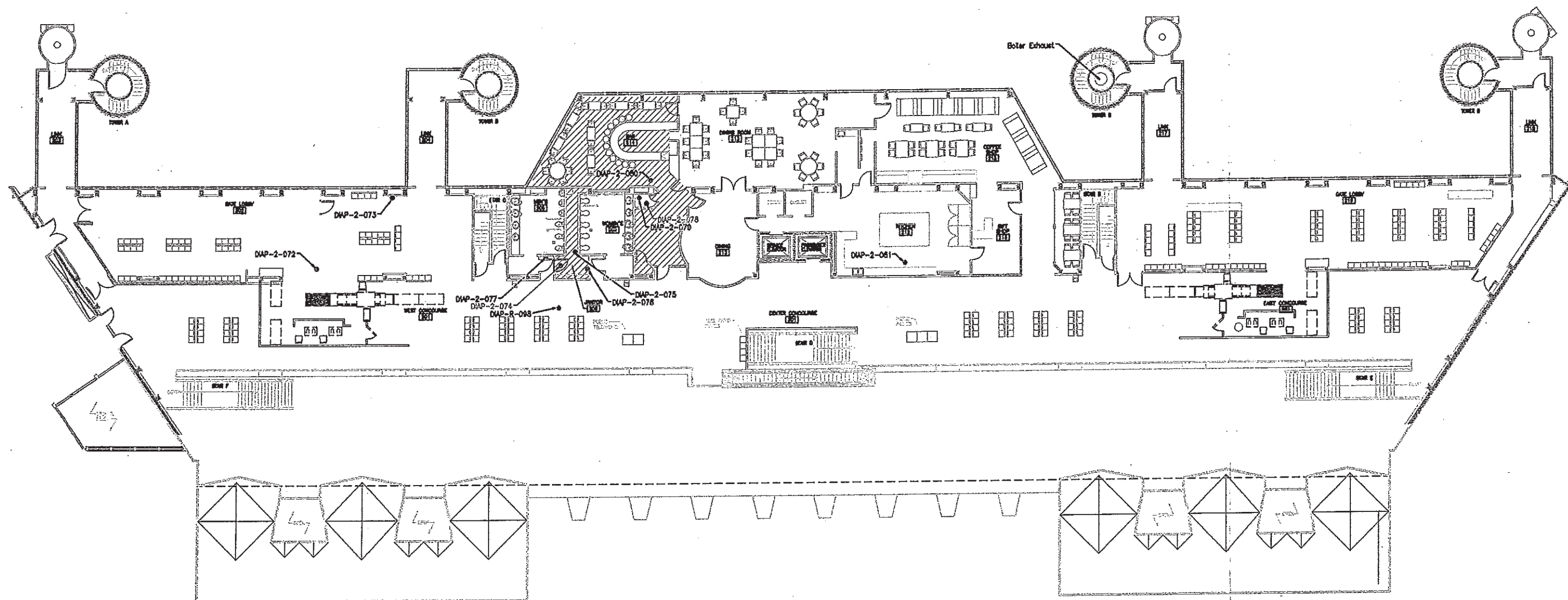
- Non-ACM Sample Location

Reynolds, Smith and Hills, Inc.  
The Duluth International Airport  
Main Terminal Building

Figure 3. First Floor Customs Area (West Addition) Plan with Sample Locations  
Asbestos Inspection Report

DRAWN BY: CAD  
CHECKED BY: SJC  
PROJECT NO. 7124.001  
REVISION NO. 1  
DATE: January 10, 2006  
REFERENCE: RS&H, 11/05





#### LEGEND

- ACM Sample Location
- Non-ACM Sample Location
- ▨ Extent of ACM White 12"x12" Floor Tile and Mastic

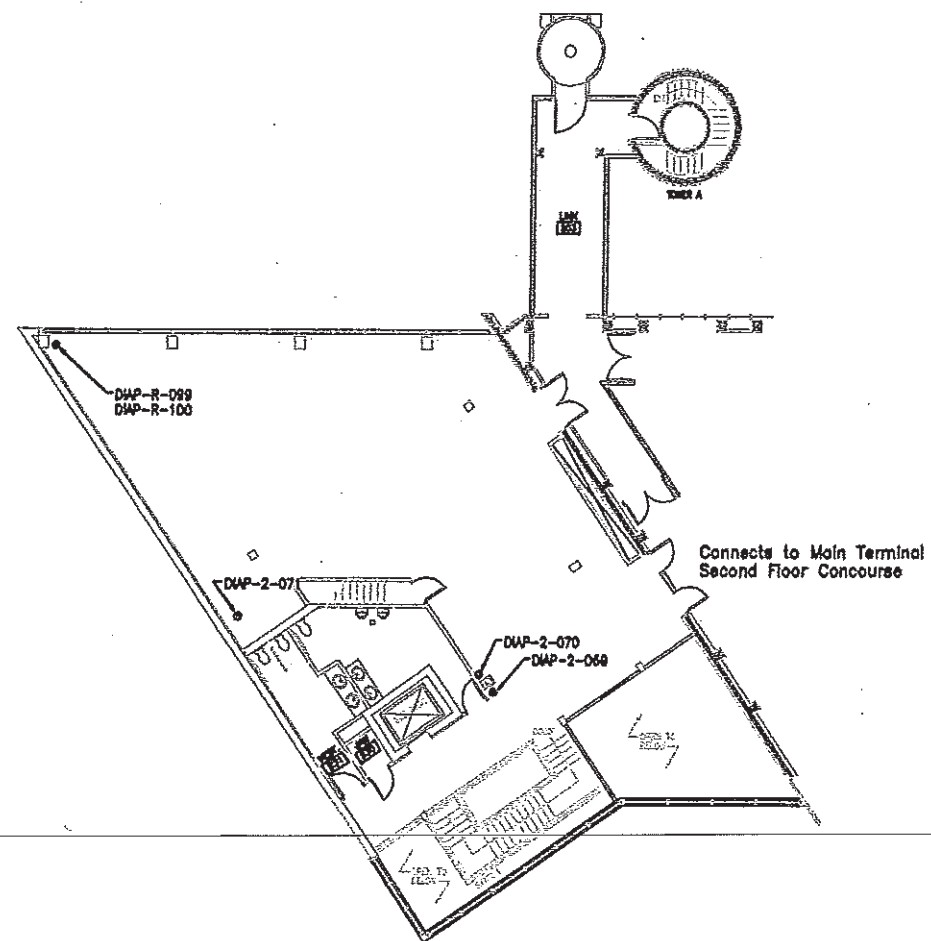
Reynolds, Smith and Hills, Inc.  
The Duluth International Airport  
Main Terminal Building

Figure 4. Second Floor Plan with Sample Locations and ACM Areas  
Asbestos Inspection Report

DRAWN BY: CAD  
CHECKED BY: SJC  
PROJECT NO. 7124.001  
REVISION NO. 1  
DATE: January 10, 2006  
REFERENCE: RS&H, 11/05







# LEGEND

- Non-ACM Sample Location

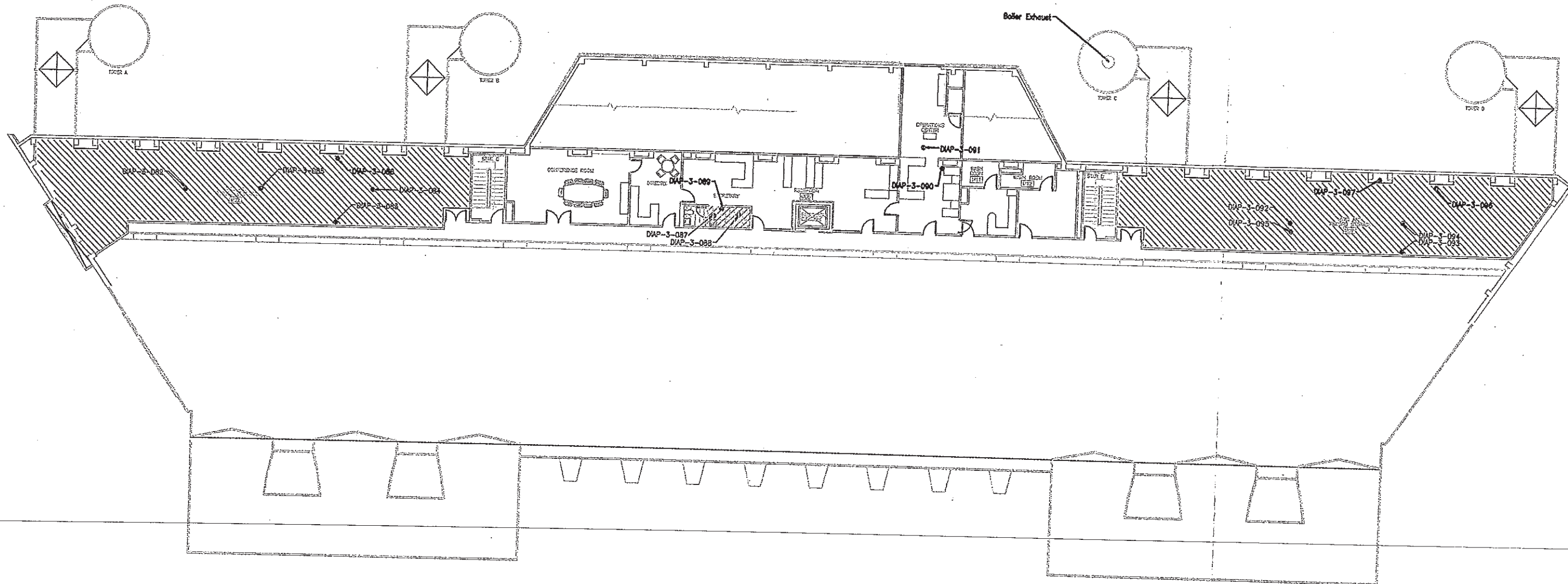
Reynolds, Smith and Hills, Inc.  
The Duluth International Airport  
Main Terminal Building

Figure 5. Second Floor Skyline Room (West Addition) Plan with Sample Locations  
Asbestos Inspection Report

DRAWN BY: CAD  
CHECKED BY: SJC  
PROJECT NO. 7124.001  
REVISION NO. 1  
DATE: January 10, 2006  
REFERENCE: RS&H, 11/05







# LEGEND

- ACM Sample Location
- Non-ACM Sample Location
- ▨ Extent of ACM White 12'x12' Floor Tile and Mastic
- ▨ Areas with ACM Pipe Fittings and Wrap
- ▨ Extent of ACM Ceiling Tile

Reynolds, Smith and Hills, Inc.  
The Duluth International Airport  
Main Terminal Building

Figure 6. Second Floor Plan with Sample Locations and ACM Areas  
Asbestos Inspection Report

DRAWN BY: CAD  
CHECKED BY: SJC  
PROJECT NO. 7124.001  
REVISION NO. 1  
DATE: January 10, 2006  
REFERENCE: RS&H, 11/05



**APPENDIX A**

**ASBESTOS INSPECTOR CERTIFICATIONS**

---



*Peter A. Blongren*  
Director, Env. Health Div.

**MDH** ASBESTOS  
INSPECTOR

Certified by:  
State of Minnesota  
Department of Health

Expires: 12/14/2006

Charles A Deye  
1401 N 55th St  
Superior, WI 54880

No. AI9479 Issued: 12/23/2005

**APPENDIX B**

**LABORATORY REPORTS**

---

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: [minneapolislab@emsl.com](mailto:minneapolislab@emsl.com)**EMSL**

Attn: **Chuck Deye**  
**EMR Inc, (Envir Mgt Res., Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

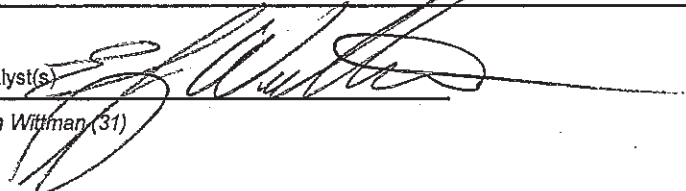
Customer ID: EMRI50  
Customer PO:  
Received: 11/21/05 9:15 AM  
EMSL Order: 350505305

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: Duluth IAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 12/13/05  
Report Date: 12/13/05

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-001 FLOOR TILE 350505305-0001	Mechanical Room F.T. 12x12 white	White Non-Fibrous  Layers: 2		93% Non-fibrous (other)	7% Chrysotile
DIAP-B-001 MASTIC 350505305-0026	Mechanical Room F.T. 12x12 white	Black Non-Fibrous  Layers: 2		90% Non-fibrous (other)	10% Chrysotile
DIAP-B-002 350505305-0002	Mechanical Room 4-inch hard fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	<1% Chrysotile
DIAP-B-003 INSULATION 350505305-0003	Mechanical Room 3-inch hard fitting	Cream Fibrous  layers: 2	65% Min. Wool	35% Non-fibrous (other)	<1% Chrysotile
DIAP-B-003 WRAP 350505305-0031	Mechanical Room 3-inch hard fitting	White Fibrous layers: 2	50% Synthetic	<1% Non-fibrous (other)	50% Chrysotile
DIAP-B-004 BASEBOARD 350505305-0004	Mechanical Room brown vinyl Baseboard	Brown Non-Fibrous  Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-B-004 MASTIC 350505305-0027	Mechanical Room brown vinyl Baseboard	Brown Non-Fibrous  Layers: 2		100% Non-fibrous (other)	None Detected

Analyst(s)   
Erin Wittman (31)



or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client.

Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: minneapolislab@emsl.com

**EMSL**

SM

Attn: **Chuck Deye**  
**EMR Inc, (Envir Mgt Res., Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO:  
Received: 11/21/05 9:15 AM  
EMSL Order: 350505305

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: Duluth IAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 12/13/05  
Report Date: 12/13/05

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-005 350505305-0005	Mechanical Room C.T. white	Beige/White Fibrous Heterogeneous	40% Min. Wool 40% Cellulose	10% Perlite 10% Non-fibrous (other)	None Detected
DIAP-B-014 FLOOR TILE 350505305-0006	Break Room F.T.	White Non-Fibrous Layers: 2		93% Non-fibrous (other)	7% Chrysotile
DIAP-B-014 MASTIC 350505305-0028	Break Room F.T.	Black Non-Fibrous Layers: 2		90% Non-fibrous (other)	10% Chrysotile
DIAP-B-015 BASEBOARD 350505305-0007	Break Room Vinyl baseboard	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-B-015 MASTIC 350505305-0029	Break Room Vinyl baseboard	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-B-016 350505305-0008	Break Room drywall	Brown/White Fibrous Heterogeneous	5% Glass 10% Cellulose	85% Non-fibrous (other)	None Detected
DIAP-B-017 350505305-0009	Break Room 2x4 C.T.	Beige Fibrous Heterogeneous	40% Min. Wool 40% Cellulose	10% Perlite 10% Non-fibrous (other)	None Detected

Analyst(s)

Erin Wittman (31)



or other approved signatory

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Phone: (763) 449-4922 Fax: (763) 449-4924 Email: minneapolislab@emsl.com

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Attn: **Chuck Deye**  
**EMR Inc, (Envir Mgt Res., Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMR150  
Customer PO:  
Received: 11/21/05 9:15 AM  
EMSL Order: 350505305

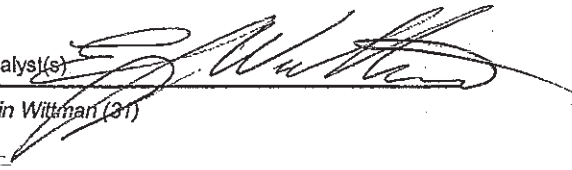
Fax: (218) 625-2201 Phone: (218) 625-2332


Project: Duluth IAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 12/13/05  
Report Date: 12/13/05

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-018 350505305-0010	Break Room hallway 2x2 C.T.	Beige Fibrous Heterogeneous	12% Synthetic 85% Min. Wool		3% Chrysotile
DIAP-B-019 BASEBOARD 350505305-0011	Maint. Office vinyl baseboard	Black Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-B-019 MASTIC 350505305-0030	Maint. Office vinyl baseboard	Cream Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-B-020 350505305-0012	Break Room water Main inlet hard fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-021 350505305-0013	Break Room Bathroom 4-inch fitting	Cream Fibrous Layers: 2	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-022 350505305-0014	East Garage 4- Inch fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-023 350505305-0016	East Garage 6- inch fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected

Analyst(s)  
  
Erin Wittman (31)



or other approved signatory

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Analysis performed by EMSL Minneapolis (NVLAP #200019-0)



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Attn: **Chuck Deye**  
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**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

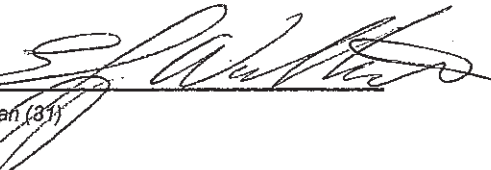
Customer ID: EMRI50  
Customer PO:  
Received: 11/21/05 9:15 AM  
EMSL Order: 350505305

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: Duluth IAP Asbestos 7124.001

EMSL Proj: .  
Analysis Date: 12/13/05  
Report Date: 12/13/05

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-024 350505305-0016	East Garage 6-inch fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-025 350505305-0017	East Garage Fireproofing	Beige Fibrous Heterogeneous	15% Cellulose	60% Non-fibrous (other) 25% Mica	None Detected
D 3-026 350505305-0018	East Garage Fireproofing	Beige Fibrous Heterogeneous	15% Cellulose	60% Non-fibrous (other) 25% Mica	None Detected
DIAP-B-027 350505305-0019	East Garage Fireproofing	Beige Fibrous Heterogeneous	15% Cellulose	60% Non-fibrous (other) 25% Mica	None Detected
DIAP-B-028 350505305-0020	West Garage 4-inch fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	<1% Chrysotile
DIAP-B-029 350505305-0021	West Garage 4-inch fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	<1% Chrysotile
DIAP-B-030 350505305-0022	West Garage 6-inch fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected

Analyst(s)   
Erin Wittman (31)



or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client.

Analysis performed by EMSL Minneapolis (NVLAP #200019-0)



**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: minneapolislab@emsl.com

**EMSL**

Attn: **Chuck Deye**  
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**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMR150  
Customer PO:  
Received: 11/21/05 9:15 AM  
EMSL Order: 350505305

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: Duluth IAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 12/13/05  
Report Date: 12/13/05

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	<u>Non-Asbestos</u>		<u>Asbestos</u>
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-031 350505305-0023	West Garage 6-inch fitting	Cream Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-032 350505305-0024	West Garage Fireproofing	Beige Fibrous Heterogeneous	15% Cellulose	60% Non-fibrous (other) 25% Mica	None Detected
D-033 350505305-0025	West Garage Fireproofing	Beige Fibrous Heterogeneous	15% Cellulose	60% Non-fibrous (other) 25% Mica	None Detected

Results amended 12/13/05 to add a layer to #3 and change results on #29.

Analyst(s)

Erin Wittman (34)



or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client.

Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

250505305



## Chain of Custody

### Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Company:	EMR Incorporated	Bill To:	EMR Inc
Address 1:	11 E. Superior Street	Address 1:	11 E. Superior Street
Address 2:	Suite 541	Address 2:	Suite 541
City, State:	Duluth, MN	City, State:	Duluth, MN
Zip/Post Code:	55802	Zip/Post Code:	55802
Country:	USA	Country:	USA
Contact Name:	Chuck Deye	Attn:	Scott Carney
Phone:	2186252332	Phone:	2186252332
Fax:	2186252201	Fax:	2186252201
Email:	cdeye@emr-inc.com	Email:	cdeye@emr-inc.com
EMSL Rep:		P.O. Number:	7124.001
Project Name/Number: Duluth IAP Asbestos 7124.001			

MATRIX			TURNAROUND			
<input type="checkbox"/> Air	<input type="checkbox"/> Soil	<input type="checkbox"/> Micro-Vac	<input type="checkbox"/> 3 Hours	<input type="checkbox"/> 6 Hours	<input type="checkbox"/> Same Day or 12 Hours*	<input type="checkbox"/> 24 Hours (1 day)
<input checked="" type="checkbox"/> Bulk	<input type="checkbox"/> Drinking Water		<input type="checkbox"/> 48 Hours (2 days)	<input type="checkbox"/> 72 Hours (3 days)	<input type="checkbox"/> 96 Hours (4 days)	<input checked="" type="checkbox"/> 120 Hours (5 days)
<input type="checkbox"/> Wipe	<input type="checkbox"/> Wastewater		<input type="checkbox"/> 144+ hours (6-10 days)			

TEM Air, 3 hours, 6 hours, Please call ahead to schedule. There is a premium charge for 3-hour lab, please call 1-800-220-3675 for price prior to sending samples. You will be asked to sign an authorization form for this service.

\*12 hours (must arrive by 11:00a.m. Mon-Fri.). Please Refer to Price Quote

<b>PCM - Air</b> <input type="checkbox"/> NIOSH 7400(A) Issue 2: August 1994 <input type="checkbox"/> OSHA w/TWA <input type="checkbox"/> Other:	<b>TEM Air</b> <input type="checkbox"/> AHERA 40 CFR, Part 763 Subpart E <input type="checkbox"/> NIOSH 7402 <input type="checkbox"/> EPA Level II	<b>TEM WATER</b> <input type="checkbox"/> EPA 100.1 <input type="checkbox"/> EPA 100.2 <input type="checkbox"/> NYS 198.2
<b>PLM - Bulk</b> <input checked="" type="checkbox"/> EPA 600/R-93/116 <input type="checkbox"/> EPA Point Count <input type="checkbox"/> NY Stratified Point Count <input type="checkbox"/> PLM NOB (Gravimetric) NYS 198.1 <input type="checkbox"/> NIOSH 9002: <input type="checkbox"/> EMSL Standard Addition:	<b>TEM BULK</b> <input type="checkbox"/> Drop Mount (Qualitative) <input type="checkbox"/> Chatfield SOP - 1988-02 <input type="checkbox"/> TEM NOB (Gravimetric) NYS 198.4 <input type="checkbox"/> EMSL Standard Addition:	<b>TEM Microvac/Wipe</b> <input type="checkbox"/> ASTM D 5755-95 (quantitative method) <input type="checkbox"/> Wipe Qualitative
<b>SEM Air or Bulk</b> <input type="checkbox"/> Qualitative <input type="checkbox"/> Quantitative	<b>PLM Soil</b> <input type="checkbox"/> EPA Protocol Qualitative <input type="checkbox"/> EPA Protocol Quantitative <input type="checkbox"/> EMSL MSD 9000 Method (fibers/grain)	<b>XRD</b> <input type="checkbox"/> Asbestos <input type="checkbox"/> Silica: NIOSH 7500  <b>OTHER</b> <input type="checkbox"/>

5305



# Chain of Custody

## Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Page 1 of 2

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) DIAP-B-001 to DIAP-B-015 + DIAP-B-014 to DIAP-B-033 Total Samples #: \_\_\_\_\_

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Received: K. Beem Date: 11/2/05 Time: 9:15

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-B-001	Mechanical Room F.T. 12x12 white	100 square feet
DIAP-B-002	Mechanical Room 4-inch hard fitting	
DIAP-B-003	Mechanical Room 3-inch hard fitting	
DIAP-B-004	Mechanical Room brown vinyl baseboard	
DIAP-B-005	Mechanical Room C.T. white	
DIAP-B-014	Brick Room F.T.	
DIAP-B-015	Brick Room vinyl baseboard	
DIAP-B-016	Brick Room drywall	
DIAP-B-017	Brick Room 2x4 C.T.	
DIAP-B-018	Brick Room hallway 2x2 C.T.	
DIAP-B-019	Maint. Office vinyl baseboard	
DIAP-B-020	Brick Room water main inlet hard fitting	1 fitting
DIAP-B-021	Brick Room Bathroom 4-inch fitting	
DIAP-B-022	East Garage 4-inch fitting	

5305



## Chain of Custody

## Asbestos Lab Services

Page 2 of 2

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) DIAP-B-023 - DIAP-B-033

Total Samples #: \_\_\_\_\_

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-B-023	East Garage 6-inch fitting	
DIAP-B-024	East Garage 6-inch fitting	
DIAP-B-025	East Garage Fireproofing	
DIAP-B-026	East Garage Fireproofing	
DIAP-B-027	East Garage Fireproofing	
DIAP-B-028	West Garage 4-inch fitting	
DIAP-B-029	West Garage 4-inch fitting	
DIAP-B-030	West Garage 6-inch fitting	
DIAP-B-031	West Garage 6-inch fitting	
DIAP-B-032	West Garage Fireproofing	
DIAP-B-033	West Garage Fireproofing	

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: minneapolislab@emsl.com

**EMSL**

Attn: **Chuck Deye**  
**EMR Inc, (Environmental Management Resources, Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO: 7124.001  
Received: 11/21/05 9:15 AM  
EMSL Order: 350505292

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: Duluth IAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 11/21/2005  
Report Date: 11/22/2005

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-006 350505292-0001	Hard Fittings 4-inch pipe Boiler Room 50 fittings	Gray Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-007 350505292-0002	Hard Fittings 4-inch pipe Boiler Room 50 fittings	Gray Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-008 350505292-0003	Hard Fitting Out-of-Service Boiler 3 fittings	Tan Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-009 350505292-0004	Hard Fitting 6-inch pipe Boiler Room 3 fittings	White Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-010 350505292-0005	Hard Fitting 6-inch pipe Boiler Room 3 fittings	White Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected
DIAP-B-011 350505292-0006	Hot Water Heat Converter #2 Boiler Room 10 square	White Fibrous Heterogeneous	15% Synthetic 5% Glass	80% Non-fibrous (other)	None Detected
DIAP-B-012 350505292-0007	Boiler Exhaust - Boiler Room 20 feet - 24inch diam	Tan Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected

Analyst(s)  
Erin Wittman (8)

Rachel J.

or other approved signatory

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S31

Attn: **Chuck Deye**  
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**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO: 7124.001  
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Project: Duluth IAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 11/21/2005  
Report Date: 11/22/2005

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	<u>Non-Asbestos</u>		<u>Asbestos</u>
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-013 350505292-0008	Out-of-Service Boiler - Boiler Room 20 feet-24 inc	Gray Fibrous Heterogeneous	65% Min. Wool	35% Non-fibrous (other)	None Detected

Analyst(s)

Erin Wittman (8)



or other approved signatory

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Analysis performed by EMSL Minneapolis (NVLAP #200019-0)





# Chain of Custody

## Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922

Fax: (763) 449-4924

<http://www.emsl.com>

Please print all information legibly.

