Public Works and Government Services Canada

Requisition No. _____

DRAWINGS & SPECIFICATIONS
For Issued for Tender

Kent Institution
Tunnel Exhaust and Ventilation System Upgrade
R.106216.001

APPROVED BY:

Fung, Philip
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DN: CN = Fung, Philip C = CA O = GC OU = PWGSC-TPSGC
Date: 2021.08.16 18:11:03 -07'00'

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Regional Manager, AES Date

Chris Patterson
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Project Manager Date

Real Property Services Branch, Professional and Technical Services, Pacific Region
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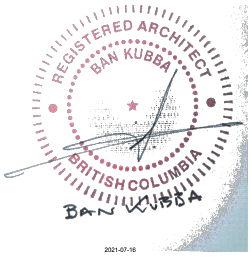
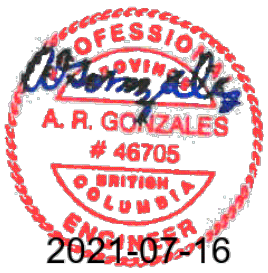
CONSULTANTS – SEAL & SIGNATURE

Discipline	**Seal / Signature / Date**
Mechanical (Prime)	
Architectural	
Structural	

Electrical



2021-07-16

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Appendix B – Pre-Renovation Hazmat Assessment – Site Review Report
Appendix C – Hazardous Building Materials Assessment

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List of Drawings (Bound Separately):

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M0-00 Cover Sheet, Drawing List
M0-01 Mechanical Legends and Notes
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ARCHITECTURAL DRAWINGS

A0-01 Partial Floor Plans, Key Notes and Details

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ELECTRICAL DRAWINGS

E0-01 Electrical Floor and Roof Plan, Drawing List, Legend, Partial Sld, Elevation and Schedule

END OF DRAWINGS

END OF SECTION

Part 1 General

1.1 SUMMARY OF WORK

Work covered by Contract Documents covers the following works at Kent Maximum Institution at Agassiz, B.C.:

.1 Ventilation of the Tunnel and sump room in the Tunnel underneath the facility..

.1 Complete testing, balancing, start-up and commissioning of the ventilation system as shown on the drawings.

.2 Work to be performed under this Contract includes, but not limited to, the following items covered further in the Contract documents:

.1 Provide a detailed work plan including a project schedule and construction phasing plan. This detailed work plan shall be submitted to the Departmental Representative for review to verify that there will be no interruption of service.

.2 All equipment and associated components are to be delivered to the site in a timely manner so that the work can proceed without delays.

.3 All of the above mentioned works to be performed in an environment which contains building hazardous materials. Provide for work including removal of hazardous materials in accordance with requirements of all Division 2 specification sections.

.4 Provide as-built drawings and closeout submittals.

.3 Contractor's Use of Premises:

.1 Contractor has limited use of site for work of this contract until Substantial Completion:

.1 Contractor use of premises for storage and access, as approved by the Departmental representative.

.2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.4 Vehicular access through the Kent Institution will be restricted during the inmate "count" at breakfast, lunch and dinner hours. Confirm times with Departmental Representative. Delays may occur when entering and exiting the Institution with vehicles due to security situations and heavy traffic.

1.2 EXISTING SERVICES

.1 Notify Departmental Representative, governing authorities and utility companies of intended interruption of services and obtain required permission.

.2 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active services including power and communications services. Adhere to approved schedule and provide notice to affected parties.

1.3 WORK RESTRICTIONS

.1 Notify Departmental Representative of intended interruption of power, heating, cooling, ventilation, communication and water services and provide schedule of interruption times.

.2 Where Work involves breaking into or connecting to existing services, give departmental Representative 48 hours of notice for necessary interruption of services throughout course of work. Keep duration of interruptions to a minimum. Coordinate interruptions with local authority having jurisdiction and local residences and businesses affected by the disruption.

.3 Provide for access by pedestrian and vehicular traffic on and around site where work is in progress.

.4 Security Requirements: refer to Section 01 14 10 - Security Requirements.

.5 Hours of work:

.1 Perform work during normal working hours of the Institution 0730 to 1600, Monday through Friday except holidays.

.2 When it is necessary, arrange in advance with Departmental Representative to work outside of normal working hours.

1.4 CONSTRUCTION WORK SCHEDULE

.1 Commence work immediately upon official notification of acceptance of offer and complete the work within 20 weeks from the date of such notification,

.2 Contractor shall manage and provide adequate work force for completion of all work under this contract without delay.

.3 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Substantial Certificate and Final Certificate as defined times of completion are of essence of this contract.

.4 Submittal:

.1 Submit to Departmental Representative within 5 working days of Award of Contract, a Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of construction progress.