<b>Company:</b> EMR Incorporated	<b>Bill To:</b> EMR Inc
<b>Address1:</b> 11 E. Superior Street	<b>Address1:</b> 11 E. Superior Street
<b>Address2:</b> Suite 541	<b>Address2:</b> Suite 541
<b>City, State:</b> Duluth, MN	<b>City, State:</b> Duluth, MN
<b>Zip/Post Code:</b> 55802	<b>Zip/Post Code:</b> 55802
<b>Country:</b> USA	<b>Country:</b> USA
<b>Contact Name:</b> Chuck Deye	<b>Attn:</b> Scott Carney
<b>Phone:</b> 2186252332	<b>Phone:</b> 2186252332
<b>Fax:</b> 2186252201	<b>Fax:</b> 2186252201
<b>Email:</b> cdeye@emr-inc.com	<b>Email:</b> cdeye@emr-inc.com
<b>EMSL Rep:</b>	<b>P.O. Number:</b> 7124.001
<b>Project Name/Number:</b> Duluth IAP Asbestos 7124.001	

MATRIX			TURNAROUND			
<input type="checkbox"/> Air	<input type="checkbox"/> Soil	<input type="checkbox"/> Micro-Vac	<input type="checkbox"/> 3 Hours	<input type="checkbox"/> 6 Hours	<input type="checkbox"/> Same Day or 12 Hours*	<input checked="" type="checkbox"/> 24 Hours (1 day)
<input checked="" type="checkbox"/> Bulk	<input type="checkbox"/> Drinking Water		<input type="checkbox"/> 48 Hours (2 days)	<input type="checkbox"/> 72 Hours (3 days)	<input type="checkbox"/> 96 Hours (4 days)	<input type="checkbox"/> 120 Hours (5 days)
<input type="checkbox"/> Wipe	<input type="checkbox"/> Wastewater		<input type="checkbox"/> 144+ hours (6-10 days)			

TEM AIR, 3 hours, 6 hours, Please call ahead to schedule. There is a premium charge for 3-hour tat, please call 1-800-220-3675 for price prior to sending samples. You will be asked to sign an authorization form for this service.

\*12 hours (must arrive by 11:00a.m. Mon -Fri.), Please Refer to Price Quote

<b>PCM - Air</b> <input type="checkbox"/> NIOSH 7400(A) Issue 2: August 1994 <input type="checkbox"/> OSHA w/TWA <input type="checkbox"/> Other:	<b>TEM Air</b> <input type="checkbox"/> AHERA 40 CFR, Part 763 Subpart E <input type="checkbox"/> NIOSH 7402 <input type="checkbox"/> EPA Level II	<b>TEM WATER</b> <input type="checkbox"/> EPA 100.1 <input type="checkbox"/> EPA 100.2 <input type="checkbox"/> NYS 198.2
<b>PLM - Bulk</b> <input checked="" type="checkbox"/> EPA 600/R-93/116 <input type="checkbox"/> EPA Point Count <input type="checkbox"/> NY Stratified Point Count <input type="checkbox"/> PLM NOB (Gravimetric) NYS 198.1 <input type="checkbox"/> NIOSH 9002: <input type="checkbox"/> EMSL Standard Addition:	<b>TEM BULK</b> <input type="checkbox"/> Drop Mount (Qualitative) <input type="checkbox"/> Chatfield SOP - 1988-02 <input type="checkbox"/> TEM NOB (Gravimetric) NYS 198.4 <input type="checkbox"/> EMSL Standard Addition:	<b>TEM Microvac/Wipe</b> <input type="checkbox"/> ASTM D 5755-95 (quantative method) <input type="checkbox"/> Wipe Qualitative
<b>SEM Air or Bulk</b> <input type="checkbox"/> Qualitative <input type="checkbox"/> Quantitative	<b>PLM Soil</b> <input type="checkbox"/> EPA Protocol Qualitative <input type="checkbox"/> EPA Protocol Quantitative <input type="checkbox"/> EMSL MSD 9000 Method fibers/gram	<b>XRD</b> <input type="checkbox"/> Asbestos <input type="checkbox"/> Silica NIOSH 7500  <b>OTHER</b> <input type="checkbox"/>

# 24-HOUR TURNAROUND



## Chain of Custody

### Asbestos Lab Services

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350805292

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<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) DIAP-B-006 - DIAP-B-013

Relinquished: Chuck Page Date: 11/18/05

Received: K. Beam Date: 11/21/05

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Total Samples #: 8

Time: 1200

Time: 9:15

Time: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-B-006	Hard Fittings 4-inch pipe Boiler Room	50 fittings
DIAP-B-007	Hard Fittings 4-inch pipe Boiler Room	50 fittings
DIAP-B-008	Hard Fitting Out-of-service Boiler	3 fittings
DIAP-B-009	Hard Fitting 6-inch pipe Boiler Room	3 fittings
DIAP-B-010	Hard Fitting 6-inch pipe Boiler Room	3 fittings
DIAP-B-011	Hot Water Heat Converter #2 Boiler Room	10 square feet
DIAP-B-012	Boiler Exhaust - Boiler Room	20 feet - 24 inch diameter
DIAP-B-013	Out-of-service Boiler - Boiler Room	20 feet - 24 inch diameter



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Attn: **Chuck Deye**  
**EMR Inc, (Envir Mgt Res., Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO: 7124.00  
Received: 12/06/05 9:30 AM  
EMSL Order: 350505472

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: 7124.001

EMSL Proj:  
Analysis Date: 12/12/2005  
Report Date: 12/12/2005

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos			Asbestos
			%	Fibrous	% Non-Fibrous	% Type
DIAP-B-034 350505472-0001	Telephone Room 2x4 C.T.	White/Beige Fibrous Heterogeneous	40%	Min. Wool Cellulose	10% Perlite 10% Non-fibrous (other)	None Detected
DIAP-B-035 INSULATION 3505472-0002	Loading Ramp 4- Inch hard fitting	Beige Fibrous Layers: 2	35%	Min. Wool Cellulose	55% Non-fibrous (other)	None Detected
DIAP-B-035 WRAP 350505472-0068	Loading Ramp 4- Inch hard fitting	Cream Fibrous Layers: 2	50%	Synthetic		50% Chrysotile
DIAP-1-036 350505472-0003	White ribbed 2x2 C.T. West Ramp	White/Beige Fibrous Heterogeneous	30%	Min. Wool Cellulose	10% Perlite 10% Non-fibrous (other)	None Detected
DIAP-1-037 BASEBOARD 350505472-0004	Brown Vinyl Baseboard West Ramp	Brown Non-Fibrous Layers: 2			100% Non-fibrous (other)	None Detected
DIAP-1-037 MASTIC 350505472-0069	Brown Vinyl Baseboard West Ramp	Cream Non-Fibrous Layers: 2			100% Non-fibrous (other)	None Detected
DIAP-1-038 VINYL 350505472-0005	White/Gray Linoleum Cust. Clear Bath	White Non-Fibrous Layers: 2			100% Non-fibrous (other)	None Detected

Analyst(s)

Erin Wittman (46)

Lynn Scott (20)

Rachel Travis (35)



or other approved signatory

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Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-038 MASTIC 350505472-0070	White/Gray Linoleum Cust. Clear Bath	Clear Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-039 BASEBOARD 350505472-0006	Tan Vinyl Baseboard cust. Clear Bath	Tan Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-039 MASTIC 350505472-0071	Tan Vinyl Baseboard cust. Clear Bath	Tan Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-040 350505472-0007	Speckled/Wormy 2x4 C.T.	Beige/White Fibrous Heterogeneous	40% Min. Wool 40% Cellulose	10% Perlite 10% Non-fibrous (other)	None Detected
DIAP-1-041 BASEBOARD 350505472-0008	Red Vinyl Baseboard	Red Non-Fibrous Layers: 3		100% Non-fibrous (other)	None Detected
DIAP-1-041 TAN MASTIC 350505472-0072	Red Vinyl Baseboard	Tan Non-Fibrous Layers: 3		100% Non-fibrous (other)	None Detected

Analyst(s)

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511

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Sample	Location	Appearance	<u>Non-Asbestos</u>		<u>Asbestos</u>
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-041 BROWN MASTIC 350505472-0073	Red Vinyl Baseboard	Brown Non-Fibrous Layers: 3		100% Non-fibrous (other)	None Detected
DIAP-1-042 COMPOSITE 3505472-0009	Drywall Customs Cleaning Area	White/Brown Fibrous Layers: 2	10% Cellulose	90% Non-fibrous (other)	None Detected
DIAP-1-043 INSULATION 350505472-0010	3-inch Hard Fitting	Gray Fibrous Heterogeneous	35% Min. Wool 10% Cellulose	55% Non-fibrous (other)	None Detected
DIAP-1-043 WRAP 350505472-0074	3-inch Hard Fitting	Cream Fibrous Layers: 2	100% Cellulose		None Detected
DIAP-1-044 BASEBOARD 350505472-0011	Brown Vinyl Baseboard	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-044 MASTIC 350505472-0075	Brown Vinyl Baseboard	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-045 350505472-0012	3-inch Hard Fitting Search Room 1	Gray Fibrous Heterogeneous	35% Min. Wool 5% Cellulose	60% Non-fibrous (other)	None Detected

Analyst(s)

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Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-046 350505472-0013	Mastic and Underlayment 171	Tan/White Fibrous Heterogeneous	25% Synthetic	75% Non-fibrous (other)	None Detected
DIAP-1-047 BASEBOARD 350505472-0014	Gray Vinyl Baseboard 171	Gray Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-047 MASTIC 350505472-0076	Gray Vinyl Baseboard 171	Gray Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-048 350505472-0015	Drywall 171	Brown/White Fibrous Heterogeneous	5% Glass 10% Cellulose	85% Non-fibrous (other)	None Detected
DIAP-1-049 350505472-0016	Fireproofing Spray-on White	White Fibrous Heterogeneous	25% Cellulose	75% Non-fibrous (other)	None Detected
DIAP-1-050 FLOOR TILE 350505472-0017	12x12 Vinyl F.T. with black mastic	White Non-Fibrous Layers: 2		97% Non-fibrous (other)	3% Chrysotile
DIAP-1-050 MASTIC 350505472-0077	12x12 Vinyl F.T. with black mastic	Black Non-Fibrous Layers: 2		90% Non-fibrous (other)	10% Chrysotile

Analyst(s)

Erin Wittman (48)

Lvnn Scott (20)

Rachel Travis (35)



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Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-051 BASEBOARD 350505472-0018	Brown Vinyl Baseboard with Tan Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-051 MASTIC 3505472-0078	Brown Vinyl Baseboard with Tan Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-052 INSULATION 350505472-0019	3-inch Hard Fitting	Cream Fibrous Layers: 2	35% Min. Wool 10% Cellulose	55% Non-fibrous (other)	<1% Chrysotile
DIAP-1-052-WRAP 350505472-0079	3-inch Hard Fitting	White Fibrous Layers: 2	50% Synthetic		50% Chrysotile
DIAP-1-053 WHITE LAYER 350505472-0020	White Wall Plaster	White Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-053 GRAY LAYER 350505472-0080	White Wall Plaster	Gray Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-054 350505472-0021	N. Cntry. Hall Ceiling Tile	Beige/White Fibrous Heterogeneous	50% Min. Wool 30% Cellulose	10% Perlite 10% Non-fibrous (other)	None Detected

Analyst(s)

Erin Wittman (46)

Ivonn Scott (20)

Rachel Travis (35)



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### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-055 350505472-0022	N. Cntry Bath Ceiling Tile	Beige/White Fibrous Heterogeneous	85% Min. Wool	12% Non-fibrous (other)	3% Chrysotile
DIAP-1-056 BASEBOARD 350505472-0023	Brown Vinyl Baseboard with Brown Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-056 MASTIC 350505472-0081	Brown Vinyl Baseboard with Brown Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-058 350505472-0024	Fireproofing spray- on white	Beige Fibrous Heterogeneous	35% Cellulose	50% Non-fibrous (other) 15% Mica	None Detected
DIAP-1-058 INSULATION 350505472-0025	3-inch Hard Fitting Weather One	Beige Fibrous Layers: 2	35% Min. Wool	65% Non-fibrous (other)	None Detected
DIAP-1-058 WRAP 350505472-0082	3-inch Hard Fitting Weather One	Beige Fibrous Layers: 2	50% Synthetic	<1% Non-fibrous (other)	50% Chrysotile
DIAP-1-059 BASEBOARD 350505472-0026	Black Vinyl Baseboard with Brown Mastic	Black Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected

Analyst(s)

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Lynn Scott (28)

Rachel Travis (35)



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Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-059 MASTIC 350505472-0083	Black Vinyl Baseboard with Brown Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-060 3505472-0027	2x2 Ceiling Tile	White/Beige Fibrous Heterogeneous	40% Min. Wool 40% Cellulose	10% Perlite 10% Non-fibrous (other)	None Detected
DIAP-1-061 350505472-0028	Gray Vinyl Stair Tread Wrap	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
DIAP-1-062 350505472-0029	Wall Plaster	White Non-Fibrous Heterogeneous	<1% Cellulose	100% Non-fibrous (other)	None Detected
DIAP-1-063 350505472-0030	3-inch Hard Fitting Tug Tunnel	Beige Fibrous Heterogeneous	35% Min. Wool <1% Cellulose	65% Non-fibrous (other)	<1% Chrysotile
DIAP-1-064 FLOOR TILE 350505472-0031	12x12 Floor Tile	White Non-Fibrous Layers: 2		95% Non-fibrous (other)	5% Chrysotile
DIAP-1-064 MASTIC 350505472-0084	12x12 Floor Tile	Black Non-Fibrous Layers: 2		90% Non-fibrous (other)	10% Chrysotile

Analyst(s)

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Lynn Scott (20)

Rachel Travis (35)

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Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-065 350505472-0032	Speckled/Wormy 2x4 Ceiling Tile	Tan/White Fibrous Heterogeneous	30% Min. Wool 40% Cellulose	10% Perlite 20% Non-fibrous (other)	None Detected
DIAP-1-066 BASEBOARD 350505472-0033	Brown Vinyl Baseboard with Tan Mastic	Black Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-066 MASTIC 350505472-0085	Brown Vinyl Baseboard with Tan Mastic	Tan Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-067 WHITE LAYER 350505472-0034	Plaster 116	White Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-1-067 TAN LAYER 350505472-0086	Plaster 116	Tan Non-Fibrous Layers: 2	<1% Cellulose	100% Non-fibrous (other)	None Detected
DIAP-1-068 INSULATION 350505472-0035	4-inch Hard Fitting Cargo 104	Tan Fibrous Layers: 2	25% Cellulose	75% Non-fibrous (other)	<1% Chrysotile
DIAP-1-068 WRAP 350505472-0087	4-inch Hard Fitting Cargo 104	Tan Fibrous Layers: 2	40% Synthetic <1% Min. Wool	15% Non-fibrous (other)	45% Chrysotile

Analyst(s)

Erin Wittman (46)

Iynn Scott (20)

Rachel Travis (35)

or other approved signatory

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Analysis performed by EMSL Minneapolis (NVLAP #200019-0)



**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: minneapolislab@emsl.com

**EMSL**

Attn: **Chuck Deye**  
**EMR Inc, (Envir Mgt Res., Inc)**  
**11 E. Superior St.**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO: 7124.00  
Received: 12/06/05 9:30 AM  
EMSL Order: 350505472

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: 7124.001

EMSL Proj:  
Analysis Date: 12/12/2005  
Report Date: 12/12/2005

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-2-069 BASEBOARD 350505472-0036	Brown Vinyl Baseboard with Tan Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-2-069 MASTIC 350505472-0088	Brown Vinyl Baseboard with Tan Mastic	Cream Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-2-070 350505472-0037	Drywall and Mud- Skyline Lounge	Tan/White Fibrous Layers: 2	<1% Glass 10% Cellulose	90% Non-fibrous (other) <1% Mica	None Detected
DIAP-2-071 FLOOR TILE 350505472-0038	12x12 Vinyl Floor Tile with Tan Mastic	White Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-2-071 MASTIC 350505472-0089	12x12 Vinyl Floor Tile with Tan Mastic	Yellow Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-2-072 350505472-0039	Drywall - West Gate Lobby	Tan/White Fibrous Layers: 2	<1% Glass 10% Cellulose	90% Non-fibrous (other)	None Detected
DIAP-2-073 WHITE LAYER 350505472-0040	Wall Plaster - Observation Lounge	White Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected

Analyst(s)

*Erin Wittman*  
Erin Wittman (46)  
Lvnn Scott (20)

*Rachel Travis*  
Rachel Travis (35)

or other approved signatory

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Customer ID: EMRI50  
Customer PO: 7124.00  
Received: 12/06/05 9:30 AM  
EMSL Order: 350505472

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: 7124.001

EMSL Proj:  
Analysis Date: 12/12/2005  
Report Date: 12/12/2005

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-2-073 TAN LAYER 350505472-0090	Wall Plaster - Observation Lounge	Tan Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-2-074 FLOOR TILE 350505472-0041	12x12 White Vinyl Floor Tile	White Non-Fibrous Layers: 2		96% Non-fibrous (other)	4% Chrysotile
DIAP-2-074 MASTIC 350505472-0091	12x12 White Vinyl Floor Tile	Black Non-Fibrous Layers: 2		90% Non-fibrous (other)	10% Chrysotile
DIAP-2-075 350505472-0042	3-inch Hard Fitting	Tan Fibrous Heterogeneous	25% Min. Wood <1% Cellulose	75% Non-fibrous (other)	None Detected
DIAP-2-076 WHITE LAYER 350505472-0043	Wall Plaster - Janitor Closet	White Non-Fibrous Layers: 2	<1% Fibrous (other)	100% Non-fibrous (other)	None Detected
DIAP-2-076 GRAY LAYER 350505472-0092	Wall Plaster - Janitor Closet	Gray Non-Fibrous Layers: 2	<1% Cellulose	100% Non-fibrous (other)	None Detected

Analyst(s)

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Rachel Travis (35)



or other approved signatory

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Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

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**Duluth, MN 55802**

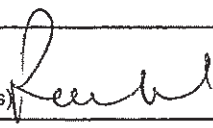
Customer ID: EMRI60  
Customer PO: 7124.00  
Received: 12/06/05 9:30 AM  
EMSL Order: 350505472

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: 7124.001

EMSL Proj:  
Analysis Date: 12/12/2005  
Report Date: 12/12/2005

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-2-077 BASEBOARD 350505472-0044	Black Vinyl Baseboard with Brown Mastic	Black Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-2-077 MASTIC 350505472-0093	Black Vinyl Baseboard with Brown Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-2-078 FLOOR TILE 350505472-0045	12x12 Vinyl Floor Tile Bar Closet 1	White Non-Fibrous Layers: 3		100% Non-fibrous (other)	None Detected
DIAP-2-078 BROWN MASTIC 350505472-0094	12x12 Vinyl Floor Tile Bar Closet 1	Brown Non-Fibrous Layers: 3		97% Non-fibrous (other)	3% Chrysotile
DIAP-2-078 YELLOW MASTIC 350505472-0095	12x12 Vinyl Floor Tile Bar Closet 1	Yellow Non-Fibrous Layers: 3		100% Non-fibrous (other)	None Detected
DIAP-2-079 350505472-0046	Fireproofing Bar Closet 1	Tan Fibrous Homogeneous	10% Cellulose	65% Non-fibrous (other) 25% Mica	None Detected
DIAP-2-080 350505472-0047	12x12 Ceiling Tile Bar	Gray/Tan Fibrous Heterogeneous	80% Min. Wool	20% Non-fibrous (other)	None Detected

Analyst(s)   
Erin Wittman (46)  
Lynn Scott (20)

  
Rachel Travis (35)

  
or other approved signatory

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Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

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Customer PO: 7124.00  
Received: 12/06/05 9:30 AM  
EMSL Order: 350505472

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: 7124.001

EMSL Proj:  
Analysis Date: 12/12/2005  
Report Date: 12/12/2005

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-2-081 350505472-0048	2x4 Ceiling Tile Kitchen	Tan/White Fibrous Heterogeneous	<1% Glass 10% Cellulose	90% Non-fibrous (other)	None Detected
DIAP-3-082 350505472-0049	6-inch Hard Fitting	Tan Fibrous Homogeneous	20% Min. Wool	80% Non-fibrous (other)	None Detected
DIAP-3-083 350505472-0050	6-inch Hard Fitting	Tan Fibrous Homogeneous	20% Min. Wool	80% Non-fibrous (other)	None Detected
DIAP-3-084 350505472-0051	4-inch Hard Fitting	Tan Fibrous Homogeneous	2% Synthetic 15% Min. Wool	80% Non-fibrous (other)	3% Chrysotile
DIAP-3-085 350505472-0052	4-inch Hard Fitting	Tan Fibrous Homogeneous	2% Synthetic 15% Min. Wool	80% Non-fibrous (other)	3% Chrysotile
DIAP-3-086 350505472-0053	Wall Plaster West HVAC	White Non-Fibrous Heterogeneous		100% Non-fibrous (other)	None Detected
DIAP-3-087 350505472-0054	2x4 Ceiling Tile	Tan Fibrous Heterogeneous	77% Min. Wool 5% Cellulose	15% Non-fibrous (other)	3% Chrysotile

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Received: 12/06/05 9:30 AM  
EMSL Order: 350505472

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Project: 7124.001

EMSL Proj:  
Analysis Date: 12/12/2005  
Report Date: 12/12/2005

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	<u>Non-Asbestos</u>		<u>Asbestos</u>
			% Fibrous	% Non-Fibrous	% Type
DIAP-3-088 FLOOR TILE 350505472-0055	12x12 White Vinyl Floor Tile	Beige Non-Fibrous Layers: 2		95% Non-fibrous (other)	5% Chrysotile
DIAP-3-088 MASTIC 3505472-0096	12x12 White Vinyl Floor Tile	Black Non-Fibrous Layers: 2		90% Non-fibrous (other)	10% Chrysotile
DIAP-3-089 BASEBOARD 350505472-0056	Brown Vinyl Baseboard with Tan Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-3-089 MASTIC 350505472-0097	Brown Vinyl Baseboard with Tan Mastic	Tan Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-3-090 BASEBOARD 350505472-0057	Brown vinyl Baseboard with Tan Mastic	Brown Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected
DIAP-3-090 MASTIC 350505472-0098	Brown vinyl Baseboard with Tan Mastic	Yellow Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected

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511

Attn: **Chuck Deye**  
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**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO: 7124.00  
Received: 12/06/05 9:30 AM  
EMSL Order: 350505472

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: 7124.001

EMSL Proj:  
Analysis Date: 12/12/2005  
Report Date: 12/12/2005

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-3-091 350505472-0058	Ribbed/Speckled 3x4 Ceiling Tile	Tan/White Fibrous Heterogeneous	40% Glass 40% Cellulose	10% Perlite 10% Non-fibrous (other)	None Detected
DIAP-3-092 350505472-0059	6-inch Hard Fitting	Tan Fibrous Homogeneous	2% Synthetic 15% Min. Wool	80% Non-fibrous (other)	3% Chrysotile
DIAP-3-093 350505472-0060	6-inch Hard Fitting	Tan Fibrous Homogeneous	<1% Synthetic 15% Min. Wool	82% Non-fibrous (other)	3% Chrysotile
DIAP-3-094 350505472-0061	4-Inch Hard Fitting	Tan Fibrous Homogeneous	2% Synthetic 15% Min. Wool	80% Non-fibrous (other)	3% Chrysotile
DIAP-3-095 350505472-0062	4-inch Hard Fitting	Tan Fibrous Homogeneous	15% Min. Wool	85% Non-fibrous (other)	<1% Chrysotile
DIAP-3-096 WHITE LAYER 350505472-0063	Wall Plaster East HVAC	White Non-Fibrous Layers: 2	<1% Fibrous (other)	100% Non-fibrous (other)	None Detected
DIAP-3-096 GRAY LAYER 350505472-0099	Wall Plaster East HVAC	Gray Non-Fibrous Layers: 2		100% Non-fibrous (other)	None Detected

Analyst(s)

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Ivonn Scott (20)

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Customer ID: EMRI50  
 Customer PO: 7124.00  
 Received: 12/08/05 9:30 AM  
 EMSL Order: 350505472

Fax: (218) 625-2201 Phone: (218) 625-2332  
 Project: 7124.001

EMSL Proj:  
 Analysis Date: 12/12/05  
 Report Date: 12/13/05

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-3-097 350505472-0064	Fireproofing East HVAC	Tan Fibrous Homogeneous	15% Cellulose	60% Non-fibrous (other) 25% Mica	None Detected
DIAP-R-098 350505472-0065	Main Terminal 12x12 Ceiling Tile	Grayish Fibrous Homogeneous	80% Min. Wool	20% Non-fibrous (other)	None Detected
P-R-099 350505472-0066	Skyline Room 12x12 Ceiling Tile	Grayish/Tan Fibrous Heterogeneous	80% Min. Wool	20% Non-fibrous (other)	None Detected
DIAP-R-100 350505472-0067	Skyline Room 12x12 Ceiling Tile	Tan/White Fibrous Heterogeneous	<1% Glass 10% Cellulose	90% Non-fibrous (other)	None Detected
DIAP-R-100 WHITE LAYER 350505472-0100	Roof Membrane	White Fibrous Layers: 2	15% Synthetic Not listed on COC.	85% Non-fibrous (other)	None Detected
DIAP-R-100 TAN LAYER 350505472-0101	Roof Membrane	Tan Fibrous Layers: 2	15% Synthetic Not listed on COC.	85% Non-fibrous (other)	None Detected

Report amended 12/13/05 to switch descriptions on samples #57 & #58.

Analyst(s)

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Rachel Travis (35)

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 Analysis performed by EMSL Minneapolis (NVLAP #200019-0)



# Chain of Custody

## Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

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Fax: (763) 449-4924

<http://www.emsl.com>

Please print all information legibly.

<b>Company:</b>	Environmental Management Resources Inc. (EMR)	<b>Bill To:</b>	Environmental Management Resources Inc. (EMR)
<b>Address1:</b>	11 E. Superior St.	<b>Address1:</b>	11 E. Superior St.
<b>Address2:</b>	Suite 541	<b>Address2:</b>	Suite 541
<b>City, State:</b>	Duluth, MN	<b>City, State:</b>	Duluth, MN
<b>Zip/Post Code:</b>	55802	<b>Zip/Post Code:</b>	55802
<b>Country:</b>	USA	<b>Country:</b>	USA
<b>Contact Name:</b>	Chuck Deye	<b>Attn:</b>	Chuck Deye
<b>Phone:</b>	218-625-2332	<b>Phone:</b>	218-625-2332
<b>Fax:</b>	218-625-2201	<b>Fax:</b>	218-625-2201
<b>Email:</b>	cdeye@emr-inc.com	<b>Email:</b>	cdeye@emr-inc.com
<b>EMSL Rep:</b>		<b>P.O. Number:</b>	7124.001
<b>Project Name/Number:</b> 7124.001			

MATRIX			TURNAROUND			
<input type="checkbox"/> Air	<input type="checkbox"/> Soil	<input type="checkbox"/> Micro-Vac	<input type="checkbox"/> 3 Hours	<input type="checkbox"/> 6 Hours	<input type="checkbox"/> Same Day or 12 Hours*	<input type="checkbox"/> 24 Hours (1 day)
<input checked="" type="checkbox"/> Bulk	<input type="checkbox"/> Drinking Water		<input type="checkbox"/> 48 Hours (2 days)	<input type="checkbox"/> 72 Hours (3 days)	<input type="checkbox"/> 96 Hours (4 days)	<input checked="" type="checkbox"/> 120 Hours (5 days)
<input type="checkbox"/> Wipe	<input type="checkbox"/> Wastewater		<input type="checkbox"/> 144+ hours (6-10 days)			

TEM AIR, 3 hours, 6 hours, Please call ahead to schedule. There is a premium charge for 3-hour tat, please call 1-800-220-3675 for price prior to sending samples. You will be asked to sign an authorization form for this service.

\*12 hours (must arrive by 11:00a.m. Mon -Fri.), Please Refer to Price Quote

<b>PCM - Air</b> <input type="checkbox"/> NIOSH 7400(A) Issue 2: August 1994 <input type="checkbox"/> OSHA w/TWA <input type="checkbox"/> Other:	<b>TEM Air</b> <input type="checkbox"/> AHERA 40 CFR, Part 763 Subpart E <input type="checkbox"/> NIOSH 7402 <input type="checkbox"/> EPA Level II	<b>TEM WATER</b> <input type="checkbox"/> EPA 100.1 <input type="checkbox"/> EPA 100.2 <input type="checkbox"/> NYS 198.2
<b>PLM - Bulk</b> <input checked="" type="checkbox"/> EPA 600/R-93/116 <input type="checkbox"/> EPA Point Count <input type="checkbox"/> NY Stratified Point Count <input type="checkbox"/> PLM NOB (Gravimetric) NYS 198.1 <input type="checkbox"/> NIOSH 9002: <input type="checkbox"/> EMSL Standard Addition:	<b>TEM BULK</b> <input type="checkbox"/> Drop Mount (Qualitative) <input type="checkbox"/> Chatfield SOP - 1988-02 <input type="checkbox"/> TEM NOB (Gravimetric) NYS 198.4 <input type="checkbox"/> EMSL Standard Addition:	<b>TEM Microvac/Wipe</b> <input type="checkbox"/> ASTM D 5755-95 (quantative method) <input type="checkbox"/> Wipe Qualitative
<b>SEM Air or Bulk</b> <input type="checkbox"/> Qualitative <input type="checkbox"/> Quantitative	<b>PLM Soil</b> <input type="checkbox"/> EPA Protocol Qualitative <input type="checkbox"/> EPA Protocol Quantitative <input type="checkbox"/> EMSL MSD 9000 Method fibers/gram	<b>XRD</b> <input type="checkbox"/> Asbestos <input type="checkbox"/> Silica NIOSH 7500  <b>OTHER</b> <input type="checkbox"/>





# Chain of Custody

## Asbestos Lab Services

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Phone: (763) 449-4922  
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Please print all information legibly.

Client Sample # (s) 048 - 061

Total Samples #: 14

Relinquished: Chadley Date: 12/2/05

Time: 1600 hrs

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-1-048	Drywall 171	
DIAP-1-049	Fireproofing Spray-on White	
DIAP-1-050	12x12 Vinyl F.T. with black mastic	
DIAP-1-051	Brown Vinyl Baseboard with Tan Mastic	
DIAP-1-052	3-inch Hard Fitting	
DIAP-1-053	White Wall Plaster	
DIAP-1-054	N. Entry. Hall Ceiling Tile	
DIAP-1-055	N. Entry Bath Ceiling Tile	
DIAP-1-056	Brown Vinyl Baseboard with Brown Mastic	
DIAP-1-057	3-inch Hard Fitting Weather One	Switch descriptions per Chadley 12/13/05
DIAP-1-058	Fireproofing spray-on white	
DIAP-1-059	Black Vinyl Baseboard with Brown Mastic	
DIAP-1-060	2x2 Ceiling Tile	
DIAP-1-061	Gray Vinyl Stair Tread Wrap	

5472



# Chain of Custody

## Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) 062 - 075

Total Samples #: 14

Relinquished: Ch. H. Hays Date: 12/2/05

Time: 1600 hrs

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-1-062	Wall Plaster	
DIAP-1-063	3-inch Hard Fitting Tug Tunnel	
DIAP-1-064	12x12 Floor Tile	
DIAP-1-065	Speckled / Wormy 2x4 Ceiling Tile	
DIAP-1-066	Brown Vinyl Baseboard with Tan Mastic	
DIAP-1-067	Plaster 116	
DIAP-1-068	4-inch Hard Fitting Cargo 104	
DIAP-2-069	Brown Vinyl Baseboard with Tan Mastic	
DIAP-2-070	Drywall and Mud - Skylight Lounge	
DIAP-2-071	12x12 Vinyl Floor Tile with Tan Mastic	
DIAP-2-072	Drywall - West Gate Lobby	
DIAP-2-073	Wall Plaster - Observation Lounge	
DIAP-2-074	12x12 White Vinyl Floor Tile	
DIAP-2-075	3-inch Hard Fitting	



**Chain of Custody**  
**Asbestos Lab Services**

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North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) 034 - 047

Total Samples #: 14

Relinquished: Chadley Date: 12/2/05

Time: 1600 hrs

Received: Beam FE Date: 12/5/05

Time: 9:30 am

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-B-034	Telephone Room 2x4 C.T	
DIAP-B-035	Loading Ramp 4-inch hard fittings	
DIAP-1-036	White ribbed 2x2 C.T. West Ramp	
DIAP-1-037	Brown Vinyl Baseboard West Ramp	
DIAP-1-038	White/Gray Linoleum Cust. Clear Bath	
DIAP-1-039	Tan Vinyl Baseboard Cust. Clear Bath	
DIAP-1-040	Speckled / Wormy 2x4 C.T.	
DIAP-1-041	Red Vinyl Baseboard	
DIAP-1-042	Drywall :: Customs Cleaning Area	
DIAP-1-043	3-inch Hard Fitting	
DIAP-1-044	Brown Vinyl Baseboard	
DIAP-1-045	3-inch Hard Fitting Search Room 1	
DIAP-1-046	Mastic and Underlayment 171	
DIAP-1-047	Gray Vinyl Baseboard 171	

5472



# Chain of Custody

## Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) 076 - 089

Total Samples #: 14

Relinquished: Chubb Date: 12/2/05

Time: 1600 hrs

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-2-076	Wall Plaster - Janitor Closet	
DIAP-2-077	Black Vinyl Baseboard with Brown Mastic	
DIAP-2-078	12x12 Vinyl Floor Tile Bar Closet 1	
DIAP-2-079	Fireproofing Bar Closet 1	
DIAP-2-080	12x12 Ceiling Tile Bar	
DIAP-2-081	2x4 Ceiling Tile Kitchen	
DIAP-3-082	6-inch Hard Fitting	
DIAP-3-083	6-inch Hard Fitting	
DIAP-3-084	4-inch Hard Fitting	
DIAP-3-085	4-inch Hard Fitting	
DIAP-3-086	Wall Plaster West HVAC	
DIAP-3-087	2x4 Ceiling Tile	
DIAP-3-088	12x12 White Vinyl Floor Tile	
DIAP-3-089	Brown Vinyl Baseboard with Tan Mastic	

5472



# Chain of Custody Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) 090 - 100

Total Samples #: 11

Relinquished: Chris Page Date: 12/2/05

Time: 1600 hrs

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-3-090	Brown vinyl Baseboard with Tan Mastic	
DIAP-3-091	Ribbed / Speckled 2x4 Ceiling Tile	
DIAP-3-092	6-inch Hard Fitting	
DIAP-3-093	6-inch Hard Fitting	
DIAP-3-094	4-inch Hard Fitting	
DIAP-3-095	4-inch Hard Fitting	
DIAP-3-096	Wall Plaster East HVAC	
DIAP-3-097	Fireproofing East HVAC	
DIAP-R-098	Main Terminal 12x12 Ceiling Tile	
DIAP-R-099	Skyline Room 12x12 Ceiling Tile	
DIAP-R-100	Skyline Room Ceiling Drywall	

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: [minneapolislab@emsl.com](mailto:minneapolislab@emsl.com)

Attn: **Chuck Deye**  
**EMR Inc, (Environmental Management Resources, Inc)**  
**11 East Superior Street**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMR150  
Customer PO:  
Received: 01/04/06 9:30 AM  
EMSL Order: 350600024

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: DIAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 1/9/2006  
Report Date: 1/9/2006

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-002 350600024-0001	4-inch pipe wrap	White Fibrous Homogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-B-006 350600024-0002	4-inch pipe wrap	White Fibrous Heterogeneous	15% Synthetic 5% Glass	20% Non-fibrous (other)	60% Chrysotile
DIAP-B-009 350600024-0003	6-inch pipe wrap	Tan Fibrous Heterogeneous	10% Synthetic 5% Glass	55% Non-fibrous (other)	30% Chrysotile
DIAP-B-011 350600024-0004	Converter #2 Wrap	Tan Fibrous Heterogeneous	20% Synthetic 5% Glass	35% Non-fibrous (other) 10% Mica	30% Chrysotile
DIAP-B-012 INSULATION 350600024-0005	In-Service Boiler Exhaust Wrap	Tan Fibrous Layers: 2	5% Wollastonite 5% Min. Wool 20% Cellulose	60% Non-fibrous (other) 10% Mica	None Detected
DIAP-B-012 WRAP 350600024-0025	In-Service Boiler Exhaust Wrap	White Fibrous Layers: 2	10% Glass	85% Non-fibrous (other)	5% Chrysotile
DIAP-B-013 INSULATION 350600024-0006	Out-of-service Boiler Exhaust Wrap	Tan Fibrous Layers: 2	5% Wollastonite 5% Min. Wool 20% Cellulose	60% Non-fibrous (other) 10% Mica	None Detected

Analyst(s)

Rachel Travis (29)



or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method variations. Interpretation and use of test results are the responsibility of the client.

Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: [minneapolislab@emsl.com](mailto:minneapolislab@emsl.com)

Attn: **Chuck Deye**  
**EMR Inc, (Environmental Management Resources, Inc)**  
**11 East Superior Street**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO:  
Received: 01/04/06 9:30 AM  
EMSL Order: 350600024

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: DIAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 1/9/2006  
Report Date: 1/9/2006

**Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy**

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-B-013 WRAP 350600024-0026	Out-of-service Boiler Exhaust Wrap	White Fibrous Layers: 2	10% Glass	85% Non-fibrous (other)	5% Chrysotile
DIAP-B-020 350600024-0007	6-inch Water Main Pipe Wrap	White Fibrous Homogeneous	5% Glass	25% Non-fibrous (other)	70% Chrysotile
DIAP-B-022 350600024-0008	4-inch pipe wrap	Tan Fibrous Homogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-B-023 350600024-0009	6-inch pipe wrap	White Fibrous Homogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-B-029 350600024-0010	4-inch pipe wrap	Tan Fibrous Homogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-B-030 INSULATION 350600024-0011	6-inch pipe wrap	Tan Fibrous Layers: 2	20% Glass	80% Non-fibrous (other)	None Detected
DIAP-B-030 WRAP 350600024-0027	6-inch pipe wrap	Tan Fibrous Layers: 2	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile

Analyst(s)

Rachel Travis (29)



or other approved signatory

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Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: [minneapolislab@emsl.com](mailto:minneapolislab@emsl.com)

Attn: **Chuck Deye**  
**EMR Inc, (Environmental Management Resources, Inc)**  
**11 East Superior Street**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO:  
Received: 01/04/06 9:30 AM  
EMSL Order: 350600024

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: DIAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 1/9/2006  
Report Date: 1/9/2006

**Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy**

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-045 350600024-0012	3-inch pipe wrap	Tan Fibrous Homogeneous	85% Cellulose	15% Non-fibrous (other)	None Detected
DIAP-1-063 350600024-0013	3-inch pipe wrap	White Fibrous Homogeneous	10% Glass	20% Non-fibrous (other)	70% Chrysotile
DIAP-2-075 350600024-0014	3-inch pipe wrap	Tan Fibrous Homogeneous	90% Cellulose	10% Non-fibrous (other)	None Detected
DIAP-3-082 350600024-0015	6-inch pipe wrap	White Fibrous Heterogeneous	10% Synthetic	10% Non-fibrous (other)	80% Chrysotile
DIAP-3-083 350600024-0016	6-inch pipe wrap	White Fibrous Heterogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-3-084 350600024-0017	4-inch pipe wrap	White Fibrous Heterogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-3-085 350600024-0018	4-inch pipe wrap	Tan Fibrous Heterogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile

Analyst(s)

Rachel Travis (29)



or other approved signatory

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Analysis performed by EMSL Minneapolis (NVLAP #200019-0)



**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: [minneapolislab@emsl.com](mailto:minneapolislab@emsl.com)

Attn: **Chuck Deye**  
**EMR Inc, (Environmental Management Resources, Inc)**  
**11 East Superior Street**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMRI50  
Customer PO:  
Received: 01/04/06 9:30 AM  
EMSL Order: 350600024

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: DIAP Asbestos 7124.001

EMSL Proj:  
Analysis Date: 1/9/2006  
Report Date: 1/9/2006

### Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-3-092 350600024-0019	6-inch pipe wrap	Tan Fibrous Heterogeneous	10% Synthetic 5% Glass	20% Non-fibrous (other)	65% Chrysotile
DIAP-3-093 350600024-0020	6-inch pipe wrap	White Fibrous Heterogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-3-094 350600024-0021	4-inch pipe wrap	White Fibrous Heterogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-3-095 350600024-0022	4-inch pipe wrap	White Fibrous Heterogeneous	10% Synthetic 5% Glass	15% Non-fibrous (other)	70% Chrysotile
DIAP-1-101 WRAP 350600024-0023	3-inch pipe wrap and insulation	White Fibrous Layers: 2	90% Cellulose	10% Non-fibrous (other)	None Detected
DIAP-1-101 INSULATION 350600024-0028	3-inch pipe wrap and insulation	Tan Fibrous Layers: 2	20% Min. Wool	80% Non-fibrous (other)	None Detected
DIAP-1-102 WRAP 350600024-0024	3-inch pipe wrap and insulation	White Fibrous Layers: 2	90% Cellulose	10% Non-fibrous (other)	None Detected

Analyst(s)

Rachel Travis (29)



or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method variations. Interpretation and use of test results are the responsibility of the client.

Analysis performed by EMSL Minneapolis (NVLAP #200019-0)

**EMSL Analytical, Inc.**

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: [minneapolislab@emsl.com](mailto:minneapolislab@emsl.com)

Attn: **Chuck Deye**  
**EMR Inc, (Environmental Management Resources, Inc)**  
**11 East Superior Street**  
**Suite 541**  
**Duluth, MN 55802**

Customer ID: EMR150  
Customer PO:  
Received: 01/04/06 9:30 AM  
EMSL Order: 350600024

Fax: (218) 625-2201 Phone: (218) 625-2332  
Project: **DIAP Asbestos 7124.001**

EMSL Proj:  
Analysis Date: 1/9/2006  
Report Date: 1/9/2006

**Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy**

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
DIAP-1-102 INSULATION 350600024-0029	3-inch pipe wrap and insulation	Tan Fibrous  Layers: 2	20% Min. Wool	80% Non-fibrous (other)	None Detected

\*\*\*Amended 1/9/06 corrected sample numbers per COC.

Analyst(s)

Rachel Travis (29)



or other approved signatory

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Analysis performed by EMSL Minneapolis (NVLAP #200019-0)



# Chain of Custody

## Asbestos Lab Services

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14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
http://www.emsl.com

Please print all information legibly.

Company:	EMR Incorporated	Bill To:	EMR Incorporated
Address1:	11 E. Superior Street	Address1:	11 E. Superior Street
Address2:	Suite 541	Address2:	Suite 541
City, State:	Duluth, MN	City, State:	Duluth, MN
Zip/Post Code:	55802	Zip/Post Code:	55802
Country:	USA	Country:	USA
Contact Name:	Chuck Deye	Attn:	Chuck Deye
Phone:	2186252332	Phone:	2186252332
Fax:	2186252201	Fax:	2186252201
Email:	cdeye@emr-inc.com	Email:	cdeye@emr-inc.com
EMSL Repr		P.O. Number:	7124.001
Project Name/Number: DIAP Asbestos 7124.001			

MATRIX			TURNAROUND			
<input type="checkbox"/> Air	<input type="checkbox"/> Soil	<input type="checkbox"/> Micro-Vac	<input type="checkbox"/> 3 Hours	<input type="checkbox"/> 6 Hours	<input type="checkbox"/> Same Day or 12 Hours*	<input type="checkbox"/> 24 Hours (1 day)
<input checked="" type="checkbox"/> Bulk	<input type="checkbox"/> Drinking Water		<input type="checkbox"/> 48 Hours (2 days)	<input checked="" type="checkbox"/> 72 Hours (3 days)	<input type="checkbox"/> 96 Hours (4 days)	<input type="checkbox"/> 120 Hours (5 days)
<input type="checkbox"/> Wipe	<input type="checkbox"/> Wastewater		<input type="checkbox"/> 144+ hours (6-10 days)			

TEM AIR, 3 hours, 6 hours, Please call ahead to schedule. There is a premium charge for 3-hour turn, please call 1-800-220-3675 for price prior to sending samples. You will be asked to sign an authorization form for this service.

\*12 hours (must arrive by 11:00a.m. Mon-Fri.), Please Refer to Price Quote

<b>PCM - Air</b> <input type="checkbox"/> NIOSH 7400(A) Issue 2: August 1994 <input type="checkbox"/> OSHA w/TWA <input type="checkbox"/> Other:	<b>TEM Air</b> <input type="checkbox"/> AHERA 40 CFR, Part 763 Subpart E <input type="checkbox"/> NIOSH 7402 <input type="checkbox"/> EPA Level II	<b>TEM WATER</b> <input type="checkbox"/> EPA 100.1 <input type="checkbox"/> EPA 100.2 <input type="checkbox"/> NYS 198.2
<b>PLM - Bulk</b> <input checked="" type="checkbox"/> EPA 600/R-93/116 <input type="checkbox"/> EPA Point Count <input type="checkbox"/> NY Stratified Point Count <input type="checkbox"/> PLM NOB (Gravimetric) NYS 198.1 <input type="checkbox"/> NIOSH 9002: <input type="checkbox"/> EMSL Standard Addition:	<b>TEM BULK</b> <input type="checkbox"/> Drop Mount (Qualitative) <input type="checkbox"/> Chatfield SOP - 1988-02 <input type="checkbox"/> TEM NOB (Gravimetric) NYS 198.4 <input type="checkbox"/> EMSL Standard Addition:	<b>TEM Microvac/Wipe</b> <input type="checkbox"/> ASTM D 5755-95 (quantitative method) <input type="checkbox"/> Wipe Qualitative
<b>SEM Air or Bulk</b> <input type="checkbox"/> Qualitative <input type="checkbox"/> Quantitative	<b>PLM Soil</b> <input type="checkbox"/> EPA Protocol Qualitative <input type="checkbox"/> EPA Protocol Quantitative <input type="checkbox"/> EMSL MSD 9000 Method fibers/gram	<b>XRD</b> <input type="checkbox"/> Asbestos <input type="checkbox"/> Silica NIOSH 7500  <b>OTHER</b> <input type="checkbox"/>

350600024



# Chain of Custody

## Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) DIAP-B-002 - DIAP-Z-075

Total Samples #: 14

Relinquished: Chaffey Date: 1/3/06

Time: 1500

Received: K Beam FG Date: 1/4/06

Time: 9:30 am

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-B-002	4-inch pipe wrap	
DIAP-B-006	4-inch pipe wrap	
DIAP-B-009	6-inch pipe wrap	
DIAP-B-011	Converter #2 Wrap	
DIAP-B-012	In-Service Boiler Exhaust Wrap	
DIAP-B-013	Out-of-Service Boiler Exhaust Wrap	
DIAP-B-020	6-inch Water Main Pipe Wrap	
DIAP-B-022	4-inch pipe wrap	
DIAP-B-023	6-inch pipe wrap	
DIAP-B-029	4-inch pipe wrap	
DIAP-B-030	6-inch wrap	
DIAP-1-045	3-inch pipe wrap	
DIAP-1-063	3-inch pipe wrap	
DIAP-2-075	3-inch pipe wrap	

350600024



# Chain of Custody

## Asbestos Lab Services

EMSL Analytical, Inc.  
14375 23rd Avenue  
North  
Minneapolis,  
MN 55447

Phone: (763) 449-4922  
Fax: (763) 449-4924  
<http://www.emsl.com>

Please print all information legibly.

Client Sample # (s) DIAP-3-082 - DIAP-1-102

Total Samples #: 10

Relinquished: Chad Page Date: 1/3/06

Time: 1500

Received: JBear FE Date: 1/4/06

Time: 9:30

Relinquished: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

Received: \_\_\_\_\_ Date: \_\_\_\_\_

Time: \_\_\_\_\_

SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME (if applicable)
DIAP-3-082	6-inch pipe wrap	
DIAP-3-083	6-inch pipe wrap	
DIAP-3-084	4-inch pipe wrap	
DIAP-3-085	4-inch pipe wrap	
DIAP-3-092	6-inch pipe wrap	
DIAP-3-093	6-inch pipe wrap	
DIAP-3-094	4-inch pipe wrap	
DIAP-3-095	4-inch pipe wrap	
DIAP-1-101	3-inch pipe wrap and insulation	
DIAP-1-102	3-inch pipe wrap and insulation	

**APPENDIX C**

**HOMOGENEOUS AREA PHYSICAL ASSESSMENT FORMS**

---

# HOMOGENEOUS AREA PHYSICAL ASSESSMENT FORM

Prepared By: Chuck Deye :: EMR Incorporated Street Address: 11 E. Superior St. Ste. 541

City, State: Duluth, MN

Building Name: Duluth International Airport Terminal Building

Sample No: 001, 050, 064, 074, 088 Date: 1/10/2006 Color: White

Material Type: 12" x 12" Vinyl Floor Tile and Mastic

Gen'l. Area: Multiple areas on all floors

Category: ☐ TSI ☐ Surfacing ☒ Misc.