.2 Identify each trade or operation.

.3 Show dates for delivery of items requiring long lead time.

.4 Identify construction plan for each Living Cell.

.5 Departmental Representative will review schedule and return one copy.

.6 Re-submit two (2) copies of finalized schedule to Departmental Representative within five (5) working days after return of reviewed preliminary copy.

.5 Project Scheduling Reporting:

.1 Update Project Schedule on bi-weekly basis reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

.6 Project Meetings:

.1 Discuss Project Schedule at bi-weekly site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

.2 Weather related delays with their remedial measures will be discussed and negotiated.

.3 Before submitting first progress claim submit breakdown of Contract price in detail as directed by Departmental Representative and aggregating contract price. After approval by Departmental Representative cost breakdown will be used as basis for progress payments. Only PWGSC paper work is acceptable.

1.5 SUBMITTAL PROCEDURES

.1 Administrative:

.1 Submit to Departmental Representative submittal listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Work affected by submittal shall not proceed until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittal prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittal not stamped, signed, dated and identified as to specific project will be returned without being examined and shall be considered rejected.

.6 Notify Departmental Representative in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are coordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative review of submittal.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.

.10 Keep one reviewed copy of each submission on site.

.2 Shop Drawings:

.1 Drawings to be originals prepared by Contractor, Subcontractor, Supplier or Distributor, which illustrate appropriate portion of work; showing fabrication, layout, setting or erection details as specified in appropriate sections.

.3 Product Data:

.1 Certain specification Sections specify that manufacturer's standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and other standard descriptive data will be accepted in lieu of shop drawings, provided that the product concerned is clearly identified. Submit in sets, not as individual submissions.

.4 Samples:

.1 Submit samples in sizes and quantities specified.

.2 Where colour is criterion, submit full range of colours.

.3 Submit all samples as soon as possible after the contract is awarded, to facilitate production of complete colour scheme by the Departmental Representative.

.5 Mock-ups:

.1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.

.2 Construct in location as specified in specific Section.

.3 Prepare mock-ups for Departmental Representative' review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

.6 Progress Photographs:

.1 Provide construction photographs in accordance with procedures and submission requirements specified in this clause.

.2 Progress Photographs:

.1 .1 Provide digital photographs with images of minimum 3.1 mega pixel resolution and stored in Jpeg format with minimal compression.

.2 Number of viewpoints: four (4), locations of viewpoints directed by Departmental Representative.

.3 Frequency: monthly, submitted on disk with monthly progress statement, sent via e-mail or as directed by Departmental Representative.

.4 Identify photos by location, date and sequential numbering system.

.3 Final Photographs:

.1 Provide digital photographs with images of minimum 3.1 mega pixel resolution and stored in Jpeg format with minimal compression. Where photos are e-mailed compression can be increased.

.2 Number of viewpoints:

.1 Each side of building for a total of 4.

.2 Interior of rooms and finishes for a total of 8.

.3 Locations of viewpoints determined by Departmental Representative.

.3 Submit final photographs in digital format on CD, before final acceptance of building.

.4 Label disks and identify with name and project number of project. Indicate exposure dates and viewpoints of each photo and photo number.

.7 Submission Requirements:

.1 Schedule submissions at least ten days before dates reviewed submissions will be needed.

.2 Submit number of copies of product data, shop drawings which Contractor requires for distribution plus four (4) copies which will be retained by Departmental Representative.

.3 Accompany submissions with transmittal letter in duplicate.

.4 Submit bond copies (hard copy) as directed by Departmental Representative.

.8 Coordination of Submissions:

.1 Review shop drawings, product data and samples prior to submission.

.2 Coordinate with field construction criteria.

.3 Verify catalogue numbers and similar data.

.4 Coordinate each submittal with requirements of the work of all trades and contract documents.

.5 Responsibility for errors and omissions in submittal is not relieved by Departmental Representative's review of submittal.

.6 Responsibility for deviations in submittal from requirements of Contract documents is not relieved by Departmental Representative's review of submittal, unless Departmental Representative gives written acceptance of specified deviations.

.7 Notify Departmental Representative, in writing at time of submission, of deviations in submittal from requirements of Contract documents.

.8 Make any changes in submissions which Departmental Representative may require consistent with Contract Documents and re-submit as directed by Departmental Representative.

.9 After Departmental Representative's review, distribute copies.

.10 Shop Drawings Review:

.1 Review of shop drawings by Public Works and Government Services Canada (PWGSC) is for the sole purpose of ascertaining conformance with the general concept.

.2 The Departmental Representative’s review does not mean that PWGSC approves the detail design inherent in the shop drawings, responsibility remains with the contractor submitting same, and such review will not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the construction and contract documents.

.3 Without restricting the generality of the foregoing, the Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for co-ordination of the work of all subtrades.

1.6 HEALTH AND SAFETY

.1 Specified in Section 01 35 33.

1.7 ENVIRONMENTAL PROCEDURES

.1 Fires and burning of rubbish on site not permitted.

.2 Do not bury rubbish and waste materials on site unless approved by Departmental Representative.

.3 Do not dispose of waste or volatile materials such as oil, paint thinner or mineral spirits into waterways, storm or sanitary systems.

.4 Provide temporary drainage and pumping as necessary to keep excavations and site free from water during excavation and grading activities.

.5 Control disposal of run-off of water containing suspended materials or other harmful substances in accordance with local authority requirements. Construct settlement ponds and silt fences as required by the Provincial Environmental authority.

.6 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

.7 Under no circumstances dispose of rubbish or waste materials on adjoining property.

1.8 REGULATORY REQUIREMENTS

.1 References and Codes:

.1 Perform Work in accordance with National Building Code of Canada (NBCC2015) and where applicable British Columbia Building Code (BCBC2018) including all amendments up to bid closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.9 QUALITY CONTROL

.1 Inspection:

.1 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.

.2 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.3 Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

.2 Procedures:

.1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

.3 Rejected Work:

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.4 Reports:

.1 Submit (4) four copies of inspection and test reports to Departmental Representative.

.5 Tests and Mix Designs:

.1 Furnish test results and mix designs as may be requested.

.6 Mill Tests:

.1 Submit mill test certificates as requested and as required of specification Sections.

.7 Equipment and Systems:

.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

.2 Refer to specific Section for definitive requirements.

1.10 TEMPORARY UTILITIES

.1 Installation and Removal:

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

.2 Dewatering:

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

.3 Water Supply:

.1 Arrange, pay for and maintain temporary water supply in accordance with local authority, governing regulations and ordinances.

.2 Permanent water supply system installed under this contract may be used for construction requirements provided that guarantees are not affected thereby. Replace damaged components.

.4 Temporary Power and Light:

.1 Arrange, pay for and maintain temporary electric power supply in accordance with local power authority governing regulations and ordinances.

.2 Electrical power and lighting installed under this contract may be used for construction purposes at no extra cost, provided that guarantees are not affected thereby and electrical components used for temporary power are replaced when damaged.

.3 Replace lighting bulbs/tubes and clean reflectors and lenses used for more than three months.

.5 Temporary Communication Facilities:

.1 Provide and pay for temporary telephone and fax hook up, line(s) necessary for own use.

.6 Fire Protection:

.1 Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.

1.11 CONSTRUCTION FACILITIES

.1 Installation and Removal:

.1 Provide construction facilities in order to execute work expeditiously.

.2 Remove from site all such work after use.

.2 Scaffolding:

.1 Design, construct and maintain scaffolding in rigid, secure and safe manner, in accordance with WorkSafeBC regulations and Section 01 35 33.

.2 Erect scaffolding independent of walls. Remove promptly when no longer required.

.3 Hoisting:

.1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.

.2 Hoists to be operated by qualified operator.

.4 Site Storage/Loading:

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

.5 Construction Parking:

.1 Make good damage to existing roads used for access to project site.

.2 Build and maintain temporary access where required and provide snow removal during period of Work.

.3 Park vehicles outside perimeter fence in designated parking areas.

.6 Contractor's Site Office and enclosure:

.1 Provide office of size to accommodate site meetings and Contractor's operations.

.2 Provide a clearly marked and fully stocked first-aid case in a readily available location.

.3 Provide temporary fenced area to enclose site and operations.

.7 Equipment, Tools and Material Storage:

.1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

.8 Sanitary Facilities:

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures. Permanent facilities may be used on approval of Departmental Representative.

1.12 TEMPORARY BARRIERS AND ENCLOSURES

.1 Hoarding:

.1 Erect temporary site enclosure using new 1.8 m high temporary construction fencing. Provide lockable truck gate. Maintain fence in good repair.

.2 Enclosure of Structure:

.1 Provide temporary weathertight enclosures and protection for exterior openings until permanently enclosed. Design enclosures to withstand wind pressure. Provide lockable entry as required for moving personnel equipment and materials.

.2 Provide temporary enclosures to secure building from entry of unauthorized personnel during construction period.

.3 Guardrails and Excavations:

.1 Provide secure, rigid guard rails and barricades around deep excavations, open edges of floors and roofs etc.

.2 Provide as required by governing authorities.

.4 Access to Site:

.1 Maintain immediate local access roads in clean condition used during work of this contract.