Amount: 7,800 ☒ S.F. ☐ L.F. ☐ M.J.

Status: ☒ In-Place ☐ Removed ☐ Removed-Partial

Class: ☐ Friable ☒ NF Category I ☐ NF Category II

Percent of Damage ☐ 0% ☒ <0-10% ☐ 10-25% ☐ >25%

Visible ☐ None ☐ <10% ☒ >10%

Mech. Vent. ☒ No ☐ Intake ☐ Exhaust

Extent of Damage ☐ Localized ☒ Distributed

Vibration ☐ None ☒ Light ☐ Moderate ☐ Heavy

Accessibility ☒ Accessible ☐ Difficult ☐ None

Air Erosion ☐ Yes ☒ No ☐ Potential

Physical Damage ☐ None ☒ Light ☐ Moderate ☐ Heavy

Barriers ☒ No ☐ Permanent ☐ Temporary

Exposure Factor ☐ None ☒ Low ☐ Moderate ☐ High

H2O Damage ☒ None ☐ Light ☐ Moderate ☐ Heavy

Activity ☐ None ☐ Light ☐ Moderate ☒ Heavy

Condition Assessment ☐ Good ☒ Damaged ☐ Significantly Damaged

# HOMOGENEOUS AREA FORMAL ASSESSMENT FORM

Prepared By: Chuck Deye :: EMR Incorporated Street Address: 11 E. Superior St. Ste. 541

City, State: Duluth, MN

Building Name: Duluth International Airport Terminal Building

Sample No: 018, 055 Color: White

Material Type: 2' x 2' Suspended Ceiling Tile Date: 1/10/2006

Gen'l. Area: Basement Bathroom/Hallway and North Country Bathrooms

Category: TSI ☐  
Surfacing ☐  
Misc. ☒

Amount: ### 385 S.F. ☐ L.F. ☐ M.J. ☐

Status: ☒ In-Place ☐ Removed ☐ Removed-Partial

Class: Friable ☒  
NF Category I ☐  
NF Category II ☐

Percent of Damage

0% ☐ None ☒  
<0-10% ☒ Light ☐  
10-25% ☐ Moderate ☐  
>25% ☐ Heavy ☐

Deterioration

None ☒  
Light ☐  
Moderate ☐  
Heavy ☐

Visible

None ☐  
<10% ☐  
>10% ☒

Mech. Vent.

No ☒  
Intake ☐  
Exhaust ☐

Extent of Damage

Localized ☐  
Distributed ☒

Vibration

None ☐  
Light ☒  
Moderate ☐  
Heavy ☐

Accessibility

Accessible ☒  
Difficult ☐  
None ☐

Air Erosion

Yes ☐  
No ☒  
Potential ☐

Physical Damage

None ☐  
Light ☒  
Moderate ☐  
Heavy ☐

Condition Assessment

Good ☐  
Damaged ☒  
Significantly Damaged ☐

H2O Damage

None ☒  
Light ☐  
Moderate ☐  
Heavy ☐

Barriers

No ☒  
Permanent ☐  
Temporary ☐

Exposure Factor

None ☐  
Low ☒  
Moderate ☐  
High ☐

Activity

None ☐  
Light ☒  
Moderate ☐  
Heavy ☐



# HOMOGENEOUS AREA PHYSICAL ASSESSMENT FORM

Prepared By: Chuck Deye :: EMR Incorporated Street Address: 11 E. Superior St. Ste. 541

Building Name: Duluth International Airport Terminal Building City, State: Duluth, MN

Sample No: DIAP-3-087 Date: 1/10/2006 Color: White

Material Type: 2' x 4' Suspended Ceiling Tile

Gen'l. Area: 3rd Floor Reception Area Coffee Room Category: TSI ☐ Surfacing ☐ Misc. ☒

Amount: 90 ☒ S.F. ☐ L.F. ☐ M.J.

Status: ☒ In-Place ☐ Removed ☐ Removed-Partial  
Class: ☒ Friable ☐ NF Category I ☐ NF Category II ☐

Percent of Damage  
0% ☒  
<0-10% ☐  
10-25% ☐  
>25% ☐  
Deterioration  
None ☒  
Light ☐  
Moderate ☐  
Heavy ☐  
Visible  
None ☐  
<10% ☐  
>10% ☒  
Mech. Vent.  
No ☒  
Intake ☐  
Exhaust ☐

Extent of Damage  
Localized ☐  
Distributed ☐  
Vibration  
None ☐  
Light ☒  
Moderate ☐  
Heavy ☐  
Physical Damage  
None ☒  
Light ☐  
Moderate ☐  
Heavy ☐  
Accessibility  
Accessible ☒  
Difficult ☐  
None ☐  
Air Erosion  
Yes ☐  
No ☒  
Potential ☐

Condition Assessment  
Good ☒  
Damaged ☐  
Significantly Damaged ☐  
Barriers  
No ☒  
Permanent ☐  
Temporary ☐  
Exposure Factor  
None ☐  
Low ☒  
Moderate ☐  
High ☐  
Activity  
None ☐  
Light ☒  
Moderate ☐  
Heavy ☐

H2O Damage  
None ☒  
Light ☐  
Moderate ☐  
Heavy ☐



# HOMOGENEOUS AREA PHYSICAL ASSESSMENT FORM

Prepared By: Chuck Deye :: EMR Incorporated Street Address: 11 E. Superior St. Ste. 541

City, State: Duluth, MN

Building Name: Duluth International Airport Terminal Building

Sample No: 82, 83, 84, 85, 92, 93, 94, 95 Date: 1/10/2006 Color: White/Tan

Material Type: Fabric pipe wrap and insulation on TSI elbows

Gen'l. Area: Third Floor East and West HVAC Rooms

Amount: 102 Fittings ☐ S.F. ☐ L.F. ☒ M.J.

Status: ☒ In-Place ☐ Removed ☐ Removed-Partial

Category: ☒ TSI ☐ Surfacing ☐ Misc.

Class: ☒ Friable ☐ NF Category I ☐ NF Category II

Percent of Damage  
☐ 0% ☒ <0-10% ☐ 10-25% ☐ >25%

Deterioration  
☐ None ☒ Light ☐ Moderate ☐ Heavy

Visible  
☐ None ☐ <10% ☒ >10%

Mech. Vent.  
☒ No ☐ Intake ☐ Exhaust

Extent of Damage  
☐ Localized ☒ Distributed

Vibration  
☐ None ☒ Light ☐ Moderate ☐ Heavy

Accessibility  
☒ Accessible ☐ Difficult ☐ None

Air Erosion  
☐ Yes ☒ No ☐ Potential

Physical Damage  
☐ None ☒ Light ☐ Moderate ☐ Heavy

Condition Assessment  
☐ Good ☒ Damaged ☐ Significantly Damaged

Barriers  
☒ No ☐ Permanent ☐ Temporary

Exposure Factor  
☐ None ☒ Low ☐ Moderate ☐ High

H2O Damage  
☐ None ☒ Light ☐ Moderate ☐ Heavy

Activity  
☐ None ☒ Light ☐ Moderate ☐ Heavy

# HOMOGENEOUS AREA PHYSICAL ASSESSMENT FORM

Prepared By: Chuck Deye :: EMR Incorporated

Street Address: 11 E. Superior St. Ste. 541

Building Name: Duluth International Airport Terminal Building

City, State: Duluth, MN

Sample No: 012 and 013

Date: 1/10/2006

Color: White/Tan

Material Type: Fabric pipe wrap on boiler exhaust runs

Gen'l. Area: Basement boiler room

Category:

TSI ☒  
Surfacing ☐  
Misc. ☐

Amount: 40 ☐ S.F. ☒ L.F. ☐ M.J.

Status: ☒ In-Place

☐ Removed

☐ Removed-Partial

Class:

Friable ☒  
NF Category I ☐  
NF Category II ☐

Percent of Damage

0% ☐  
<0-10% ☒  
10-25% ☐  
>25% ☐

Deterioration

None ☐  
Light ☒  
Moderate ☐  
Heavy ☐

Visible

None ☐  
<10% ☐  
>10% ☒

Mech. Vent.

No ☒  
Intake ☐  
Exhaust ☐

Extent of Damage

Localized ☐  
Distributed ☒

Vibration

None ☐  
Light ☒  
Moderate ☐  
Heavy ☐

Accessibility

Accessible ☒  
Difficult ☐  
None ☐

Air Erosion

Yes ☐  
No ☒  
Potential ☐

Physical Damage

None ☐  
Light ☒  
Moderate ☐  
Heavy ☐

Condition Assessment

Good ☐  
Damaged ☒  
Significantly Damaged ☐

Barriers

No ☒  
Permanent ☐  
Temporary ☐

Exposure Factor

None ☐  
Low ☒  
Moderate ☐  
High ☐

H2O Damage

None ☒  
Light ☐  
Moderate ☐  
Heavy ☐

Activity

None ☐  
Light ☒  
Moderate ☐  
Heavy ☐

# HOMOGENEOUS AREA PHYSICAL ASSESSMENT FORM

Prepared By: Chuck Deye :: EMR Incorporated

Street Address: 11 E. Superior St. Ste. 541

Building Name: Duluth International Airport Terminal Building

City, State: Duluth, MN

Sample No: DIAP-B-011

Date: 1/10/2006

Color: White/Tan

Material Type: Fabric pipe wrap on water heat converter

Gen'l. Area: Basement boiler room

Category: TSI

Amount: 20 ☒ S.F. ☐ L.F. ☐ M.J.

Status: ☒ In-Place

☐ Removed

☐ Removed-Partial

Class:

☒ Friable

☐ NF Category I

☐ NF Category II

Percent of Damage

☒ 0%

☐ <0-10%

☐ 10-25%

☐ >25%

Deterioration

☒ None

☐ Light

☐ Moderate

☐ Heavy

Extent of Damage

☐ Localized

☐ Distributed

Vibration

☐ None

☒ Light

☐ Moderate

☐ Heavy

Physical Damage

☒ None

☐ Light

☐ Moderate

☐ Heavy

Condition Assessment

☒ Good

☐ Damaged

☐ Significantly Damaged

H2O Damage

☒ None

☐ Light

☐ Moderate

☐ Heavy

Visible

☐ None

☐ <10%

☒ >10%

Mech. Vent.

☒ No

☐ Intake

☐ Exhaust

Accessibility

☒ Accessible

☐ Difficult

☐ None

Air Erosion

☐ Yes

☒ No

☐ Potential

Barriers

☒ No

☐ Permanent

☐ Temporary

Exposure Factor

☐ None

☒ Low

☐ Moderate

☐ High

Activity

☐ None

☒ Light

☐ Moderate

☐ Heavy

## **Appendix F**

### **Bulk Asbestos Analysis Report**

Mr. Camron Vollbrecht  
Braun Intertec-Duluth  
4511 W. First Street, Suite 4  
Duluth, MN 55807

June 26, 2012

Work Order #: 1203549

RE: Duluth International Airport

DU-12-01858

Dear Camron Vollbrecht:

## **Bulk Asbestos Analysis Report**

The microscopy department of Braun Intertec Corporation received your analytical request on June 19, 2012. The objective of this analysis was to determine the presence of asbestos using polarized light microscopy (PLM) and to determine the percent of asbestos and non-asbestos fibrous components by calibrated visual area estimation. Analytical results are summarized on the following laboratory report.

## **Methodology**

Bulk asbestos analysis is conducted in accordance with the Environmental Protection Agency's (EPA) methods 40 CFR, Part 763, Ch. 1, Subpart F, Appendix A (7-1-87 Edition) and EPA/600/R-93/116. All analyses are in compliance with the quality control procedures specified by the methods. All samples are examined for homogeneity. If a sample contains more than one layer, each layer is analyzed individually. Total fibrous content is calculated for joint compound/wallboard systems by combining layer results according to their percentages of the total sample. All routine quality assurance procedures were followed, unless otherwise noted.

## **Remarks**

Braun Intertec is accredited by the National Institute of Standards and Technology's (NIST), National Voluntary Laboratory Accreditation Program (NVLAP) for selected test methods for bulk asbestos identification under Lab Code 101234-0. This report in no way constitutes or implies product certification, approval or endorsement by NVLAP or any other agency of the U.S. Government. This test report relates only to the items submitted for analysis.



June 26, 2012

Work Order #: 1203549

Samples are retained at our laboratory for a period of 30 days and will be disposed of unless otherwise instructed by the client.

This report is issued under terms of our General Conditions. It can not be copied, except in its entirety, without prior written permission from Braun Intertec.

We appreciate your decision to use Braun Intertec Corporation for this project. We are committed to being your vendor of choice to meet your analytical needs.

If you have any questions please contact me at 952-995-2688.

Sincerely,

**BRAUN INTERTEC CORPORATION**



Steve Felton

Project Manager



Client: **Braun Intertec-Duluth**  
 Log-In: 06/19/12  
 Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
 Lab Contact: Steve Felton  
 PO Number: DU-12-01858

Date Reported: 6/26/2012  
**Page 3 of 15**

Sample No:	1203549-01	Client ID:	Br-100A
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Sheetrock</b>	3	100	1,2,3	Cellulose 5 Glass Fibers <1		None Detected		06/22/12
White powdery compound	(A)	5	1,2,3	None Detected		None Detected		
Brown paper	(B)	5	3	Cellulose 95		None Detected		
White chalky	(C)	90	1,3	Glass Fibers <1		None Detected		

Sample No:	1203549-02	Client ID:	Br-100B
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Sheetrock</b>	3	100	1,3,6	Cellulose 5 Glass Fibers <1		None Detected		06/22/12
White granular compound	(A)	100	1,3,6	None Detected		None Detected		
Brown paper	(B)	5	3	Cellulose 95		None Detected		
White chalky	(C)	85	1,3	Glass Fibers <1		None Detected		

Sample No:	1203549-03	Client ID:	Br-101
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray fibrous ceiling tile with paint</b>	1	100	3,6,11	Cellulose 60 Glass Fibers 20		None Detected		06/22/12

Client:	<b>Braun Intertec-Duluth</b>	Laboratory:	<b>Braun Intertec Corporation</b>	Date Reported:	6/26/2012
Log-In:	06/19/12	Lab Contact:	Steve Felton	<b>Page 4 of 15</b>	
Client Reference:	Duluth International Airport	PO Number:	DU-12-01858		

Sample No:	1203549-04	Client ID:	Br-102
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Baseboard with adhesive</b>	2	100	-	-		-		06/22/12
Brown rubbery	(A)	>99	1,3,10	None Detected		None Detected		
Yellow adhesive	(B)	<1	1,7	None Detected		None Detected		

Sample No:	1203549-05	Client ID:	Br-103
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Green adhesive</b>	1	100	1,7	Cellulose <1 Glass Fibers <1		None Detected		06/22/12

Sample No:	1203549-06	Client ID:	Br-104
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray fibrous ceiling tile with paint</b>	1	100	3,6,11	Cellulose 60 Glass Fibers 10		None Detected		06/25/12

Sample No:	1203549-07	Client ID:	Br-105
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray fibrous ceiling tile with paint</b>	1	100	3,6,11	Cellulose 1 Glass Fibers 80		None Detected		06/25/12

Client: **Braun Intertec-Duluth**  
Log-In: 06/19/12  
Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
Lab Contact: Steve Felton  
PO Number: DU-12-01858

Date Reported: 6/26/2012  
**Page 5 of 15**

Sample No:	1203549-08	Client ID:	Br-106
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Sheetrock</b>	2	100	1,3	Cellulose 17		None Detected		06/25/12
Brown paper	(A)	15	3	Cellulose 95		None Detected		
White chalky	(B)	85	1,3	Cellulose 3		None Detected		

Sample No:	1203549-09	Client ID:	Br-107
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray vinyl</b>	1	100	1,3,9	None Detected		None Detected		06/25/12

Sample No:	1203549-10	Client ID:	Br-108
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Yellow adhesive</b>	1	100	1,7	Cellulose 3 Synthetic Fibers <1		None Detected		06/25/12

Sample No:	1203549-11	Client ID:	Br-109
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray fibrous ceiling tile with paint</b>	1	100	1,3,11,14	Cellulose 3 Glass Fibers 80		None Detected		06/25/12

Client: **Braun Intertec-Duluth**  
Log-In: 06/19/12  
Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
Lab Contact: Steve Felton  
PO Number: DU-12-01858

Date Reported: 6/26/2012  
**Page 6 of 15**

Sample No:	1203549-12	Client ID:	Br-110
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Yellow adhesive</b>	1	100	1,7	Cellulose <1 Synthetic Fibers <1		None Detected		06/25/12

Sample No:	1203549-13	Client ID:	Br-111
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Tan fabric with paint</b>	1	100	11	Cellulose 95		None Detected		06/25/12

Sample No:	1203549-14	Client ID:	Br-112
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Insulation</b>	2	100	-	-		-		06/25/12
White fibrous coating	(A)	60	1,3,11,14	Cellulose 5 Glass Fibers 10		Chrysotile 4		
Yellow fibrous	(B)	40	--	Glass Fibers 100		None Detected		

Sample No:	1203549-15	Client ID:	Br-113
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray fibrous ceiling tile with paint</b>	1	100	3,6,11	Cellulose 60 Glass Fibers 10		None Detected		06/25/12

Client:	<b>Braun Intertec-Duluth</b>	Laboratory:	<b>Braun Intertec Corporation</b>	Date Reported:	6/26/2012
Log-In:	06/19/12	Lab Contact:	Steve Felton	<b>Page 7 of 15</b>	
Client Reference:	Duluth International Airport	PO Number:	DU-12-01858		

Sample No:	1203549-16	Client ID:	Br-114
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray fibrous ceiling tile with paint</b>	1	100	3,6,11	Cellulose 60 Glass Fibers 10		None Detected		06/25/12

Sample No:	1203549-17	Client ID:	Br-115A
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Tan powdery compound with paint</b>	1	100	1,3,11	None Detected		None Detected		06/25/12

Sample No:	1203549-18	Client ID:	Br-115B
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Tan powdery compound with paint</b>	1	100	1,3,11	None Detected		None Detected		06/25/12

Sample No:	1203549-19	Client ID:	Br-115C
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Tan powdery compound with paint</b>	1	100	1,3,11	None Detected		None Detected		06/25/12

Client:	<b>Braun Intertec-Duluth</b>	Laboratory:	<b>Braun Intertec Corporation</b>	Date Reported:	6/26/2012
Log-In:	06/19/12	Lab Contact:	Steve Felton	<b>Page 8 of 15</b>	
Client Reference:	Duluth International Airport	PO Number:	DU-12-01858		

Sample No:	1203549-20	Client ID:	Br-116
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray fibrous tacky</b>	1	100	1,3,6	None Detected		Chrysotile 5		06/25/12

Sample No:	1203549-21	Client ID:	Br-117
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Tan fibrous micaceous</b>	1	100	1,2,3	Cellulose 15		None Detected		06/25/12

Sample No:	1203549-22	Client ID:	Br-118
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray fibrous ceiling tile with paint</b>	1	100	3,6,11	Cellulose 40 Glass Fibers 40		Chrysotile 2		06/25/12

Sample No:	1203549-23	Client ID:	Br-119
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Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray fibrous ceiling tile with paint</b>	1	100	3,6,11	Cellulose 60 Glass Fibers 10		None Detected		06/25/12

Client: **Braun Intertec-Duluth**  
 Log-In: 06/19/12  
 Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
 Lab Contact: Steve Felton  
 PO Number: DU-12-01858

Date Reported: 6/26/2012  
**Page 9 of 15**

Sample No: 1203549-24		Client ID: Br-120						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Baseboard with adhesive</b>	2	100	-	-		-		06/25/12
Gray rubbery	(A)	97	1,3,10	None Detected		None Detected		
Yellow adhesive	(B)	3	1,7	Cellulose <1		None Detected		
Sample No: 1203549-25		Client ID: Br-121						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Gray fibrous micaceous</b>	1	100	1,2,3	None Detected		None Detected		06/25/12
Sample No: 1203549-26		Client ID: Br-122						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Sheetrock</b>	3	100	1,3	Cellulose 14 Glass Fibers <1		None Detected		06/25/12
White powdery compound	(A)	10	1,3	None Detected		None Detected		
Brown/white paper	(B)	15	3	Cellulose 95		None Detected		
White chalky	(C)	75	1,3	Cellulose <1		None Detected		
Sample No: 1203549-27		Client ID: Br-123						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
<b>Yellow adhesive</b>	1	100	1,7	Cellulose <1		None Detected		06/25/12

Client:	<b>Braun Intertec-Duluth</b>	Laboratory:	<b>Braun Intertec Corporation</b>	Date Reported:	6/26/2012
Log-In:	06/19/12	Lab Contact:	Steve Felton	<b>Page 10 of 15</b>	
Client Reference:	Duluth International Airport	PO Number:	DU-12-01858		

Sample No: 1203549-28		Client ID: Br-124						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Gray rubbery	1	100	1,10	None Detected		None Detected		06/25/12

Sample No: 1203549-29		Client ID: Br-125						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Black granular tarry	1	100	1,8	None Detected		None Detected		06/25/12

Sample No: 1203549-30		Client ID: Br-126						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Black rubber, plastic and tar	1	100	8,10,12	None Detected		None Detected		06/25/12

Sample No: 1203549-31		Client ID: Br-127						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Brown rubbery	1	100	1,10	None Detected		None Detected		06/25/12

Sample No: 1203549-32		Client ID: Br-128						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Black tarry	1	100	8	None Detected		None Detected		06/25/12



Client: **Braun Intertec-Duluth**  
Log-In: 06/19/12  
Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
Lab Contact: Steve Felton  
PO Number: DU-12-01858

Date Reported: 6/26/2012  
**Page 11 of 15**

Sample No: 1203549-33		Client ID: Br-129						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Black tarry	1	100	1,8	None Detected		None Detected		06/25/12

Sample No: 1203549-34		Client ID: Br-130						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Black tarry	1	100	1,8	Cellulose <1		Chrysotile 5		06/25/12

Sample No: 1203549-35		Client ID: Br-131						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Black tarry	1	100	8	None Detected		None Detected		06/25/12

Sample No: 1203549-36		Client ID: Br-132						
Macroscopic Description	No. of Layers and Layer Designator	Percent of Total Sample	Non-Fibrous Components*	Other Fibrous Non-Asbestos Content Total or Layer %	Footnotes	Asbestos Content Total or Layer %	Footnotes	Analytical Date
Brown fibrous	1	100	3	Cellulose 85		None Detected		06/25/12

Footnotes and Definitions

<	Less Than	* Key to Non-Fibrous Components			
>	Greater Than				
		1 = Rock/Mineral fragments	5 = Diatoms	9 = Vinyl	13 = Spores/Pollen
		2 = Mica/Vermiculite	6 = Perlite	10 = Foam/Rubber	14 = Foil
		3 = Binders	7 = Adhesive/Mastic	11 = Paint	
		4 = Opaques	8 = Tar	12 = Other	

Client: **Braun Intertec-Duluth**  
 Log-In: 06/19/12  
 Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
 Lab Contact: Steve Felton  
 PO Number: DU-12-01858

Date Reported: 6/26/2012  
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Sample	Material
1,2 Br-100A-B	Sheetrock / joint compound
3 Br-101	2'x2' CT
4 Br-102	Brown Vinyl B.B.
5 Br-103	Carpet Mastic
6 Br-104	2'x2' CT
7 Br-105	2'x4' CT
8 Br-106	Sheetrock Tie Buckle 8'x2'
9 Br-107	Vinyl Threshold
10 Br-108	Carpet Mastic
11 Br-109	2'x2' C.T.
12 Br-110	Carpet Mastic
13 Br-111	Insulating tape on air exchangers
14 Br-112	Duct insulation
15 Br-113	2'x2' CT step down
16 Br-114	2'x2' CT
17,18,19 Br-115A-C	Wall Texture
20 Br-116	Brown pipe wrap
21 Br-117	spray on insulation
22 Br-118	2'x4' C.T.
23 Br-119	2'x2' C.T.
24 Br-120	Vinyl B.B. grey
25 Br-121	Spray insulation
26 Br-122	Sheetrock / joint compound
27 Br-123	Carpet Mastic
28 Br-124	Caulk
29 Br-125	Terry Seabury
30 Br-126	Black roof underlayment
31 Br-127	Caulk

DU-12-01858  
 6-14/15/12

Client: **Braun Intertec-Duluth**  
Log-In: 06/19/12  
Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
Lab Contact: Steve Felton  
PO Number: DU-12-01858

Date Reported: 6/26/2012  
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Sample	Metformin
32 Br-128	Tam sealant
33 Br-129	Rest sealant
34 Br-130	Tam sealant
35 Br-131	Ex window caulk
36 Br-132	Expansion joint