.5 Protection for Off-Site and CSC Property:

.1 Protect surrounding CSC property from damage during performance of Work.

.2 Be responsible for damage incurred.

.6 Protection of Building Finishes:

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

1.13 COMMON PRODUCT REQUIREMENTS

.1 Reference Standards:

.1 If there is question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.

.2 Cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

.3 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

.2 Quality:

.1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.

.4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

.6 The use of asbestos containing materials is prohibited in this project. Contractor shall provide a letter to the Departmental Representative prior to Substantial Completion confirming that asbestos containing materials are not used in this project.

.3 Storage, Handling and Protection:

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

.9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

.4 Transportation:

.1 Pay costs of transportation of products required in performance of Work.

.2 Transportation cost of products supplied by Departmental Representative will be paid for by Departmental Representative. Unload, handle and store such products.

.5 Manufacturer’s Instructions:

.1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

.2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative may establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

.6 Quality of Work:

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

.7 Co-ordination:

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

.8 Concealment:

.1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation, inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

.9 Remedial Work:

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner neither to damage nor to put at risk any portion of Work.

.10 Location of Fixtures:

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Departmental Representative of conflicting installation. Install as directed.

.3 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

.11 Fastenings:

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

.12 Fastenings - Equipment:

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

.13 Protection of Work in Progress:

.1 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

.14 Existing Utilities:

.1 Where work involves breaking into or connecting to existing services, carry out work at times directed by governing authorities, with minimum of disturbance to pedestrian and vehicular traffic.

.2 Before commencing work, establish location and extent of service lines in areas of work and notify Departmental Representative of findings.

.3 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.

.4 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

.5 Record locations of maintained, capped and re-routed services lines.

.15 Contractors Options for Selection of Products:

.1 Products specified by **"Prescriptive" specifications**: select any product meeting or exceeding specifications.

.2 Products specified under "**Acceptable Products**" (used for complex Mechanical or Electrical Systems): select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specifications and indicated Products.

.3 Products specified by performance and referenced standard: select any product meeting or exceeding the referenced standard.

.4 Products specified to meet particular design requirements or to match existing materials: use only material specified Approved Product. Alternative products may be considered provided full technical data is received in writing by Departmental Representative in accordance with “Instructions to Bidders".

.5 When products are specified by a referenced standard or by Performance specifications, upon request of Departmental Representative, obtain from manufacturer an independent laboratory report showing that the product meets or exceeds the specified requirements.

.16 Substitution after award of Contract:

.1 No substitutions are permitted without prior written approval of the Departmental Representative.

.2 Proposals for substitution may only be submitted after Contract award. Such request must include statements of respective costs of items originally specified and the proposed substitution.

.3 Proposals will be considered by the Departmental Representative if:

.1 products selected by tenderer from those specified are not available;

.2 delivery date of products selected from those specified would unduly delay completion of Contract, or

.3 alternative product to that specified, which is brought to the attention of and considered by Departmental Representative as equivalent to the product specified, and will result in a credit to the Contract amount.

.4 Should the proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on the project. Pay for design or drawing changes required as result of substitution.

.5 Amounts of all credits arising from approval of the substitutions will be determined by the Departmental Representative, and the Contract price will be reduced accordingly.

1.14 EXAMINATION AND PREPARATION

.1 Existing Services:

.1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.

.2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

.2 Location of Equipment and Fixtures:

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Departmental Representative of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.15 EXECUTION REQUIREMENTS

.1 Preparation:

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.5 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

.2 Execution:

.1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective and non-conforming Work.

.5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.8 Cut rigid materials using purpose made saw or core drill. Pneumatic or impact tools not allowed on brittle materials without prior approval.

.9 Restore work with new products in accordance with requirements of Contract Documents.

.10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, full thickness of the construction element.

.12 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

.13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.16 CLEANING

.1 Project Cleanliness:

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.

.3 Clear snow and ice from access to building.

.4 Provide on-site containers for collection of waste materials and debris.

.5 Provide and use clearly marked separate bins for recycling. Refer to-Construction/Demolition Waste Management And Disposal.

.6 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.

.7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

.2 Final Cleaning:

.1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.3 Prior to final review, remove surplus products, tools, construction machinery and equipment.

.4 Remove waste products and clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.5 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.

.6 Clean lighting reflectors, lenses, and other lighting surfaces.

.7 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

.8 Wax, seal, vacuum clean, shampoo or prepare floor finishes, as recommended by manufacturer.

.9 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.10 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.11 Remove dirt and other disfiguration from exterior surfaces.

.12 Sweep and wash clean paved areas.

.13 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.

.14 Clean roofs, downspouts, and drainage systems.

.15 Remove snow and ice from access to building.

1.17 CONSTRUCTION/DEMOLITION WASTE MANAGEMENT AND DISPOSAL

.1 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and/or recyclable materials and waste.

.1 Separate non-salvageable materials from salvaged items.

.2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

.3 Transport and deliver non-salvageable items to licensed disposal facility.

.2 Provide containers to deposit reusable and/or recyclable materials. Locate containers in locations, to facilitate deposit of materials without hindering daily operations. Provide containers to deposit reusable and/or recyclable materials.

.3 Collect, handle, store on-site and transport off-site, salvaged materials in separate condition. Transport to approved and authorized recycling facility and/or users of material for recycling.

.4 Locate waste and salvage bins on site as directed by Departmental Representative.

.5 Provide removal of hazardous materials in accordance with Section 01 35 33 – Health and Safety Requirements.

1.18 CLOSEOUT PROCEDURES

.1 Inspection and Declaration:

.1 Contractor's Inspection: Conduct an inspection of Work with all subcontractors, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.2 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.3 Request Departmental Representative's Inspection.

.2 Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.

.3 Substantial Completion: submit written certificate that following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.

.4 Certificates required by Authority Having Jurisdictions for seismic restraints.

.5 Operation of systems have been demonstrated to Departments personnel.

.6 Work is complete and ready for Final Inspection.

.7 Asbestos containing materials are not used in this project.

.4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

1.19 CLOSEOUT SUBMITTAL

.1 Record Drawings:

.1 As work progresses, maintain accurate records to show all deviations from the Contract Drawings. Note on as-built drawings as changes occur. At completion supply:

.1 Four (4) sets of CD's in AutoCad file format (version: 2010) and PDF format with all as-built information on the diskettes.

.2 Four (4) sets of printed as-built drawings.

.3 Submit one copy of check plots to Departmental Representative prior to final printing of as-built drawings.

.4 Departmental Representative will supply copies of the original AutoCad files.

.5 Retain original logo and title block on the as-built drawings. Contractor may place on the upper right-hand title block area a small company logo, the text "AS-BUILT" and the date.

.2 Costs for transferring as-built information from marked up working set of drawings to electronic format using ACAD and plotting service is included in the Contract.

.2 Operation and Maintenance Manuals (O&M Manuals):

.1 On completion of project submit to Departmental Representative four (4) CD R/ disk copies and four (4) paper copies (in loose leaf type binder) of Operation and Maintenance Manual, made up as follows:

.1 Provide maintenance manual on CDs using pdf, or other approved format for descriptive writing, page size images and page size drawings. Organize manuals into industry standard maintenance manual tabs with links in index to each descriptive section describing the component or maintenance procedure etc.

.2 Organize files into CSI Masterformat numbering system or other approved descriptive titles.

.3 Label disk "Operation and Maintenance Data", project name, date, names of Contractor, subcontractors, consultants and subconsultants.

.4 Include scanned guarantees, diagrams and drawings.

.5 Organize contents into applicable sections of work to parallel project specification break-down. Mark each section by labeled tabs (navigational buttons).

.6 Drawings, diagrams and manufacturer's literature must be legible.

.7 Refer to Mechanical and Electrical Divisions for specific details for Mechanical and Electrical data.

.2 At the time of review of substantial completion documents, an amount equal to one percent (1%) of total contract value must be allocated for operation and maintenance manuals and as-built drawings shown as a line item in the contractor progress billing. This amount shall be released after review and approval of O&M manuals by Departmental Representative.

.3 Maintenance Materials, Special Tools and Spare Parts:

.1 Specific requirements for maintenance materials, tools and spare parts are specified in individual sections.

.2 Deliver maintenance materials, special tools and spare parts to Departmental Representative and store in designated area as directed by Departmental Representative.

.3 Prepare lists of maintenance materials, special tools and spare parts for inclusion in O&M Manual specified in Clause 1.18.2.

.4 Maintenance materials:

.1 Deliver wrapped, identify on carton or package, colour, room number, system or area as applicable where item is used.

.5 Special tools:

.1 Assemble as specified;

.2 Include identifications and instructions on intended use of tools.

.6 Spare parts:

.1 Assemble parts as specified;

.2 Include part number, identification of equipment or system for which parts are applicable;

.3 Installation instructions;

.4 Name and address of nearest supplier.

.4 Warranties and Bonds:

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing in maintenance manual.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.

.4 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until the Date of Interim Completion is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Retain warranties and bonds until time specified for submittal.