Client: **Braun Intertec-Duluth**  
Log-In: 06/19/12  
Client Reference: Duluth International Airport

Laboratory: **Braun Intertec Corporation**  
Lab Contact: Steve Felton  
PO Number: DU-12-01858

Date Reported: 6/26/2012  
Page 15 of 15

For Braun Intertec Use Only Braun Intertec Project No. <b>DU-12-01858</b> <b>1203549</b>		<b>BRAUN INTERTEC</b> Braun Intertec Corporation 11001 Hampshire Ave. S Minneapolis, MN 55438		<b>REQUEST FOR LABORATORY ANALYTICAL SERVICES</b> Bottle orders and sampling inquires: <b>labservices@braunintertec.com</b> Phone: 952-995-2600 Fax: 952-995-2601		<b>IMPORTANT</b> Date Results Requested: _____ Time _____ Rush Charges Authorized? ____ Yes ____ No Rush / Quote # _____																																																																																	
<b>REPORT RESULTS TO</b>	Contact Name	<b>Camron Uolibrand</b>			Project ID/Project Name	<b>Duluth International Airport</b>																																																																																	
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<b>Special Instructions and/or Specific Regulatory Requirements:</b> (method, limit of detection, petrofund, reporting units)					<b>ANALYSIS REQUESTED</b> (Enter an 'X' in the box below to indicate request)																																																																																		
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Form # CS02.01 F:\Groups\QA-QC\Forms\clientservices\COCC-CS02 Effective Date: 7/22/05

## **Appendix G**

### **Asbestos Building Inspector Certificate**



Certificate No: 5LM07211114IR

Expiration Date: July 21, 2012

*This is to certify that*  
**Camron Vollbrecht**  
*has attended and successfully completed an*  
**ASBESTOS INSPECTOR**  
**REFRESHER TRAINING COURSE**

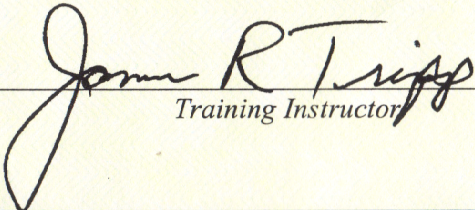
*permitted by*  
*the State of Minnesota under Minnesota Rules 4620.3702 to 4620.3722*  
*and meets the requirements of*  
*Section 206 of Title II of the Toxic Substances Control Act (TSCA)*  
*conducted by*

**Lake States Environmental, Ltd.**

*in*  
**White Bear Lake, MN on July 21, 2011**

**Examination Date: July 21, 2011**

Lake States Environmental, Ltd  
P. O. Box 645, Rice Lake, WI 54868  
(800) 254-9811

  
Training Instructor

MDH  
ASBESTOS  
INSPECTOR

Certified by:  
State of Minnesota  
Department of Health  
Expires: 07/21/2012  
Camron M Vollbrecht  
828 Chester Park Dr  
Duluth, MN 55812



No. A19598 Issued: 10/19/2011  
Director, Env. Health Div





CONSULTANTS  
• ENVIRONMENTAL  
• GEOTECHNICAL  
• MATERIALS  
• FORENSICS

## **REPORT OF GEOTECHNICAL EXPLORATION AND REVIEW**

**Duluth International Airport Terminal  
Duluth, Minnesota**

---

**AET #07-04216.2**

**Date:**

October 14, 2009

**Prepared For:**

Mr. John Hippchen, PE, LEED AP  
Reynolds, Smith and Hills  
4525 Airport Approach Road  
Duluth, MN 55811







CONSULTANTS  
· ENVIRONMENTAL  
· GEOTECHNICAL  
· MATERIALS  
· FORENSICS

October 14, 2009

Mr. John Hippchen, PE, LEED AP  
Reynolds, Smith and Hills  
4525 Airport Approach Road  
Duluth, MN 55811

Re: Geotechnical Exploration/Review  
Proposed Duluth International Airport Terminal  
Duluth, Minnesota  
AET Project #07-04216.2

Dear Mr. Hippchen:

American Engineering Testing, Inc. (AET) has completed a subsurface exploration and geotechnical engineering review for the above referenced project. We are sending you two copies of our report. Our report documents the exploration/review results and provides our opinions and recommendations to aid you and your design team in planning and construction of the project.

AET appreciates this opportunity to serve you. As your project proceeds, we remain interested in providing additional consulting or testing services. If you have questions about the report, or if we can provide additional services for you, I can be reached at (218) 628-1518 or [sleow@amengtest.com](mailto:sleow@amengtest.com).

Sincerely,  
American Engineering Testing, Inc.

Sara L. Leow, PE  
Geotechnical Engineer

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**AET PROJECT 07-04216.2**  
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- Excavation and Refilling for Structural Support
- Floor Slab Moisture/Vapor Protection
- Standard Recommendations for Utility Trench Backfilling
- Bedding/Foundation Support of Buried Pipe
- Freezing Weather Effects on Building Construction

**APPENDIX**

- Figure 1 – Approximate Test Boring Locations
- Logs of Test Borings
- Boring Log Notes
- Unified Soil Classification System
- Geologic Terminology

**GEOTECHNICAL EXPLORATION/REVIEW  
DULUTH INTERNATIONAL AIRPORT TERMINAL  
DULUTH, MINNESOTA  
AET #07-04216.2**

**INTRODUCTION**

A new terminal building is planned to be constructed at the Duluth International Airport in Duluth, Minnesota. RS&H authorized American Engineering Testing, Inc. (AET) to conduct a subsurface exploration program and provide geotechnical engineering recommendations for this project. This report presents the field information we obtained at the site and our engineering recommendations.

To protect you, AET, and the public, we authorize use of opinions and recommendations in this report only by you and your project team for this specific project. Contact us if other uses are intended. Even though this report is not intended to provide sufficient information to accurately determine quantities and locations of particular materials, we recommend that your potential contractors be advised of the report availability.

**Scope of Services**

Our scope of services for this work, outlined in AET Proposal #07-04216.2 and authorized by you, consisted of:

- Arranging for the location of existing public underground utilities through the Gopher State One-Call System and the location of private utilities by a private utility locator.
- Performing ten standard penetration test (SPT) borings. The test borings were performed in general accordance with ASTM designation D1586, and soils classified in general accordance with ASTM D2487.
- Performing limited laboratory testing to aid in soil classification and assessment of soil engineering properties.
- Providing a geotechnical report that presents the results of the test borings, laboratory testing results, recommendations for proposed building foundations and fill, compaction levels, opinions regarding the construction of a retaining wall along the north side of the terminal, and groundwater management.

The scope of our work is intended for geotechnical purposes only. This scope is not intended to explore for the presence or extent of chemical contamination at the site.

## **PROJECT INFORMATION**

### **Project Background**

We understand RS&H is providing design services for the new terminal building at the Duluth International Airport. Information provided to us indicates the new terminal will be a slab-on-grade structure, constructed immediately to the south of the existing terminal. The overall dimensions of the proposed terminal building are approximately 180.5 feet by 330 feet. The new terminal building will be either steel or concrete construction, or a combination of both. You have indicated the tug ramps in the northeastern-most and northwestern-most corners of the building will not be heated, but all other areas of the terminal will be heated above 40 degrees Fahrenheit year-round.

The new terminal will be bordered by concrete aprons on the north and a departure/arrival service road on the south. The grade on the north side of the terminal will be raised 10 feet to 15 feet to match the grade of the existing aircraft apron. According to MBJ (project structural engineer), a sheet-pile retaining wall or mechanically stabilized earth (MSE) wall, may be considered to retain fill placed to raise the grade east and west of the north building wall.

Current structural plans indicate the new terminal will have up to three stories. The south side (front) of the terminal building will be a single-story, high-ceiling area for ticketing. The main entrance to the terminal will include an exterior canopy structure on the south side. The three-story portion of the structure will be situated in the central portion of the building, with the remaining two-story area on the north side of the building, next to the aircraft apron.

Our discussion with the project structural engineer indicates maximum column loads for the terminal are anticipated to be on the order of 500 to 600 kips. We understand that due to these relatively high loads, the structural engineer may want to explore the possibility of using foundation elements with

soil bearing pressures exceeding 5,000 pounds per square foot (psf).

### **Project Assumptions**

The recommendations contained in this report are based on attaining a factor of safety of at least 3 with respect to localized shear or base failure of the foundations. We have also assumed allowable foundation settlements of 1 inch total and ½ inch differential are acceptable.

The presented project information represents our understanding of the proposed construction. This information is an integral part of our engineering review. It is important that you contact us if there are changes from that described so that we can evaluate whether modifications to our recommendations are appropriate.

## **SITE CONDITIONS**

### **Surface Observations**

On the dates the test borings were performed, the ground surface within the new terminal footprint was mainly covered by bituminous pavement for the existing long and short-term parking areas. The ground surface on the north side of the terminal footprint area was covered by grass. This ground surface slopes up from the parking lots to the passenger loading/unloading drive on the south side of the existing terminal.

### **Subsurface Soils/Geology**

Logs of the test borings are included in the Appendix. Please refer to the logs for general information concerning soil layering, soil classification, geologic description, and moisture. Relative density or consistency is also noted, which is based on the standard penetration resistance (N-value).

The boring logs only indicate the subsurface conditions at the sampled locations. Variations often occur between and beyond borings.

The test borings indicate a generalized subsurface profile of existing fill overlying native soils comprised of till, coarse alluvium, and/or fine alluvium. Existing fill depths range between 1½ and

6 feet. Bituminous pavement, organic sandy silt, slightly organic silty sand, silty sand with gravel, lean clay with sand, and sand with silt and gravel compose the existing fill. Between 7¼ and 9½ inches of bituminous pavement was encountered at the ground surface in the test borings advanced in existing pavement areas.

Fine alluvium layers between 2 and 7½ feet thick were encountered in test borings 09-02 and 09-07. The fine alluvium consists of sandy silt and sandy silty clay. The recorded N-values indicate the non-cohesive (silt) fine alluvium is medium dense to dense, and the cohesive (clay) fine alluvium has a very stiff consistency.

Coarse alluvium was encountered in test borings 09-03, 09-04, 09-06, and 09-09. The coarse alluvium layer thicknesses range from 2½ and 9½ feet. The coarse alluvium consists of silty sand with gravel, gravelly sand, sand with silt and gravel, and gravelly sand with silt. Sand with silt between approximately 4 and 5.2 feet in test boring 09-07 may be fill. Based on the recorded N-values, the coarse alluvium is medium dense to very dense.

Till was encountered in each of the test borings, and is composed of silty sand and silty sand with gravel. The silty sand between approximately 2 and 6 feet in test boring 09-05 may be fill. Apparent cobbles were encountered in the till in test borings 09-02 and 09-03. The recorded N-values indicate the till is mainly medium dense to dense.

Auger refusal was encountered in test boring 09-03 at a depth of 20 feet and in test boring 09-09 at a depth of 13 feet. Auger refusal may have been caused by a cobble, a boulder, or bedrock. The cause of auger refusal cannot be documented without performing rock coring.

### **Water Level Measurements**

Groundwater was encountered in test borings 09-02, 09-03, 09-04, 09-07, 09-09, and 09-10 between the depths of 4.4 and 16.5 feet after the boreholes were left open for up to 17 hours. Groundwater was not encountered in test borings 09-05, 09-06, or 09-08 during drilling or after the boreholes

were left open for 5 to 25 minutes. Based on the groundwater levels measured in the test borings, we anticipate groundwater may be present at frost-footing depth in some areas of the building excavation.

The silty sand, sandy silt, and sandy silty clay encountered in the test borings are considered slow draining to relatively impermeable, while the sand and sand with silt are considered fast draining and permeable. Groundwater will tend to flow through more permeable soils and perch on less permeable soils. Groundwater present in the less permeable soils may not have had enough time to collect and/or stabilize in the boreholes before they were abandoned. For this reason, water level measurements from the test borings may not be reliable for assessing the static groundwater level in the area. A discussion of the water level measurement methods is presented in the SUBSURFACE EXPLORATION section of this report.

Ground water levels usually fluctuate. Fluctuations occur due to varying seasonal and yearly rainfall and snow melt, as well as other factors.

## **LABORATORY TESTING**

Limited laboratory testing was performed on select samples from the test borings. Laboratory testing consisted of measuring moisture content. The moisture content of selected samples is listed on the test boring logs in the column labeled 'WC.'

## **GEOTECHNICAL CONSIDERATIONS**

The following considerations are the basis for the recommendations presented later in this report.

### **Review of Soil Properties**

#### **Strength/Stability**

The existing fill is considered to have low strength and stability under the anticipated building loads. This is due to the undocumented nature in which fill was placed and the presence of organics. The fine alluvium, coarse alluvium, and till soils are considered to have high strength and stability beneath the anticipated building loads. If the native soils become disturbed or are subjected to



excess moisture, the strength and stability of these soils may decrease.

### **Compressibility**

The existing fill soils are considered moderately to highly compressible beneath the anticipated structural loads. The coarse alluvium, fine alluvium, and till are considered to have moderately low to low compressibility potential.

### **Frost Susceptibility**

Silty sand, sandy silt, sandy silty clay, and soils containing organics are considered highly frost susceptible due to their silt and/or organic content. Sand with silt and lean clay are considered moderately frost susceptible, while the sand is not considered frost susceptible.

### **Drainage Properties**

The silty and clayey soils are considered to have a low permeability, and are slow to very slow draining. The sand and sand with silt soils are considered permeable, and are relatively fast draining.

## **RECOMMENDATIONS**

### **Grading Procedures**

#### **Excavation**

All existing fill and soils containing organics should be removed from the building foundation areas. All existing parking lot elements, such as bituminous pavement, curb, and gate structures, should also be removed from the building area. Any disturbed, wet, or soft soils should be removed from the foundation areas, as well. If an excavation extends below the bottom-of-foundation grade, a lateral zone of excavation should extend out horizontally at least 1 foot from the outside edge of perimeter foundations for every foot of new fill placed below the base of the footing (i.e. 1H:1V excavation oversize). This lateral oversize is to be measured at the base of the excavation, not at the surface.

The test borings indicate excavations may need to extend to depths of 6 feet in the building areas to remove existing fill. The required depths of excavation may be different than indicated by the test borings. Suitable excavation depths should be reviewed by a geotechnical engineer or engineering technician performing full-time observation and testing during site preparation.

### **Filling/Compaction**

Where fill is needed to attain building grades, engineered fill should be used. Engineered fill should be a non-organic, granular material void of frozen soil, boulders, and debris. Excavated on-site soils void of organics, boulders, and debris can also be used as engineered fill if these soils have a moisture content suitable for attaining required compaction levels. Laboratory testing of select test boring samples indicate moisture contents of some of the on-site soils may be too high to attain required compaction levels. If used as engineered fill, these soils may need to be conditioned and reworked to reduce their moisture content to levels required for suitable compaction. Reducing the moisture content in silty and clayey soils is typically difficult to accomplish in the Duluth area due to a climate with limited days of drying weather.

Engineered fill should be placed in thin loose lifts and compacted to at least 95% of the maximum Modified Proctor dry density (ASTM D1557). Please refer to the attached standard data sheet entitled "Excavation and Refilling for Structural Support" for general information regarding excavation and fill placement for foundation support.

### **Building Foundation Support**

After preparing the site according to the above building grading procedures, it is our judgment that wall and column loads for the proposed building can be supported by a spread footing system bearing on competent undisturbed fine alluvium, coarse alluvium, or till, or on engineered fill placed directly on these competent native soils. It is our opinion that strip footings and column footing pads placed on competent native soils, or compacted engineered fill placed directly on native soils, can be designed for an allowable bearing pressure of 5,000 psf. A coefficient of sliding friction of 0.45 can

be used between the foundations and native soils.

Strip footings should have a minimum width of 20 inches and column footings should have a minimum dimension of 3 feet. Perimeter footings supporting heated structures, and all footings supporting unheated structures, including the canopy, should extend at least 72 inches below final grade for frost protection. Interior column footings for heated structures should be embedded at least 12 inches below the bottom of the floor slab. A structure is considered heated if an indoor air temperature of at least 40° Fahrenheit is maintained year-round.

Faces of foundations supporting the canopy should be as smooth as possible to prevent adhesion of freezing soils to the sides of the foundations. A bond breaker, such as overlapping sheets of plastic, should be applied to foundation surfaces to minimize adhesion of frost susceptible soils.

It is our judgment that this foundation design will include a factor of safety of greater than 3 against shear or base failure. It is also our judgment that total and differential building settlement should be less than 1 inch and ½ inch, respectively.

### **Advanced Field Testing**

It is our opinion that foundations for the proposed terminal building can potentially be designed for foundation bearing pressures greater than 5,000 psf, based on previous geotechnical explorations AET has performed in similar soils in the Duluth area and at the Duluth International Airport. An advanced testing program AET uses to evaluate soils for heavy soil bearing pressures is in-situ testing with a pressuremeter (the pressuremeter test). We recommend performing pressuremeter testing if foundation loads exceeding 5,000 psf are considered for the proposed terminal building. Pressuremeter testing would be performed as a supplement to the test borings recently performed at the site.

## **North Wall Backfill and Drainage**

### **Excavation and Backfill**

Existing fill, including any elements of the existing terminal building, should be removed within 6 feet of the north building wall that is planned to be constructed into the hillside. Engineered fill should be used for backfill along the north wall. Backfill should consist of a non-frozen, granular material void of organics, boulders, rubble, and debris; also, clayey soils should be avoided as backfill behind the north wall.

To keep lateral earth pressures to a minimum, backfill within 6 horizontal feet of the wall should consist of non-frost susceptible (NFS) sand meeting the gradation in Table I, below. In green areas, the upper 1 foot of backfill should consist of a relatively impermeable soil, such as on-site soils or topsoil, to reduce infiltration of water into the backfill.

**Table I: Non-Frost Susceptible Engineered Fill Gradation Recommendation**

Sieve Size or Number	Percent Passing by Weight
2"	100
#4	90 - 100
#40	10 - 40
#200	0 - 6

Backfill in zones below future non-aircraft pavement areas should be compacted to at least 90% of the Modified Proctor density. In future aircraft pavement areas, backfill should meet aircraft pavement design criteria for soil gradations and compaction levels. Compaction should be observed by a geotechnical engineer or engineering technician under the supervision of a geotechnical engineer.

### **Drainage**

Suitable drainage should be provided behind the north wall to keep moisture from collecting in the backfill. Moisture retained in the backfill adds to the lateral pressure exerted on the wall. Also, upon freezing, additional pressures can be exerted on the wall from the expansion of moisture in the backfill. The drainage system should allow infiltrating moisture (from both the ground surface and hillside) to migrate through the backfill to a drainage system at the base of the wall. Drainage along the wall can be accomplished by entirely backfilling with free-draining sand, or incorporating layers and/or zones of free-draining sand and/or geosynthetic drainage mats in the backfill. The NFS engineered fill specified by the gradation in Table I is considered free-draining fill.

### **Retaining Walls**

#### **Sheetpile Walls**

The encountered soil conditions indicate that installation of sheetpile for the retaining walls may be limited by the dense to very dense till soils that were encountered in the test borings. As indicated in two of the test borings performed at the terminal building site, and based on past projects at the airport, boulders and cobbles are common in the till soils in the airport area. The presence of boulders and cobbles can also cause construction difficulties such as sheetpile obstruction or deflection.

If sheetpile are installed for the retaining walls, the grading, backfill, and drainage should follow the recommendations in the 'North Wall Backfill and Drainage' section.

#### **MSE Walls**

It is our opinion the site is suitable for MSE wall construction. Grading procedures, backfill integrated into the MSE wall system, and backfill drainage should also follow the recommendations described above in the 'North Wall Backfill and Drainage' section. Grading procedures should encompass the entire area of reinforced soil. Design of reinforcement and facing may also influence the selection of wall backfill type.

MSE wall reinforcement and facing are typically designed by an MSE wall contractor. Selection of MSE wall facing should consider exposure to deicing chemicals from the aircraft apron, and from any parking areas near the walls. Some MSE wall designs also include a footing to support the wall facing and reduce the potential for direct impacts to the facing from maintenance equipment, such as snow plows. Similar to the building footings, MSE wall footings can be designed for an allowable bearing pressure of 5,000 psf if constructed on competent, native soils or engineered fill over native soils.

### **Lateral Earth Pressures**

Lateral earth pressures acting upon north terminal wall and retaining walls will differ depending on the backfill composition. Table II below provides lateral earth pressure recommendations for NFS sand, and Table III provides lateral earth pressure recommendations for silty sand soil (e.g. till soils at the site). Backfill soils other than those listed below will result in different earth pressure values. The values shown in Tables II and III also do not include any surcharge loads that may be present behind the north building wall and retaining walls, such as surcharge loads from aircraft, the aircraft pavement section, and aircraft support vehicles and equipment.

**Table II: Estimated Lateral Earth Pressure Parameters for NFS Engineered Fill**

<b>Soil Condition</b>	<b>Coefficient of Lateral Earth Pressure</b>	<b>Equivalent Fluid Weight - Drained (pcf)</b>	<b>Equivalent Fluid Weight - Saturated (pcf)</b>
At Rest	0.47	55	88
Active	0.31	40	80
Passive	3.25	390	235

**Table III: Estimated Lateral Earth Pressure Parameters for Silty Sand Soil**

<b>Soil Condition</b>	<b>Coefficient of Lateral Earth Pressure</b>	<b>Equivalent Fluid Weight - Drained (pcf)</b>	<b>Equivalent Fluid Weight - Saturated (pcf)</b>
At Rest	0.5	65	95
Active	0.33	45	85
Passive	3.0	390	265

### **Floor Slab Support**

Excavation of unsuitable soils from the building areas, and replacement of the excavated soils with engineered fill as described above, will prepare the area for floor slab support. If the floor slab is constructed over existing fill, there is a potential for cracking to occur in the slab. The risk of cracking can be reduced by removing the existing fill from floor slab areas. The risk of floor slab cracking can also be reduced in unheated areas by removing frost susceptible soils to a depth of 6 feet below final grade, and backfilling with NFS sand.

The floor slab should be constructed on a layer of clean sand fill meeting the gradation for NFS sand in Table I. The clean sand layer should have a thickness of at least 6 inches to provide a capillary break for moisture. All engineered fill supporting the floor slab should be compacted to a minimum of 95% of Modified Proctor density. This includes utility and foundation trench backfill in floor slab areas.

A value of  $300 \text{ lb/in}^3$  can be used as the modulus of subgrade reaction for floor slab design over the recommended engineered fill. If moisture sensitive floor coverings are used, a polyethylene vapor membrane can provide added moisture protection beneath the floor slab. For standard recommendations pertaining to moisture and vapor protection of the building floor slab, we refer you to the attached standard sheet entitled "Floor Slab Moisture/Vapor Protection."

### **Site Drainage**

We recommend that site grades be established that promote drainage of surface water away from the

planned terminal building. Also, the building should be equipped with a sufficient collection system that collects precipitation from the roof and directs it away from the building and associated pavement areas.

### **Utility Construction**

Care should be taken to ensure that utilities outside the building are designed with sufficient flexibility to accommodate potential differential movements than can occur between frozen and unfrozen soils. As utilities enter building areas, they cross a transition from a frost susceptible zone to a zone not susceptible to freezing, which can result in local differential movement within the transition zone. We recommend that utility lines be provided with a minimum of 7 feet of soil cover for protection from frost. If utilities are placed at shallower depths, they should be protected from frost with insulation.

Standard data sheets entitled “Standard Recommendations for Utility Trench Backfilling” and “Bedding/Foundation Support of Buried Pipe” are also included with this report. These standard sheets provide recommendations for backfill materials and placement of backfill in trenches.

## **CONSTRUCTION CONSIDERATIONS**

### **Potential Difficulties**

#### **Cobbles and Boulders**

Apparent cobbles were encountered in two test borings, and auger refusal was encountered in test borings 09-03 and 09-09. Cobbles and boulders are common in till soils, and shallow bedrock has been observed in past excavations at the airport. Cobbles, boulders, or bedrock may be present within planned excavation areas, and could present excavation difficulties or problems for the construction of the building and underground utilities.

#### **Runoff Water in Excavations**

The silty and clayey soils encountered in the borings are likely to perch water during periods of wet



weather. To allow observation of the excavation bottom, reduce the potential for soil disturbance, and to facilitate filling operations, we recommend that all free-standing water within the excavations be removed prior to proceeding with construction. Based on the soils encountered, we anticipate that any groundwater which enters the excavations can be handled with conventional sump pumping.

### **Soil Disturbance**

The soils encountered in the test borings are susceptible to disturbance and weakening when exposed to construction equipment and/or foot traffic, especially when moist or saturated. If soils do become disturbed, they should be carefully excavated and be replaced with compacted, engineered fill.

### **Cold Weather Construction**

If construction occurs during freezing temperatures, there are certain precautions that should be considered for placement of fill and backfilling around structures. We refer you to the attached sheet entitled “Freezing Weather Effects on Building Construction” for information regarding cold weather precautions.