1.20 DEMONSTRATION AND TRAINING

.1 Demonstration and Training:

.1 Demonstrate operation and maintenance of equipment and systems to maintenance personnel following interim Completion and prior to date of final certificate of completion

.2 Departmental Representative will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.21 GENERAL COMMISSIONING

.1 Commission installed systems in accordance with Section 01 91 00 - Commissioning prior to Demonstration and Training.

END OF SECTION

Part 1 General

1.1 PURPOSE

.1 To ensure that both the construction project and the institutional operations may proceed without undue disruption or hindrance and that the security of the Institution is maintained at all times.

1.2 DEFINITIONS

.1 "Contraband" means:

.1 An intoxicant, including alcoholic beverages, drugs and narcotics

.2 a weapon or a component thereof, ammunition for a weapon, and anything that is designed to kill, injure or disable a person or that is altered so as to be capable of killing, injuring or disabling a person, when possessed without prior authorization,

.3 An explosive or a bomb or a component thereof,

.4 Currency over any applicable prescribed limit, $25.00, and

.5 Any item not described in paragraphs (1) to (4) above that could jeopardize the security of a Penitentiary or the safety of persons, when that item is possessed without prior authorization.

.2 Unauthorized smoking and related items means all smoking items including, but not limited to, cigarettes, cigars, tobacco, chewing tobacco, cigarette making machines, matches and lighters.

.3 "Commercial Vehicle" means any motor vehicle used for the shipment of material, equipment and tools required for the construction project.

.4 "CSC" means Correctional Service Canada.

.5 "Director" means Director or Warden of the Institution as applicable or their representative.

.6 "Construction employees" means persons working for the general contractor, the sub-contractors, equipment operators, material suppliers, testing and inspection companies and regulatory agencies.

.7 "Departmental Representative" means the Public Works and Government Services Canada representative defined in General Conditions.

.8 "Perimeter" means the fenced or walled area of the institution that restrains the movement of the inmates.

.9 "Construction zone" means the area, as indicated in the contract documents, that the contractor will be allowed to work". This area may or may not be isolated from the security area of the institution. Limits to be confirmed at construction start-up meeting.

1.3 PRELIMINARY PROCEEDINGS

.1 At construction start-up meeting:

.1 Discuss the nature and extent of all activities involved in the Project.

.2 Establish mutually acceptable security procedures in accordance with this instruction and the institution's particular requirements.

.2 The Contractors' responsibilities:

.1 Ensure that all construction employees are aware of the CSC security requirements.

.2 Ensure that a copy of the CSC security requirements is always prominently on display at the job site.

.3 Co-operate with institutional personnel in ensuring that security requirements are observed by all construction employees.

1.4 CONSTRUCTION EMPLOYEES

.1 Submit CPIC form and scanned copy of government issued ID for each employee to the Departmental Representative.

.2 Allow 10 working days for processing of security clearances. Employees will not be admitted to the Institution without a valid security clearance in place and a recent picture identification such as a provincial driver's license. Security clearances obtained from other CSC institutions are not valid at this institution except as approved otherwise.

.3 The Director may require that facial photographs may be taken of construction employees and these photographs may be displayed at appropriate locations in the institution or in an electronic database for identification purposes. The Director may require that Photo ID cards be provided for all construction workers. ID cards will then be left at the designated entrance to be picked upon arrival at the institution and shall be displayed prominently on the construction employees clothing at all time while employees are at the institution.

.4 Entry to Institutional Property will be refused to any person there may be reason to believe may be a security risk.

.5 Any person employed on the construction site will be subject to immediate removal from Institutional Property if they:

.1 appear to be under the influence of alcohol, drugs or narcotics.

.2 behave in an unusual or disorderly manner.

.3 are in possession of contraband.

1.5 VEHICLES

.1 All unattended vehicles on CSC property must have windows closed; fuel caps locked, doors and trunks locked and keys removed. The keys must be securely in the possession of the owner or an employee of the company that owns the vehicle.

.2 The director may limit at any time the number and type of vehicles allowed within the Institution.

.3 Drivers of delivery vehicles for material required by the project will require security clearances and must remain with their vehicle the entire time that the vehicle is in the Institution. The director may require that these vehicles be escorted by Institutional staff or PWGSC Construction Escorts while in the Institution.

.4 If the Director permits trailers to be left inside the secure perimeter of the Institution, the trailer doors must be locked at all times. All windows must be securely locked bars when left unoccupied. Cover all windows with expanded metal mesh. When not in use lock all

storage trailers located inside and outside the perimeter. All storage trailers inside and outside the perimeter must be locked when not in use.

1.6 PARKING

.1 The parking area(s) to be used by construction employees will be designated by the Director. Parking in other locations will be prohibited and vehicles may be subject to removal.