### **Temporary Sidesloping and Shoring**

Temporary sideslopes should be excavated in accordance with OSHA Regulations (Standards 29 CFR), Part 1926, Subpart P, “Excavations” (can be found on [www.osha.gov](http://www.osha.gov)). Sideslopes should be protected to prevent erosion. Further testing and geotechnical review should be performed where temporary sideslopes are designed to be steeper than OSHA Regulations applicable to site soil types.

If used, temporary shoring should be designed by a professional structural engineer. Geotechnical recommendations for temporary shoring are beyond the scope of services for this report, but can be provided by AET, if requested.

### **Observation and Testing**

The recommendations in this report are based on the subsurface conditions found at our test boring locations. Since the soil conditions can be expected to vary away from the soil boring locations, we

recommend on-site observations by a geotechnical engineer, or the engineer's representative, during construction to evaluate the effect of these potential changes.

We recommend that all foundation excavations be observed by a geotechnical engineer immediately prior to placement of engineered fill or concrete. The soils at the site are very susceptible to disturbance from moisture or construction traffic, and should be protected until a final observation can be made immediately prior to engineered fill or concrete. Soil density testing should also be performed on all fill placed at the site to document that project recommendations or specifications for compaction and moisture have been satisfied. Where fill material type is important, sieve analysis tests should be performed to document the actual fill meets the recommended gradation criteria.

## **SUBSURFACE EXPLORATION**

### **General**

Our subsurface exploration program included advancing ten standard penetration test (SPT) borings at the site on September 15<sup>th</sup> and 16<sup>th</sup>, 2009. The approximate locations of the borings are shown on the Figure 1 sketch in the Appendix. The test boring elevations were not available as of the date of this report.

### **Drilling Methods**

The standard penetration test borings were advanced using 3¼ inch inside diameter hollow stem augers. The boreholes were backfilled in compliance with Minnesota Department of Health regulations.

### **Sampling Methods**

#### **Split-Spoon Samples (SS)**

Standard Penetration (split-spoon) samples were collected in general accordance with ASTM D1586. This method consists of driving a 2" O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30". The sampler is driven a total of 18" into the soil.

After an initial set of 6 inches, the number of hammer blows to drive the sampler the final 12 inches is known as the Standard Penetration resistance or N-value.

### **Sampling Limitations**

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

### **Classification Methods**

Soil classifications shown on the boring logs are generally based on the Unified Soil Classification System (USCS). The USCS is described in ASTM D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, classifications per ASTM D2487 are possible. Otherwise, soil classifications shown on the boring logs are visual-manual judgments. We have attached charts in the Appendix illustrating the USCS, the descriptive terminology, and the symbols used on the boring logs.

The boring logs include judgments of the geologic depositional origin. This judgment is primarily based on observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation and development can sometimes aid this judgment.

### **Water Level Observations**

The water level measurements are shown at the bottom of the boring logs. The following information appears under “Water Level Measurements” on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered

- **Drilling Fluid Level:** same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

### **Sample Storage**

We will retain representative samples of the soils recovered from the borings for a period of 30 days. The samples will then be discarded unless you notify us otherwise.

## **LIMITATIONS**

The data derived through the exploration program have been used to develop our opinions about the subsurface conditions at your site. However, because no exploration program can reveal totally what is in the subsurface, conditions between borings and between samples and at other times, may differ from conditions described in this report. The exploration we conducted identified subsurface conditions only at those points where we took samples or observed ground water conditions. Depending on the sampling methods and sampling frequency, every soil layer may not be observed, and some materials or layers which are present in the ground may not be noted on the boring logs.

If conditions encountered during construction differ from those indicated by our borings, it may be necessary to alter our conclusions and recommendations, or to modify construction procedures, and the cost of construction may be affected.

The extent and detail of information about the subsurface condition are directly related to the scope of the exploration. It should be understood, therefore, that information can be obtained by means of additional exploration.

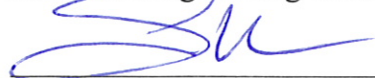
## **STANDARD OF CARE**

Our services for your project have been conducted to those standards considered normal for services of this type at this time and location. Other than this, no warranty, express or implied, is intended.

## **SIGNATURES**

We have appreciated the opportunity to provide our services for this project. If you have questions regarding this report, or if we may provide additional assistance, please contact us.

Report Prepared by:  
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Report Reviewed by:  
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Senior Geotechnical Engineer

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## **EXCAVATION AND REFILLING FOR STRUCTURAL SUPPORT**

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### **EXCAVATION**

Excavations for structural support at soil boring locations should be taken to depths recommended in the geotechnical report. Since conditions can vary, recommended excavation depths between and beyond the boring locations should be evaluated by geotechnical field personnel. If ground water is present, the excavation should be dewatered to avoid the risk of unobservable poor soils being left in-place. Excavation base soils may become disturbed due to construction traffic, ground water or other reasons. Such soils should be subcut to underlying undisturbed soils. Where the excavation base slopes steeper than 4:1, the excavation bottom should be benched across the slope parallel to the excavation contour.

Soil stresses under footings spread out with depth. Therefore, the excavation bottom and subsequent fill system should be laterally oversized beyond footing edges to support the footing stresses. A lateral oversize equal to the depth of fill below the footing (i.e., 1:1 oversize) is usually recommended. The lateral oversize is usually increased to 1.5:1 where compressible organic soils are exposed on the excavation sides. Variations in oversize requirements may be recommended in the geotechnical report or can be evaluated by the geotechnical field personnel.

Unless the excavation is retained, the backslopes should be maintained in accordance with OSHA Regulations (Standards - 29 CFR), Part 1926, Subpart P, "Excavations" (found on [www.osha.gov](http://www.osha.gov)). Even with the required OSHA sloping, ground water can induce sideslope raveling or running which could require that flatter slopes or other approaches be used.

### **FILLING**

Filling should proceed only after the excavation bottom has been approved by the geotechnical engineer/technician. Approved fill material should be uniformly compacted in thin lifts to the compaction levels specified in the geotechnical report. The lift thickness should be thin enough to achieve specified compaction through the full lift thickness with the compaction equipment utilized. Typical thicknesses are 6" to 9" for clays and 12" to 18" for sands. Fine grained soils are moisture sensitive and are often wet (water content exceeds the "optimum moisture content" defined by a Proctor test). In this case, the soils should be scarified and dried to achieve a water content suitable for compaction. This drying process can be time consuming, labor intensive, and requires favorable weather.

Select fill material may be needed where the excavation bottom is sensitive to disturbance or where standing water is present. Sands (SP) which are medium to coarse grained are preferred, and can be compacted in thicker lift thicknesses than finer grained soils.

Filling operations for structural support should be closely monitored for fill type and compaction by a geotechnical technician. Monitoring should be on a full-time basis in cases where vertical fill placement is rapid; during freezing weather conditions; where ground water is present; or where sensitive bottom conditions are present.

### **EXCAVATION/REFILLING DURING FREEZING TEMPERATURES**

Soils that freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density loss depends on the soil type and moisture condition; and is most pronounced in clays and silts. Foundations, slabs, and other improvements should be protected from frost intrusion during freezing weather. For earthwork during freezing weather, the areas to be filled should be stripped of frozen soil, snow and ice prior to new fill placement. In addition, new fill should not be allowed to freeze during or after placement. For this reason, it may be preferable to do earthwork operations in small plan areas so grade can be quickly attained instead of large areas where much frost stripping may be needed.

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## FLOOR SLAB MOISTURE/VAPOR PROTECTION

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Floor slab design relative to moisture/vapor protection should consider the type and location of two elements, a granular layer and a vapor membrane (vapor retarder, water resistant barrier or vapor barrier). In the following sections, the pros and cons of the possible options regarding these elements will be presented, such that you and your specifier can make an engineering decision based on the benefits and costs of the choices.

### **GRANULAR LAYER**

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In American Concrete Institute (ACI) 302.1-96, a “base material” is recommended, rather than the conventional cleaner “sand cushion” material. The manual maintains that clean sand (common “cushion” sand) is difficult to compact and maintain until concrete placement is complete. ACI recommends a clean, fine graded material (with at least 10% to 30% of particles passing a #100 sieve) which is not contaminated with clay, silt or organic material. We refer you to ACI 302.1-96 for additional details regarding the requirements for the base material.

In cases where potential static water levels or significant perched water sources appear near or above the floor slab, an underfloor drainage system may be needed wherein a draitile system is placed within a thicker clean sand or gravel layer. Such a system should be properly engineered depending on subgrade soil types and rate/head of water inflow.

### **VAPOR MEMBRANE**

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The need for a vapor membrane depends on whether the floor slab will have a vapor sensitive covering, will have vapor sensitive items stored on the slab, or if the space above the slab will be a humidity controlled area. If the project does not have this vapor sensitivity or moisture control need, placement of a vapor membrane may not be necessary. Your decision will then relate to whether to use the ACI base material or a conventional sand cushion layer. However, if any of the above sensitivity issues apply, placement of a vapor membrane is recommended. Some floor covering systems (adhesives and flooring materials) require a vapor membrane to maintain a specified maximum slab moisture content as a condition of their warranty.

### **VAPOR MEMBRANE/GRANULAR LAYER PLACEMENT**

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A number of issues should be considered when deciding whether to place the vapor membrane above or below the granular layer. The benefits of placing the slab on a granular layer, with the vapor membrane placed **below** the granular layer, include **reduction** of the following:

- Slab curling during the curing and drying process.
- Time of bleeding, which allows for quicker finishing.
- Vapor membrane puncturing.
- Surface blistering or delamination caused by an extended bleeding period.
- Cracking caused by plastic or drying shrinkage.

The benefits of placing the vapor membrane **over** the granular layer include the following:

- The moisture emission rate is achieved faster.
- Eliminates a potential water reservoir within the granular layer above the membrane.
- Provides a “slip surface”, thereby reducing slab restraint and the associated random cracking.

If a membrane is to be used in conjunction with a granular layer, the approach recommended depends on slab usage and the construction schedule. The vapor membrane should be placed above the granular layer when:

- Vapor sensitive floor covering systems are used or vapor sensitive items will be directly placed on the slab.
- The area will be humidity controlled, but the slab will be placed before the building is enclosed and sealed from rain.
- Required by a floor covering manufacturer’s system warranty.

The vapor membrane should be placed below the granular layer when:

- Used in humidity controlled areas (without vapor sensitive coverings/stored items), with the roof membrane in place, and the building enclosed to the point where precipitation will not intrude into the slab area. Consideration should be given to slight sloping of the membrane to edges where draitile or other disposal methods can alleviate potential water sources, such as pipe or roof leaks, foundation wall damp proofing failure, fire sprinkler system activation, etc.

There may be cases where membrane placement may have a detrimental effect on the subgrade support system (e.g., expansive soils). In these cases, your decision will need to weigh the cost of subgrade options and the performance risks.

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## **STANDARD RECOMMENDATIONS FOR UTILITY TRENCH BACKFILLING**

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### **GENERAL**

Clayey and silty soils are often difficult to compact, as they may be naturally wet or may become wet due to ground water or surface/rain water during construction. Soils will need to be placed within a certain range of water (moisture) content to attain desired compaction levels. Moisture conditioning to within this range can be time consuming, labor intensive, and requires favorable weather.

The degree of compaction and the soil type used for backfill within open cut utility trenches depends on the function of the overlying land surface. Details are as follows:

### **ROADWAYS**

Where trenches are located below roadways, we recommend using inorganic fill and compacting these soils per Mn/DOT Specification 2105.3F1 (Specified Density Method). This specification requires 100% of the Standard Proctor density in the upper one meter subgrade zone, and 95% below this. Note that this specification includes moisture content range requirements which are important for proper subgrade stability.

Where available soils are wet or of poor quality, it may be possible to use the "Quality Compaction Method" (Mn/DOT Specification 2105.3F2) for soils below the upper one meter subgrade zone if you can tolerate some subsidence. However, a high level of stability is still important within the upper subgrade zone and recommend that the "Specified Density Method" be used in this upper subgrade area. We caution that if backfill soils in the lower trench area are significantly unstable, it may be difficult or even impossible to properly compact soils within the upper one meter subgrade zone. In this case, placing a geotextile fabric directly over the unstable soils can aid in offsetting the instability.

### **STRUCTURAL AREAS**

If fill is placed beneath or within the significant zone of influence of a structure (typically a 1:1 lateral oversize zone), the soil type and minimum compaction level will need to be evaluated on an individual basis. Because trenches result in variable fill depths over a short lateral distance, higher than normal compaction levels and/or more favorable (sandy) soil fill types may be needed. If this situation exists, it is important that special geotechnical engineering review be performed.

### **NON-STRUCTURAL AREAS**

In grass/ditch areas, backfill soils should be placed in reasonable lift thicknesses and compacted to a minimum of 90% of the Standard Proctor density (ASTM:D698) and/or per the Mn/DOT "Quality Compaction Method." If lower compaction levels are attained, more noticeable subsidence at the surface can occur. Steep or high slopes require special consideration.



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## BEDDING/FOUNDATION SUPPORT OF BURIED PIPE

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### **GENERAL**

This page addresses soil bedding and foundation support of rigid pipe, such as reinforced concrete, and flexible pipe, such as steel and plastic. This does not address selection of pipe based on loads and allowable deflections, but rather addresses the geotechnical/soil aspects of uniform pipe support. Bedding/foundation support needs relate to local conditions directly beneath and to the sides of the pipe zone, which may be influenced by soft in-situ ground conditions or by soil disturbance due to soil sensitivity or ground water. Bedding relates to granular materials placed directly beneath the bottom of the pipe (usually 4" to 6" thick), which is intended to provide increased support uniformity. We refer to foundation soils as thicker layers of sands and/or gravels (beneath the bedding zone) intended to provide increased foundation strength support, usually needed due to soft, unstable and/or waterbearing conditions.

### **GRANULAR BEDDING**

With circular pipes, high local loads (approaching point loads) develop if pipes are placed on hard surfaces. Load distribution is improved by placing granular bedding materials beneath the pipe, which are either shaped to match the pipe bottom or are placed without compaction to allow "settling in." The bedding should be placed in such a manner that the pipe will be at the proper elevation and slope when the pipe is laid on the bedding. Common bedding material is defined in Mn/DOT Specification 3149.2F, Granular Bedding. Published documents recommend rigid pipes having a diameter of 12" to 54" be placed on a bedding thickness of 4", which increases to 6" of bedding for pipe diameters ranging from 54" to 72". Beyond a 72" diameter, the bedding thickness can be equal to the pipe outside diameter divided by 12. Typically, the need for bedding under small diameter pipes (less than 12") depends on the pipe designer's specific needs, although in obvious point loads situations (bedrock, cobbles, significant coarse gravel content), bedding is recommended. Note that bedding should also account for larger diameter bells at joints.

### **FOUNDATION FILL**

Positive uniform strength is usually compromised in soft or unstable trench bottom conditions. In this case, deeper subcuts and foundation fill placement is needed beneath the pipe. In moderate instability conditions, improvement can likely be accomplished with a thicker bedding layer. However, in more significant instability situations, particularly where ground water is present, coarser materials may be needed to provide a stronger foundation. Thicker gravel layers can also be a favorable media from which to dewater. The following materials would be appropriate for stability improvement, with the coarser materials being appropriate for higher instability/ground water cases.

- C Fine Filter Aggregate – Mn/DOT Specification 3149.2J

- C Coarse Filter Aggregate –Mn/DOT Specification 3149.2H

When using a coarser material which includes significant void space, we highly recommend enveloping the entire gravel layer within a geotextile fabric. The gravel material includes open void space, and the fabric acts as a separator which minimizes the intrusion of fines into the open void space. If an additional granular bedding sand is used above foundation gravel, the fabric would also prevent downward infiltration of bedding sand into the rock void space.

Although it is preferred to not highly compact thin granular bedding zones directly beneath the pipe center, it is desirable to compact the foundation materials to prevent more significant pipe settlement. We recommend foundation fill be compacted to a minimum of 95% of the Standard Proctor density (ASTM:D698). It is not possible to test coarse rock fill, although this material should still be well compacted/ tamped.

Often, pipes entering structures such as catch basins, lift stations, etc., enter the structure at a higher elevation than the structure bottom, and are therefore placed on the structure backfill. Fill beneath these pipes should be considered foundation fill. Depending on the flexibility of the connection design, it may be necessary to increase the minimum compaction level to reduce differential settlements, particularly with thicker fills.

### **SIDE FILL SUPPORT**

If the pipe designer requires support from the side fill, granular bedding should also be placed along the sides of the pipe. In poor soil conditions, the sand fill may need to be placed laterally up to two pipe diameters on both sides of the pipe. With rigid pipe, compacted sand placement up to the spring line (within the haunch area) is usually sufficient. With flexible pipe, side fill should be placed and compacted at least to the top of the pipe. For positive support, it is very important to properly compact the sands within the haunch area.

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## **FREEZING WEATHER EFFECTS ON BUILDING CONSTRUCTION**

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### **GENERAL**

Because water expands upon freezing and soils contain water, soils which are allowed to freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density/strength loss depends on the soil type and moisture condition. Heave is greater in soils with higher percentages of fines (silts/clays). High silt content soils are most susceptible, due to their high capillary rise potential which can create ice lenses. Fine grained soils generally heave about 1/4" to 3/8" for each foot of frost penetration. This can translate to 1" to 2" of total frost heave. This total amount can be significantly greater if ice lensing occurs.

### **DESIGN CONSIDERATIONS**

Clayey and silty soils can be used as perimeter backfill, although the effect of their poor drainage and frost properties should be considered. Basement areas will have special drainage and lateral load requirements which are not discussed here. Frost heave may be critical in doorway areas. Stoops or sidewalks adjacent to doorways could be designed as structural slabs supported on frost footings with void spaces below. With this design, movements may then occur between the structural slab and the adjacent on-grade slabs. Non-frost susceptible sands (with less than 12% passing a #200 sieve) can be used below such areas. Depending on the function of surrounding areas, the sand layer may need a thickness transition away from the area where movement is critical. With sand placement over slower draining soils, subsurface drainage would be needed for the sand layer. High density extruded insulation could be used within the sand to reduce frost penetration, thereby reducing the sand thickness needed. We caution that insulation placed near the surface can increase the potential for ice glazing of the surface.

The possible effects of adfreezing should be considered if clayey or silty soils are used as backfill. Adfreezing occurs when backfill adheres to rough surfaced foundation walls and lifts the wall as it freezes and heaves. This occurrence is most common with masonry block walls, unheated or poorly heated building situations and clay backfill. The potential is also increased where backfill soils are poorly compacted and become saturated. The risk of adfreezing can be decreased by placing a low friction separating layer between the wall and backfill.

Adfreezing can occur on exterior piers (such as deck, fence or other similar pier footings), even if a smooth surface is provided. This is more likely in poor drainage situations where soils become saturated. Additional footing embedment and/or widened footings below the frost zones (which include tensile reinforcement) can be used to resist uplift forces. Specific designs would require individual analysis.

### **CONSTRUCTION CONSIDERATIONS**

Foundations, slabs and other improvements which may be affected by frost movements should be insulated from frost penetration during freezing weather. If filling takes place during freezing weather, all frozen soils, snow and ice should be stripped from areas to be filled prior to new fill placement. The new fill should not be allowed to freeze during transit, placement or compaction. This should be considered in the project scheduling, budgeting and quantity estimating. It is usually beneficial to perform cold weather earthwork operations in small areas where grade can be attained quickly rather than working larger areas where a greater amount of frost stripping may be needed. If slab subgrade areas freeze, we recommend the subgrade be thawed prior to floor slab placement. The frost action may also require reworking and recompaction of the thawed subgrade.

# *Appendix*

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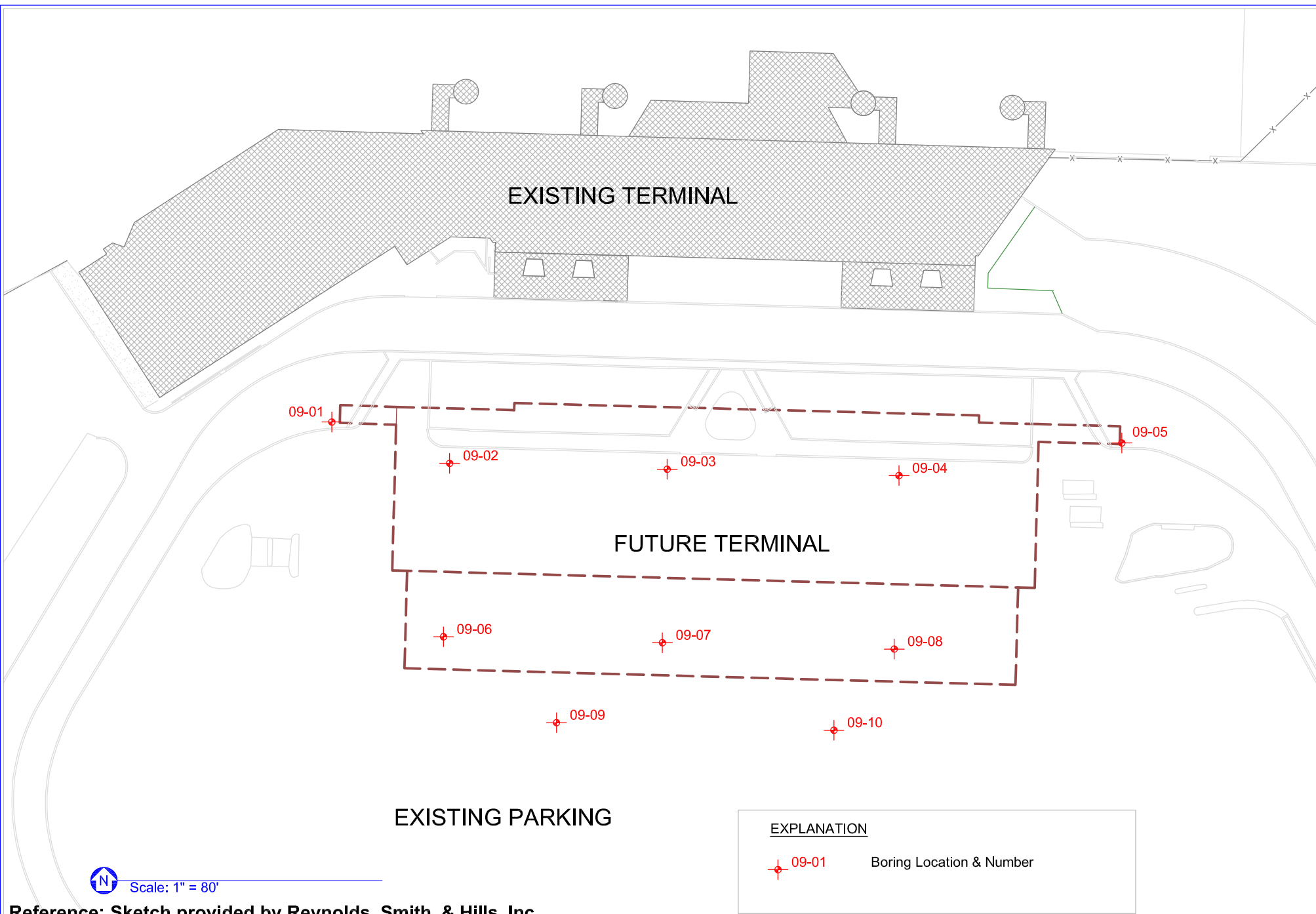
Figure 1 –Approximate Test Boring Locations

Logs of Test Borings

Boring Log Notes

Unified Soil Classification System

Geologic Terminology



Reference: Sketch provided by Reynolds, Smith, & Hills, Inc.

➔	PROJECT NO.	07-04216.02	APPROXIMATE BORING LOCATIONS
	ALTERED BY:	DWA	
	CHECKED BY:		
	DATE:	10/06/09	

DULUTH INTERNATIONAL AIRPORT TERMINAL  
Duluth, Minnesota





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# SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04216.2**

LOG OF BORING NO. **09-01 (p. 1 of 1)**

PROJECT: **Duluth International Airport Terminal; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: _____ MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DD	LL	PL	%-#200
1	FILL, organic sandy silt with roots, dark brown	FILL		M	SU						
2	FILL, coarse sand and gravel, dark brown (pea rock)			M	SS	3					
3			4	M	SS						
4	SILTY SAND, dark brown, moist, medium dense (SM)	TILL		M	SS	16	11				
5			21	M	SS						
6				M	SS	18					
7	SILTY SAND, a little gravel, dark brown, moist to wet, medium dense (SM)		18	M	SS						
8				M	SS	12					
9			23	M	SS						
10				M	SS	0					
11	SILTY SAND, dark brown, moist with wet lenses, very dense to dense (SM)		60	M	SS						
12				M	SS	9					
13			46	W	SS						
14											
15											
16	<b>END OF BORING AT 16.0 FEET</b> Borehole backfilled with auger cuttings										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
<b>0-14½'</b>	<b>3.25" HSA</b>	<b>9/16/09</b>	<b>8:43</b>	<b>13.5</b>	<b>12.0</b>	<b>11.8</b>	<b>---</b>	<b>11.0</b>	
		<b>9/16/09</b>	<b>8:50</b>	<b>16.0</b>	<b>14.5</b>	<b>14.5</b>	<b>---</b>	<b>11.4</b>	
BORING COMPLETED: <b>9/16/09</b>		<b>9/16/09</b>	<b>8:59</b>	<b>16.0</b>	<b>None</b>	<b>3.0</b>	<b>---</b>	<b>None</b>	
DR: <b>LA</b> LG: <b>TDD</b> Rig: <b>51</b>									



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# SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04216.2**

LOG OF BORING NO. **09-02 (p. 1 of 1)**

PROJECT: **Duluth International Airport Terminal; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: _____ MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DD	LL	PL	%-#200
	Bituminous Pavement - 9½" thickness	PAVEMENT			SU						
1	FILL, silty sand with gravel, dark brown	FILL	12	M	SS	2					
2	FILL, lean clay with sand, a little gravel, reddish brown		8	M	SS	8					
3	SILTY SAND, a little gravel, dark brown, moist, medium dense to dense, lenses of sandy silt below about 8' (SM)		17	M	SS	13	12				
4		TILL	31	M	SS	13					
5			22	M	SS	16					
6											
7											
8											
9	SANDY SILT, dark brown, moist, medium dense (ML)	FINE ALLUVIUM	24	M	SS	16					
10			31	M	SS	14					
11	SANDY SILT, dark brown, moist, dense, laminations of light brown fine grained sand and reddish brown lean clay (ML)		44	M/W	SS	17					
12											
13											
14		TILL	22/0.5'	M	SS	4					
15			50/0.2'								
16											
17											
18											
19	SILTY SAND WITH GRAVEL, apparent cobbles, dark brown, moist with wet lenses, dense (SM)	TILL									
20											
21											
22											
23											
24											
25	<b>END OF BORING AT 25.2 FEET</b> Borehole backfilled with auger cuttings and bituminous patch										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
<b>0-24½'</b>	<b>3.25" HSA</b>								
		9/15/09	10:22	25.2	24.5	25.2	---	None	
		9/15/09	10:35	25.2	None	20.0	---	None	
BORING COMPLETED: 9/16/09		9/15/09	15:30	25.2	None	17.0	---	16.0	
DR: LA LG: TDD Rig: 51		9/16/09	9:10	25.2	None	4.5	---	4.4	













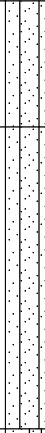







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# SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04216.2**

LOG OF BORING NO. **09-03 (p. 1 of 1)**

PROJECT: **Duluth International Airport Terminal; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: _____ MATERIAL DESCRIPTION		GEOLOGY	N	MC		SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS						
									WC	DD	LL	PL	%-#200		
1	Bituminous Pavement - 8" thickness		PAVEMENT				SU								
2	FILL, sand with silt and gravel, dark brown		FILL		M		SU								
3	SILTY SAND WITH GRAVEL, dark brown, moist, medium dense (SM)		COARSE ALLUVIUM	21	M		SS	14							
4															
5				GRAVELLY SAND, medium to coarse grained, brown, moist, dense to very dense (SP)		32	M		SS	9					
6															
7															
8	GRAVELLY SILTY SAND, brown, moist with wet lenses, very dense (SM)		TILL	58			SS	9							
9															
10															
11															
12	SILTY SAND WITH GRAVEL, apparent cobbles, dark brown, moist with wet lenses to wet, very dense (SM)		TILL	74	M/W		SS	5							
13															
14															
15															
16	GRAVELLY SAND WITH SILT, dark brown, wet (SP-SM)		TILL	67	M/W		SS	10							
17															
18															
19															
20	50/0.2'	W		SS	2										
AUGER REFUSAL AT 20.0 FEET Borehole backfilled with auger cuttings and bituminous patch															

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-20'	3.25" HSA	9/15/09	11:15	13.5	12.0	12.0	---	11.5	
		9/15/09	11:23	16.0	14.5	14.7	---	7.7	
BORING COMPLETED: 9/15/09		9/15/09	12:06	16.0	None	6.5	---	6.4	
DR: LA LG: TDD Rig: 51									



# SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04216.2**

LOG OF BORING NO. **09-04 (p. 1 of 1)**

PROJECT: **Duluth International Airport Terminal; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: _____ MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DD	LL	PL	%-#200
1	Bituminous Pavement - 7/4" thickness	PAVEMENT									
2	FILL, silty sand with gravel, dark brown	FILL		M	SU						
3	SANDY SILT, light brown, moist (ML)										
4	LEAN CLAY, reddish brown, laminations of silt (CL)	FINE ALLUVIUM	9	M	SS	16					
5	SILTY SAND, a little gravel, fine to medium grained, dark brown, moist (SM)	COARSE ALLUVIUM	33	M	SS	8					
6	SILTY SAND, a little gravel, dark brown, moist with wet lenses, medium dense, lenses of silty clay below about 9' (SM)		15	M/W	SS	18	13				
7											
8											
9											
10		TILL	4/0.5' 16/0.5' 50/0.2'	M/W	SS	8					
11	SILTY SAND WITH GRAVEL, dark brown, moist with wet lenses, medium dense, lenses of gravelly sand with silt and silty clayey sand with gravel (SM)		18	M/W	SS	13					
12											
13											
14	GRAVELLY SAND WITH SILT, fine to coarse grained, dark brown, wet, medium dense (SP-SM)	COARSE ALLUVIUM	19	W	SS	5					
15											
16											
17											
18											
19	SILTY SAND WITH GRAVEL, dark brown, wet, dense to very dense (SM)		42	W	SS	7					
20											
21											
22		TILL									
23											
24											
25			56	W	SS	11					
26	<b>END OF BORING AT 26.0 FEET</b> Borehole backfilled with auger cuttings and bituminous patch										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
<b>0-24 1/2'</b>	<b>3.25" HSA</b>	<b>9/15/09</b>	<b>13:43</b>	<b>21.0</b>	<b>19.5</b>	<b>20.5</b>	<b>---</b>	<b>13.8</b>	
		<b>9/15/09</b>	<b>14:09</b>	<b>26.0</b>	<b>None</b>	<b>16.0</b>	<b>---</b>	<b>11.0</b>	
BORING COMPLETED: <b>9/15/09</b>									
DR: <b>LA</b> LG: <b>TDD</b> Rig: <b>51</b>									





# SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04216.2**

LOG OF BORING NO. **09-05 (p. 1 of 1)**

PROJECT: **Duluth International Airport Terminal; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: _____ MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DD	LL	PL	%-#200
1	FILL, slightly organic silty sand with roots, dark brown	FILL	15	M	SU	15					
2	FILL, medium to coarse sand with gravel, brown			M	SS						
3	SILTY SAND WITH GRAVEL, dark brown, moist, medium dense, trace roots above about 2.5' (SM) (may be fill)	TILL OR FILL	14	M	SS	11					
4				M	SS						
5				M	SS						
6	SILTY SAND, a little gravel, dark brown, moist, medium dense (SM)	TILL	22	M	SS	11					
7				M	SS						
8				M	SS						
9	SILTY SAND WITH GRAVEL, dark brown, moist, dense (SM)	TILL	30	M	SS	15					
10				M	SS						
11				M	SS						
12	SILTY SAND, a little gravel, dark brown, moist, medium dense (SM)	TILL	37	M	SS	5					
13				M	SS						
14				M	SS						
15	SILTY SAND, a little gravel, dark brown, moist, medium dense (SM)	TILL	29	M	SS	17					
16				M	SS						
16	<b>END OF BORING AT 16.0 FEET</b> Borehole backfilled with auger cuttings										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
<b>0-14½'</b>	<b>3.25" HSA</b>	<b>9/15/09</b>	<b>14:57</b>	<b>16.0</b>	<b>14.5</b>	<b>15.0</b>	<b>---</b>	<b>None</b>	
		<b>9/15/09</b>	<b>15:03</b>	<b>16.0</b>	<b>None</b>	<b>12.7</b>	<b>---</b>	<b>None</b>	
BORING COMPLETED: <b>9/15/09</b>									
DR: <b>LA</b> LG: <b>TDD</b> Rig: <b>51</b>									











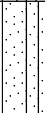








# SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04216.2**

LOG OF BORING NO. **09-06 (p. 1 of 1)**

PROJECT: **Duluth International Airport Terminal; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: _____ MATERIAL DESCRIPTION		GEOLOGY	N	MC		SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
									WC	DD	LL	PL	%-#200
1	Bituminous Pavement - 8½" thickness		PAVEMENT		M		SU						
2	FILL, silty sand with gravel, dark brown		FILL	14	M		SS	8					
3	SILTY SAND, a little gravel, dark brown, moist, medium dense to dense (SM)		TILL	17	M		SS	10	13				
4													
5				21	M		SS	14					
6													
7													
8				36	M		SS	14					
9	SAND WITH SILT AND GRAVEL, fine to coarse grained, dark brown, wet, dense (SP-SM)		COARSE ALLUVIUM										
10				39	W		SS	10					
11	SILTY SAND WITH GRAVEL, dark brown, wet, dense (SM)		TILL										
12				44	M		SS	9					
13													
14													
15				43	M		SS	18					
16	<b>END OF BORING AT 16.0 FEET</b> Borehole backfilled with auger cuttings and bituminous patch <i>Boring offset 3' N of staked location</i>												

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
<b>0-14½'</b>	<b>3.25" HSA</b>	<b>9/16/09</b>	<b>9:56</b>	<b>16.0</b>	<b>14.5</b>	<b>15.0</b>	<b>---</b>	<b>None</b>	
		<b>9/16/09</b>	<b>10:03</b>	<b>16.0</b>	<b>None</b>	<b>10.7</b>	<b>---</b>	<b>None</b>	
BORING COMPLETED: <b>9/16/09</b>									
DR: <b>LA</b> LG: <b>TDD</b> Rig: <b>51</b>									












# SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04216.2**

LOG OF BORING NO. **09-07 (p. 1 of 1)**

PROJECT: **Duluth International Airport Terminal; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: _____ MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DD	LL	PL	%-#200
	Bituminous Pavement - 8" thickness	 PAVEMENT									
1	FILL, silty sand with gravel, dark brown			M	SU						
2											
3			10	M	SS	11					
4	SAND WITH SILT AND GRAVEL, fine to medium grained, dark brown, moist, medium dense (SP-SM) (may be fill)										
5			16	M	SS	12					
6	SILTY SAND WITH GRAVEL, dark brown, moist (SM)										
7											
8	SANDY SILTY CLAY, brown, moist, very stiff, lenses of reddish brown sandy lean clay (CL-ML)										
9			22	M	SS	14	21				
10	SAND WITH SILT AND GRAVEL, medium to coarse grained, dark brown, wet, medium dense (SP-SM)										
11			22	W	SS	7					
12	SILTY SAND WITH GRAVEL, fine to coarse grained, dark brown, wet (SM)										
13	SANDY SILT, dark brown, wet, dense to medium dense (ML)		34	W	SS	13					
14											
15			23	W	SS	13					
16											
17	SILTY SAND WITH GRAVEL, dark brown, wet, very dense (SM)										
18											
19											
20			79	W	SS	10					
21											
22											
23	SILTY SAND, a little gravel, dark brown, wet, dense (SM)										
24											
25			48	W	SS	14					
26											
26	<b>END OF BORING AT 26.0 FEET</b> Borehole backfilled with auger cuttings and bituminous patch										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
<b>0-24½'</b>	<b>3.25" HSA</b>	<b>9/16/09</b>	<b>11:10</b>	<b>11.0</b>	<b>9.5</b>	<b>9.5</b>	<b>---</b>	<b>7.5</b>	
		<b>9/16/09</b>	<b>11:45</b>	<b>26.0</b>	<b>24.5</b>	<b>24.5</b>	<b>---</b>	<b>16.5</b>	
BORING COMPLETED: <b>9/16/09</b>									
DR: <b>LA</b> LG: <b>TDD</b> Rig: <b>51</b>									



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# SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04216.2**

LOG OF BORING NO. **09-08 (p. 1 of 1)**

PROJECT: **Duluth International Airport Terminal; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: _____ MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DD	LL	PL	%-#200
1	Bituminous Pavement - 7½" thickness	PAVEMENT									
2	FILL, silty sand with gravel, dark brown, apparent cobbles below about 2'	FILL	50/0.3'	M	SU						
3					SS	0					
4											
5	SILTY SAND, a little gravel, dark brown, moist, medium dense (SM)	TILL	18	M	SS	13	11				
6											
7											
8				M	SS	12					
9											
10	SILTY SAND WITH GRAVEL, dark brown, moist with wet lenses, medium dense to dense (SM)	TILL	18	M/W	SS	5					
11											
12											
13					SS	0					
14											
15		TILL	35								
16					SS	0					
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**END OF BORING AT 16.0 FEET**  
Borehole backfilled with auger cuttings and bituminous patch

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
<b>0-14½'</b>	<b>3.25" HSA</b>								
		<b>9/16/09</b>	<b>13:30</b>	<b>16.0</b>	<b>14.5</b>	<b>14.5</b>	<b>---</b>	<b>None</b>	
		<b>9/16/09</b>	<b>13:35</b>	<b>16.0</b>	<b>None</b>	<b>11.0</b>	<b>---</b>	<b>None</b>	
BORING COMPLETED: <b>9/16/09</b>									
DR: <b>LA</b> LG: <b>TDD</b> Rig: <b>51</b>									



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# SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04216.2**

LOG OF BORING NO. **09-09 (p. 1 of 1)**

PROJECT: **Duluth International Airport Terminal; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: _____ MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DD	LL	PL	%-#200
	Bituminous Pavement - 9½" thickness	PAVEMENT									
1	FILL, mostly silty sand with gravel, a little clayey sand, brown	FILL	11	M	SU						
2				M	SS	2					
3				M	SS						
4	SILTY SAND, a little gravel, lenses of sandy silt, dark brown, moist, medium dense (SM)	TILL	18	M	SS	14	14				
5				M	SS						
6	GRAVELLY SAND WITH SILT, fine to coarse grained, dark brown, wet, dense (SP-SM)	COARSE ALLUVIUM	37	W	SS	11					
7				W	SS						
8	SILTY SAND, a little gravel, dark brown, moist with wet lenses, medium dense (SM)	TILL	21	M	SS	15					
9				M	SS						
10				M	SS						
11											
12			50/0.45	M	SS	3					
13	<b>AUGER REFUSAL AT 13.0 FEET</b> Borehole backfilled with auger cuttings and bituminous patch										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
<b>0-13'</b>	<b>3.25" HSA</b>								
		<b>9/16/09</b>	<b>15:10</b>	<b>11.0</b>	<b>9.5</b>	<b>9.5</b>	<b>---</b>	<b>None</b>	
		<b>9/16/09</b>	<b>15:23</b>	<b>12.5</b>	<b>13.0</b>	<b>13.0</b>	<b>---</b>	<b>None</b>	
BORING COMPLETED: <b>9/16/09</b>		<b>9/16/09</b>	<b>15:30</b>	<b>12.5</b>	<b>None</b>	<b>7.5</b>	<b>---</b>	<b>7.0</b>	
DR: <b>LA</b> LG: <b>TDD</b> Rig: <b>51</b>									









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# SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04216.2**

LOG OF BORING NO. **09-10 (p. 1 of 1)**

PROJECT: **Duluth International Airport Terminal; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: _____ MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
								WC	DD	LL	PL	%-#200	
	Bituminous Pavement - 8" thickness		PAVEMENT										
1	FILL, silty sand with gravel, dark brown		FILL		M	SU							
2	FILL, silty sand with gravel, trace roots, brown and dark brown			17	M	SS	14						
3													
4													
5				11		SS	0						
6	SILTY SAND WITH GRAVEL, brown, moist, medium dense, lenses of sandy silt (SM)		TILL										
7													
8				22		SS	17	11					
9													
10				15		SS	12						
11													
12	SILTY SAND WITH GRAVEL, dark brown, wet, medium dense, lenses of sand with silt above about 12' (SM)			19	M/W	SS	10						
13													
14													
15				28	W	SS	10						
16	<b>END OF BORING AT 16.0 FEET</b> Borehole backfilled with auger cuttings and bituminous patch												

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
<b>0-14½'</b>	<b>3.25" HSA</b>	<b>9/16/09</b>	<b>14:20</b>	<b>13.5</b>	<b>12.0</b>	<b>12.0</b>	<b>---</b>	<b>11.0</b>	
		<b>9/16/09</b>	<b>14:31</b>	<b>16.0</b>	<b>None</b>	<b>11.0</b>	<b>---</b>	<b>8.5</b>	
BORING COMPLETED: <b>9/16/09</b>									
DR: <b>LA</b> LG: <b>TDD</b> Rig: <b>51</b>									

## BORING LOG NOTES

### DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
B,H,N:	Size of flush-joint casing
CA:	Crew Assistant (initials)
CAS:	Pipe casing, number indicates nominal diameter in inches
CC:	Crew Chief (initials)
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RD:	Rotary drilling with fluid and roller or drag bit
REC:	In split-spoon (see notes) and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
REV:	Revert drilling fluid
SS:	Standard split-spoon sampler (steel; 1d" is inside diameter; 2" outside diameter); unless indicated otherwise
SU	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after falling through drilling fluid
WH:	Sampler advanced by static weight of drill rod and 140-pound hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
?	Water level directly measured in boring
I	Estimated water level based solely on sample appearance

### TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q <sub>p</sub> :	Pocket Penetrometer strength, tsf ( <u>approximate</u> )
q <sub>c</sub> :	Static cone bearing pressure, tsf
q <sub>u</sub> :	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remoulded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

### STANDARD PENETRATION TEST NOTES

The standard penetration test consists of driving the sampler with a 140 pound hammer and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM:D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

The length of sample recovered, as shown on the AREC@column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM:D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

# UNIFIED SOIL CLASSIFICATION SYSTEM

## ASTM Designations: D 2487, D2488

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Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests <sup>A</sup>				Soil Classification		Notes
				Group Symbol	Group Name <sup>B</sup>	
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines <sup>C</sup>	Cu≥4 and 1≤Cc≤3 <sup>E</sup>	GW	Well graded gravel <sup>F</sup>	<sup>A</sup> Based on the material passing the 3-in (75-mm) sieve.
			Cu<4 and/or 1>Cc>3 <sup>E</sup>	GP	Poorly graded gravel <sup>F</sup>	<sup>B</sup> If field sample contained cobbles or boulders, or both, add “with cobbles or boulders, or both” to group name.
		Gravels with Fines more than 12% fines <sup>C</sup>	Fines classify as ML or MH	GM	Silty gravel <sup>F,G,H</sup>	<sup>C</sup> Gravels with 5 to 12% fines require dual symbols:
			Fines classify as CL or CH	GC	Clayey gravel <sup>F,G,H</sup>	GW-GM well-graded gravel with silt GW-GC well-graded gravel with clay GP-GM poorly graded gravel with silt GP-GC poorly graded gravel with clay
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines <sup>D</sup>	Cu≥6 and 1≤Cc≤3 <sup>E</sup>	SW	Well-graded sand <sup>I</sup>	<sup>D</sup> Sands with 5 to 12% fines require dual symbols:
			Cu<6 and 1>Cc>3 <sup>E</sup>	SP	Poorly-graded sand <sup>I</sup>	SW-SM well-graded sand with silt SW-SC well-graded sand with clay SP-SM poorly graded sand with silt SP-SC poorly graded sand with clay
		Sands with Fines more than 12% fines <sup>D</sup>	Fines classify as ML or MH	SM	Silty sand <sup>G,H,I</sup>	
			Fines classify as CL or CH	SC	Clayey sand <sup>G,H,I</sup>	
Fine-Grained Soils 50% or more passes the No. 200 sieve  (see Plasticity Chart below)	Silts and Clays Liquid limit less than 50	inorganic	PI>7 and plots on or above “A” line <sup>J</sup>	CL	Lean clay <sup>K,L,M</sup>	
			PI<4 or plots below “A” line <sup>J</sup>	ML	Silt <sup>K,L,M</sup>	
		organic	Liquid limit–oven dried <0.75 Liquid limit – not dried	OL	Organic clay <sup>K,L,M,N</sup>	
					Organic silt <sup>K,L,M,O</sup>	
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above “A” line	CH	Fat clay <sup>K,L,M</sup>	
			PI plots below “A” line	MH	Elastic silt <sup>K,L,M</sup>	
		organic	Liquid limit–oven dried <0.75 Liquid limit – not dried	OH	Organic clay <sup>K,L,M,P</sup>	
					Organic silt <sup>K,L,M,Q</sup>	
Highly organic soil			Primarily organic matter, dark in color, and organic in odor	PT	Peat <sup>R</sup>	

**SIEVE ANALYSIS**

Equation of “A”-line  
Horizontal at PI = 4 to LL = 25.5,  
then PI = 0.73 (LL-20)

Equation of “U”-line  
Vertical at LL = 16 to PI = 7,  
then PI = 0.9 (LL-8)

$C_u = \frac{D_{60}}{D_{10}} = \frac{15}{0.075} = 200$        $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = \frac{2.5^2}{0.075 \times 15} = 5.6$

**Plasticity Chart**

For classification of fine-grained soils and fine-grained fraction of coarse-grained soils.

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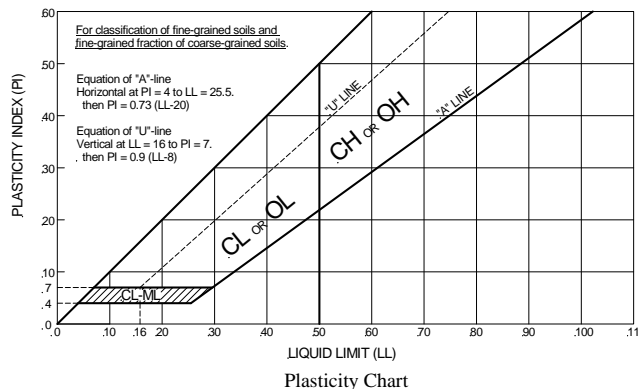
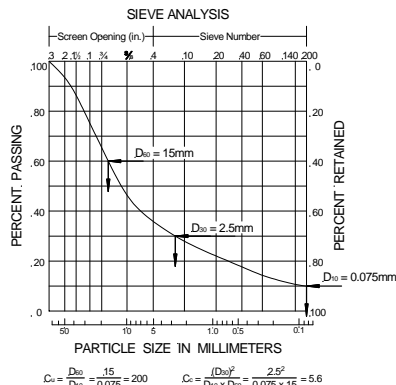
CL-ML

CL-ML</

**Notes**  
<sup>A</sup>Based on the material passing the 3-in (75-mm) sieve.  
<sup>B</sup>If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.  
<sup>C</sup>Gravels with 5 to 12% fines require dual symbols:  
 GW-GM well-graded gravel with silt  
 GW-GC well-graded gravel with clay  
 GP-GM poorly graded gravel with silt  
 GP-GC poorly graded gravel with clay  
<sup>D</sup>Sands with 5 to 12% fines require dual symbols:  
 SW-SM well-graded sand with silt  
 SW-SC well-graded sand with clay  
 SP-SM poorly graded sand with silt  
 SP-SC poorly graded sand with clay

$$^E C_u = D_{60} / D_{10}, \quad C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

<sup>F</sup>If soil contains  $\geq 15\%$  sand, add "with sand" to group name.  
<sup>G</sup>If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.  
<sup>H</sup>If fines are organic, add "with organic fines" to group name.  
<sup>I</sup>If soil contains  $\geq 15\%$  gravel, add "with gravel" to group name.  
<sup>J</sup>If Atterberg limits plot is hatched area, soils is a CL-ML silty clay.  
<sup>K</sup>If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.  
<sup>L</sup>If soil contains  $\geq 30\%$  plus No. 200, predominantly sand, add "sandy" to group name.  
<sup>M</sup>If soil contains  $\geq 30\%$  plus No. 200, predominantly gravel, add "gravelly" to group name.  
<sup>N</sup>PI  $\geq 4$  and plots on or above "A" line.  
<sup>O</sup>PI < 4 or plots below "A" line.  
<sup>P</sup>PI plots on or above "A" line.  
<sup>Q</sup>PI plots below "A" line.  
<sup>R</sup>Fiber Content description shown below.



### ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size		Gravel Percentages		Consistency of Plastic Soils		Relative Density of Non-Plastic Soils	
Term	Particle Size	Term	Percent	Term	N-Value, BPF	Term	N-Value, BPF
Boulders	Over 12"	A Little Gravel	3% - 14%	Very Soft	less than 2	Very Loose	0 - 4
Cobbles	3" to 12"	With Gravel	15% - 29%	Soft	2 - 4	Loose	5 - 10
Gravel	#4 sieve to 3"	Gravelly	30% - 50%	Firm	5 - 8	Medium Dense	11 - 30
Sand	#200 to #4 sieve			Stiff	9 - 15	Dense	31 - 50
Fines (silt & clay)	Pass #200 sieve			Very Stiff	16 - 30	Very Dense	Greater than 50
				Hard	Greater than 30		
Moisture/Frost Condition		Layering Notes		Fiber Content of Peat		Organic/Roots Description (if no lab tests)	
(MC Column)				Fiber Content (Visual Estimate)		Soils are described as <i>organic</i> , if soil is not peat and is judged to have sufficient organic fines content to influence the soil properties. <i>Slightly organic</i> used for borderline cases.	
D (Dry):	Absence of moisture, dusty, dry to touch.	Laminations: Layers less than 1/2" thick of differing material or color.		Term			
M (Moist):	Damp, although free water not visible. Soil may still have a high water content (over "optimum").			Fibric Peat:	Greater than 67%		
W (Wet/ Waterbearing):	Free water visible intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.			Hemic Peat:	33 - 67%		
F (Frozen):	Soil frozen	Lenses: Pockets or layers greater than 1/2" thick of differing material or color.		Sapric Peat:	Less than 33%		
						With roots:	Judged to have sufficient quantity of roots to influence the soil properties.
						Trace roots:	Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.