1.7 SHIPMENTS

.1 To avoid confusion with the institution's own shipments, address all shipments of project material, equipment and tools in the Contractor's name and have a representative on site to receive any deliveries or shipments. CSC or PWGSC staff will **NOT** accept receipt of deliveries or shipments of any material equipment or tools for the contractor.

1.8 TELEPHONES

.1 The installation of telephones, facsimile machines and computers with Internet connections is not permitted within the Institution perimeter unless prior approved by the Director.

.2 The Director will ensure that approved telephones, facsimile machine and computers with Internet connections are located where they are not accessible to inmates. All computers will have an approved password protection that will stop an Internet connection to unauthorized personnel.

.3 Wireless cellular and digital telephones, including but not limited to devices for telephone messaging, pagers, Blackberries, PDAs, telephone used as 2-way radios are not permitted within the Institution unless approved by the Director. If wireless cellular telephones are permitted, the user will not permit their use by any inmate.

.4 The Director may approve but limit the use of 2-way radios.

1.9 WORK HOURS

.1 Work hours within the Institution are generally 7:30am to 16:00 with some exceptions. Refer to Division 1 and coordinate with director for exceptions.

.2 Work is not permitted during weekends and statutory holidays without the permission of the Director. A minimum of seven days advance notice will be required to obtain the required permission. In case of emergencies or other special circumstances, this advance notice may be waived by the Director.

1.10 OVERTIME WORK

.1 Conform to Division 1.

.2 Provide 48 hours advance notice to Director for all work to be performed after normal working hours of the Institution. Notify Director immediately if emergency work is required, such as to complete a concrete pour or make the construction site safe and secure.

1.11 TOOLS AND EQUIPMENT

.1 Maintain a complete list of all tools and equipment to be used during the construction project. Make this inventory available for inspection when required by the Institution.

.2 Throughout the construction project maintain up-to-date the list of tools and equipment specified above.

.3 Keep all tools and equipment under constant supervision, particularly power-driven and cartridge-driven tools, cartridges, files, saw blades, rod saws, wire, rope, ladders and any sort of jacking device.

.4 Store all tools and equipment in approved secure locations.

.5 Lock all tool boxes when not in use. Keys to remain in the possession of the employees of the contractor. Secure and lock scaffolding when not erected and when erected Secure in a manner agreed upon with the Institution designate.

.6 Report all missing or lost tools or equipment immediately to the Departmental Representative/Director.

.7 The Director will ensure that the security staff members carry out checks of the Contractor's tools and equipment against the list provided by the Contractor. These checks may be carried out at the following intervals:

.1 At the beginning and conclusion of every work day or shift upon entering and exiting the Institution.

.2 At any time when contractor is on Institution property.

.8 Certain tools/equipment such as cartridges and hacksaw blades are highly controlled items. The contractor will be given at the beginning of the day, a quantity that will permit one day's work. Used blades/cartridges will be returned to the Director's representative at the end of each day. Maintain up to date inventory of all used blades/cartridges.

.9 If propane or natural gas is used for temporary heating during construction, the institution will require that the contractor supervise the construction site during non-working hours.

1.12 KEYS

.1 Security Hardware Keys.

.1 Arrange with the security hardware supplier/installer to have the keys for the security hardware to be delivered directly to Institution, specifically the Security Maintenance Officer (SMO).

.2 The SMO will provide a receipt to the Contractor for security hardware keys.

.3 Provide a copy of the receipt to the Departmental Representative.

.2 Other Keys

.1 Use standard construction cylinders for locks for his use during the construction period.

.2 Issue instructions to employees and sub-trades, as necessary, to ensure safe custody of the construction set of keys.

.3 Upon completion of each phase of the construction, the CSC representative will, in conjunction with the lock manufacturer:

.1 Prepare an operational keying schedule

.2 Accept the operational keys and cylinders directly from the lock manufacturer.

.3 Arrange for removal and return of the construction cores and install the operational core in all locks.

.4 Upon putting operational security keys into use, the PWGSC construction escort will obtain these keys as they are required from the SMO and open doors as required by the Contractor. The Contractor shall issue instructions to his employees advising them that all security keys shall always remain with the PWGSC construction escort.

1.13 SECURITY HARDWARE

.1 Turn over all removed security hardware to the Director of the Institution for disposal or for safekeeping until required for re-installation.

1.14 PRESCRIPTION DRUGS

.1 Employees of the contractor who are required to take prescription drugs during the workday shall obtain approval of the Director to bring a one day supply only into the Institution.

1.15 SMOKING RESTRICTIONS

.1 Smoking is not permitted inside correctional facilities or outdoors within the perimeter of a correctional facility and persons must not possess unauthorized smoking items within the perimeter of a correctional facility.