## **GEOLOGIC TERMINOLOGY (SOILS)**

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General categories of geologic deposits used, descriptive information and common soil types is as follows:

**FILL (F):** Soils, rock and/or waste products placed or disturbed by man rather than through geologic processes. Mixed soils are usually easy to identify. Uniform material is more difficult, and signs such as small inclusions, underlying topsoil, topography or knowledge of below grade improvements (e.g., basement backfill, utility trenches, etc.) may be needed to properly judge. When mixed condition is stratified horizontally, the soil may be a weathered natural soil rather than fill.

**TOPSOIL (TS):** Upper darker colored layer formed by weathering of inorganic soil and accumulation of organic material. Usually black, dark brown, dark gray or dark grayish brown. Often transitions from darker to lighter color.

**SLOPEWASH (SW):** Organic and/or inorganic materials (sometimes interlayered) washed from slopes and redeposited. Usually stratified. Will be located in depressed areas where they can be washed in from slopes. When topsoil layers are thick in depressed areas, there is a good chance the soil is slopewash.

**SWAMP DEPOSITS (SD):** Highly organic material (peats and organic clays) which are formed through accumulation of organic material under water. **Peat, Organic clay**

**COARSE ALLUVIUM (CA):** Sandy (and gravelly). Stratified. Deposited from fast moving waters in streams and rivers. Includes glacial outwash. **Sand, Sand with silt, Silty sand, Gravels**

**FINE ALLUVIUM (FA):** Clayey and/or silty. Stratified. Deposited from slow moving waters in streams, rivers, lakes and ponds. Includes glacial outwash. **Lean clay, Fat clay, Silty clay, Silt, Sandy silt**

**MIXED ALLUVIUM (MA):** Combination of Fine and Coarse Alluvium. **Clayey sand, Sandy lean clay**, interlayered CA/FA

**LACUSTRINE (LAC):** Fine grained lake bed deposits (lakes may or may not still be in existence). Usually in very flat topography. **Fat clay, Lean clay, Silty clay, Silt**

**LOESS (LOESS):** Uniform, non-stratified, silty material (or very fine sand) which is deposited by wind. Can include significant clay content, and grain contacts may be cemented by clay or calcareous (limestone/chalky) material. **Silt, Sandy silt, Silty clay, Lean clay**

**TILL (T):** Normally contains a wide range of grain sizes, from boulders through clay. Usually non-stratified (not sorted through water action). Deposited directly from glaciers. **Silty sand, Clayey sand, Sandy lean clay**, usually contains gravel

**WEATHERED TILL (WT):** Tills which have been altered by exposure to the action of frost, water, or chemicals. Often softer than underlying soils. May be stratified with varying colors/soil types due to filling in or other changes in frost lensed zones.

**COLLUVIUM (COL):** Dominantly gravel, boulders and rock slabs, sometimes intermixed or layered with soils. Deposited from gravity flow down hills or cliffs.



AMERICAN  
ENGINEERING  
TESTING, INC.

CONSULTANTS  
· ENVIRONMENTAL  
· GEOTECHNICAL  
· MATERIALS  
· FORENSICS

January 29, 2010

Mr. John Hippchen, PE, LEED AP  
Reynolds, Smith, and Hills  
4525 Airport Approach Road, Suite A  
Duluth, MN 55811

Re: Duluth International Airport Terminal  
Pressuremeter Testing  
Duluth, Minnesota  
AET Project #07-04216.3

Dear Mr. Hippchen,

This letter presents the results of field pressuremeter testing and engineering review American Engineering Testing, Inc. (AET) performed for the new Duluth International Airport Terminal in Duluth, Minnesota. This letter is an addendum to our "Report of Geotechnical Exploration and Review," AET #07-04216.2 dated October 14, 2009 (October 14 Report), that was prepared for the new airport terminal.

### **Background Information**

The project structural engineer (MBJ) has indicated current structural plans for the new terminal structure that will include up three stories. The front (south side) of the terminal building will be a single-story, high-ceiling area for ticketing. The main entrance to the terminal will include an exterior canopy structure on the south side of the building leading to the ticketing area. The three-story portion of the structure will be situated in the central portion of the building, with the remaining area on the north side of the building, next to the apron, being two stories. MJB indicated maximum column loads for the terminal are anticipated to be on the order of 500 to 600 kips.

The October 14 Report presented our geotechnical recommendations for the new airport terminal building. Our foundation recommendations for the terminal building included an allowable soil pressure of 5,000 pounds per square foot (psf). RS&H and MJB expressed interest in the possibility of designing foundation elements with a higher soil pressure. RS&H authorized AET to perform pressuremeter testing at the planned terminal site to assess the ability of subgrade soils to support a greater foundation bearing pressure.

## Field Methods

AET performed three pressuremeter tests within the new terminal building footprint on December 16, 2009. The pressuremeter tests were used to measure strength (pressuremeter limit pressure) and strain (pressuremeter modulus) properties of subsurface soils at the planned terminal site. The measured pressuremeter limit and modulus properties were used to evaluate the potential bearing capacity and settlement of foundations with bearing pressures exceeding 5,000 psf. Pressuremeter tests were performed in boreholes offset from test borings 09-03 and 09-07. Two borings were offset from test boring 09-03 due to soil caving conditions in the borehole. The pressuremeter tests were conducted in general accordance with ASTM:D4719, Method A (Equal Pressure Method).

At the pressuremeter test locations, the borehole was extended with a drill rig using 3.25 inch inside-diameter hollow stem auger. A 3 inch outside diameter split-spoon sampler was driven to create the hole for the pressuremeter probe. The pressuremeter probe was then inserted into the hole to the desired test depth.

## Pressuremeter Test Method and Results

Numerous strain readings were recorded for each test, with the pressure to the probe increased for each incremental reading. As the pressure is increased, the probe expands within the borehole causing the soil in the sides of the borehole to deform. The pressure is incrementally increased until the maximum volume of the probe is reached, or the soil has been tested beyond desired bearing capacity. For the pressuremeter test performed in borehole 09-03B, the probe membrane failed prior to reaching the pressure limit value.

The pressuremeter test results are plotted on a graph as a pressuremeter curve and a yield pressure curve. An apparent limit pressure is estimated from the yield pressure curve of the corrected pressure versus the normalized probe volume change. The pressuremeter modulus ( $E$ ) is calculated from the slope of the straight line portion of this pressuremeter curve. The results of the pressuremeter testing are presented in Table I, below.

**Table I: Pressuremeter Test Results**

Boring Number	Test Depth (ft)	Net Limit Pressure (tsf)	Pressuremeter Modulus (tsf)
09-03B	11-13	13.0	209
09-07A	12.5-14.5	20.0	506
09-07A	18.5-20.6	24.5	672

Mr. John Hippchen, PE, LEED AP  
Duluth International Airport Terminal  
January 29, 2010  
AET #07-04216.3  
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### Recommendations

Based on our engineering review of the pressuremeter test results, it is our opinion foundations for the new airport terminal building can be designed for a maximum soil bearing pressure of 8,000 psf, if constructed directly on undisturbed native soils. Any native soils that become disturbed should be excavated down to undisturbed soils. Foundation grades should be attained with a concrete fill capable of supporting foundation pressures of 8,000 psf. Perimeter footings, and any footings in unheated structures, should extend to a minimum of 72 inches below the final grade. Interior footings in heated structures should be embedded a minimum of 48 inches below at-grade slab. Other recommendations in the October 14 Report remain applicable. It is our judgment that this foundation design will include a factor of safety of greater than 3 against shear or base failure. It is also our judgment that total and differential building settlement should be less than 1 inch and ½ inch, respectively.

As previously discussed in the October 14 Report, we recommend foundation excavations be observed by a geotechnical engineer prior to placing foundation concrete. The geotechnical engineer should review foundation excavations for the presence of disturbed soils.

### Closing

We appreciate the opportunity to provide additional geotechnical engineering services for this project. If you have questions, or if we can be of additional service, please contact us. We can be reached at (218) 628-1518.

American Engineering Testing, Inc.



Sara L. Leow, PE  
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Attachments: Figure 1: Boring Locations for Pressuremeter Testing  
Pressuremeter Test Results

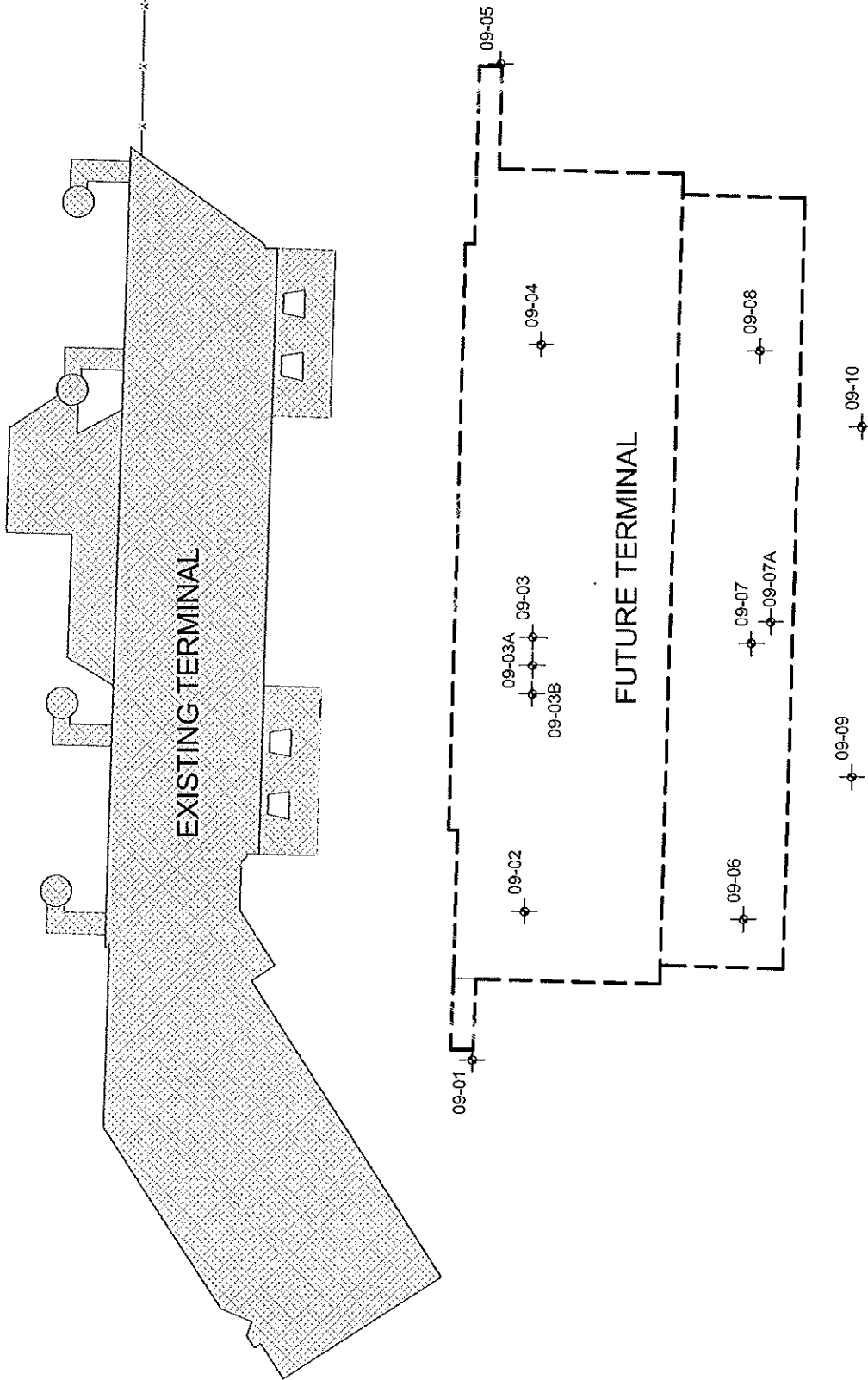
Reference: Sketch provided by Reynolds, Smith, & Hills, Inc.

Scale: 1" = 80'

EXISTING PARKING

EXPLANATION

- 09-01 2009 Boring Location & Number
- 09-03A Test Boring Location & Number for Pressuremeter Testing

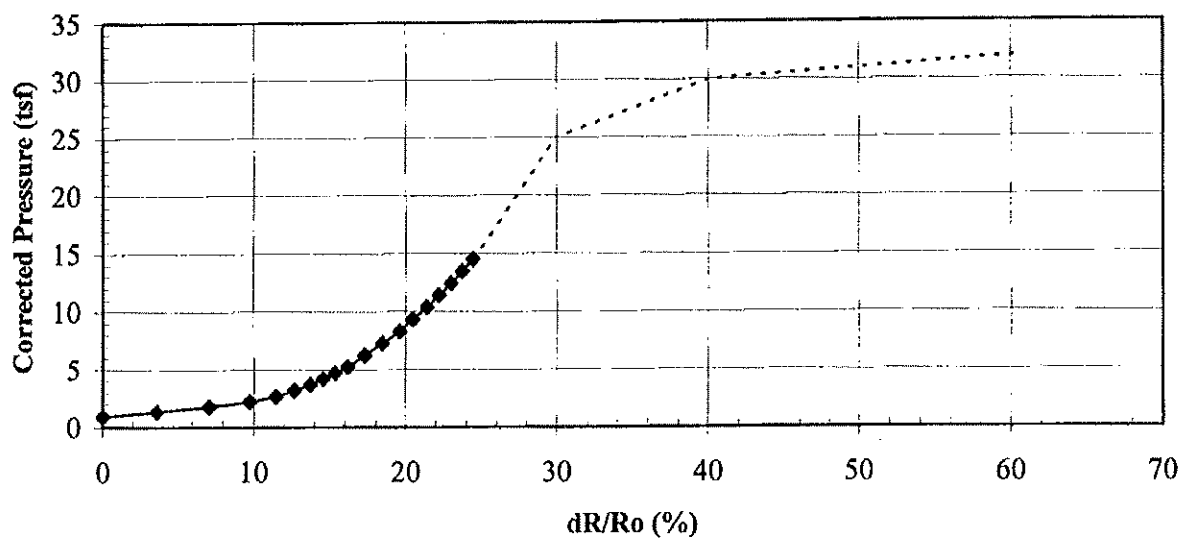


## PRESSUREMETER TEST RESULTS

Airport Terminal Duluth

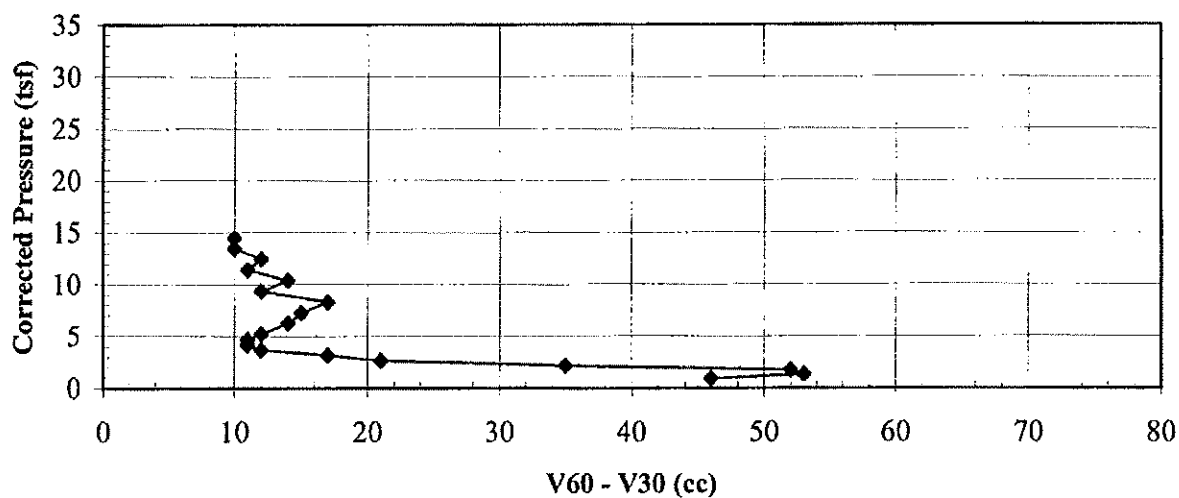
AET No. 07-04216.03

### PRESSUREMETER CURVE



Boring No. : 3	$P_L(\text{tsf}) > 15.0$	$E_o(\text{tsf}) = 209$	$E_o / P_1^* = 16.1$
Depth (ft) : 11-13	$P_o(\text{tsf}) = 2.0$	Points Used = 13 to 19	$E_o / N = 3.0$
Soil : SM & Gravel	$P_L^*(\text{tsf}) > 13.0$	$P_y(\text{tsf}) > 15.0$	$P_y / P_1 = 1.00$
$N_{ave}$ (bpf) : 70			

### YIELD PRESSURE CURVE

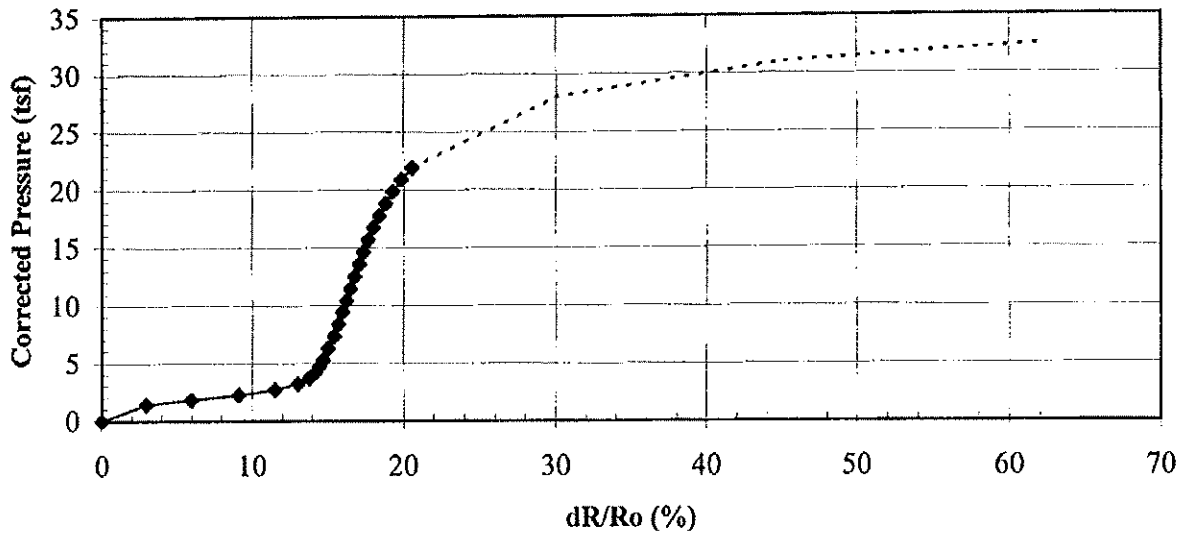


## PRESSUREMETER TEST RESULTS

Airport Terminal Duluth

AET No. 07-04216.03

### PRESSUREMETER CURVE



Boring No. : 7

Depth (ft) : 12.5-14.5

Soil : SM/ML

N<sub>ave</sub> (bpf) : 28

P<sub>L</sub>(tsf) > 22.0

P<sub>o</sub>(tsf) = 2.0

P<sub>L</sub>\*(tsf) > 20.0

E<sub>o</sub>(tsf) = 506

Points Used = 11 to 21

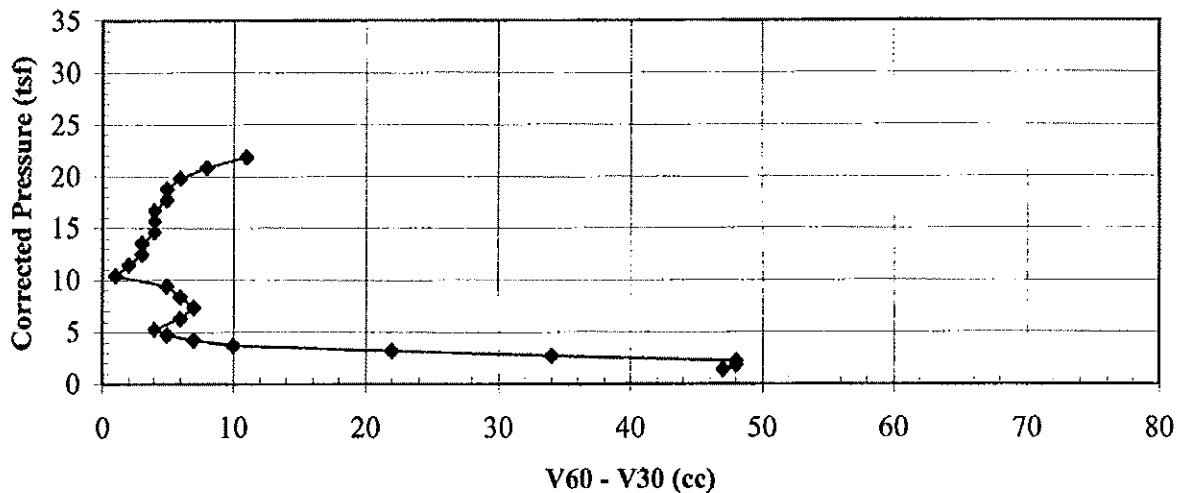
P<sub>y</sub>(tsf) = 19.0

E<sub>o</sub> / P<sub>L</sub>\* = 25.3

E<sub>o</sub> / N = 18.1

P<sub>y</sub> / P<sub>L</sub> = 0.86

### YIELD PRESSURE CURVE

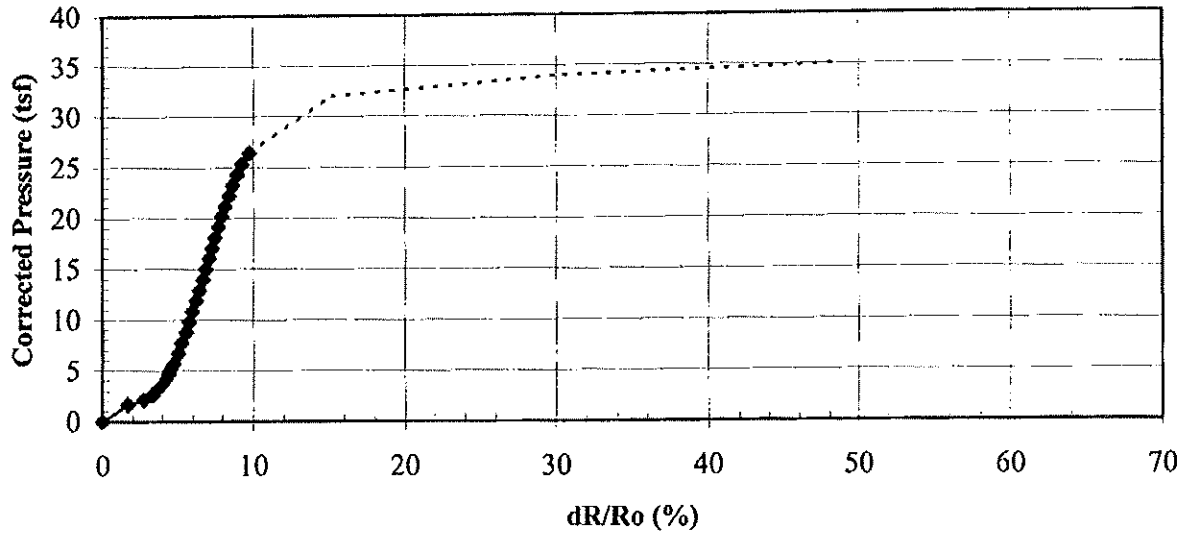


## PRESSUREMETER TEST RESULTS

Airport Terminal Duluth

AET No. 07-04216.03

### PRESSUREMETER CURVE



Boring No. : 7

Depth (ft) : 18.5-20.5

Soil : SM & Gravel

N<sub>ave</sub> (bpf) : 79

P<sub>L</sub>(tsf) > 27.0

P<sub>o</sub>(tsf) = 2.5

P<sub>L</sub>\*(tsf) > 24.5

E<sub>o</sub>(tsf) = 672

Points Used = 12 to 24

P<sub>y</sub>(tsf) = 24.0

E<sub>o</sub> / P<sub>1</sub>\* = 27.4

E<sub>o</sub> / N = 8.5

P<sub>y</sub> / P<sub>1</sub> = 0.89

### YIELD PRESSURE CURVE