.2 Persons in violation of this policy will be requested to immediately cease smoking or dispose of any unauthorized smoking items and, if they persist will be directed to leave the Institution.

.3 Smoking is permitted outside the perimeter of a correctional facility in an area designated by the Director.

1.16 CONTRABAND

.1 Weapons, ammunition, explosives, alcoholic beverages, drugs and narcotics are prohibited on institutional property.

.2 The discovery of contraband on the construction site and the identification of the person(s) responsible for the contraband shall be reported immediately to the Director.

.3 Contractors should be vigilant with both their staff and the staff of their sub-contractors and suppliers that the discovery of contraband may result in cancellation of the security clearance of the affected employee. Serious infractions may result in the removal of the company from the Institution for the duration of the construction.

.4 Presence of arms and ammunition in vehicles of contractors, sub-contractors and suppliers or employees of these will result in the immediate cancellation of security clearances for the driver of the vehicle.

1.17 SEARCHES

.1 All vehicles and persons entering institutional property may be subject to search.

.2 When the Director suspects, on reasonable grounds, that an employee of the Contractor is in possession of contraband, he may order that person to be searched.

.3 All employees entering the Institution may be subject to screening of personal effects for traces of contraband drug residue.

1.18 ACCESS AND REMOVAL FROM INSTITUTION PROPERTY

.1 Construction personnel and commercial vehicles will not be admitted to the institution after normal working hours, unless approved by the Director.

1.19 MOVEMENT VEHICLES

.1 Construction vehicles are not to leave the Institution until an inmate count is completed. Escorted commercial vehicles will be allowed to enter or leave the institution through the vehicle access gate during the following hours:

.1 AM: 0745 hrs. to 1100 hrs.

.2 PM: 1300hrs. to 1530 hrs.

.2 .The contractor will advise the Director twenty four (24) hours in advance to the arrival on the site of heavy equipment such as concrete trucks, cranes, etc.

.3 Vehicles being loaded with soil or other debris, or any vehicle considered impossible to search, must be under continuous supervision by CSC staff or PWGSC construction escorts working under the authority of the Director.

.4 Commercial vehicles will only be allowed access to institutional property when their contents are certified by the Contractor or his representative as being strictly necessary to the execution of the construction project.

.5 Vehicles will be refused access to institutional property if, in the opinion of the Director, they contain any article which may jeopardize the security of the institution. Arrange with Director for parking of contractors vehicles.

.6 Private vehicles of construction employees will not be allowed within the security wall or fence of maximum security institutions without the authorization of the Director.

.7 With the approval of the Director, certain equipment may be permitted to remain on the construction site overnight or over the weekend. This equipment must be securely locked, with the battery removed. The Director may require that the equipment be secured with a chain and padlock to another solid object.

1.20 MOVEMENT OF CONSTRUCTION EMPLOYEES ON INSTITUTIONAL PROPERTY

.1 Subject to the requirements of good security, the Director will permit the Contractor and his employees as much freedom of action and movement as is possible.

.2 However, notwithstanding paragraph above, the Director may:

.1 Prohibit or restrict access to any part of the institution.

.2 Require that in certain areas of the institution, either during the entire construction project or at certain intervals, construction employees only be allowed access when accompanied by a member of the CSC security staff or PWGSC Construction Escort Officer.

.3 During the lunch and coffee/health breaks, all construction employees will remain within the construction site. Construction employees are not permitted to eat in the Institution cafeteria and dining room.

1.21 SURVEILLANCE AND INSPECTION

.1 Construction activities and all related movement of personnel and vehicles will be subject to surveillance and inspection by CSC security staff members to ensure that established security requirements are met.

.2 CSC staff members will ensure that an understanding of the need to carry out surveillance and inspections, as specified above, is established among construction employees and maintained throughout the construction project.

1.22 STOPPAGE OF WORK

.1 The director may request at any time that the contractor, his employees, sub-contractors and their employees not enter or leave the work site immediately due to a security situation occurring within the Institution. The contractor's site supervisor will note the name of the staff member giving the instruction, the time of the request and obey the order as quickly as possible.

.2 The contractor shall advise the Departmental Representative of this interruption of the work within 24 hours.

1.23 CONTACT WITH INMATES

.1 Unless specifically authorized, it is forbidden to come into contact with inmates, to talk with them, to receive objects from them or to give them objects. Any employee doing any of the above will be removed from the site and his security clearance revoked.

.2 Digital cameras (or any other type) are not allowed on CSC property.

.3 Notwithstanding the above paragraph, if the director approves of the use of cameras, it is strictly forbidden to take pictures of inmates, of CSC staff members or of any part of the Institution other than those required as part of this contract.

1.24 COMPLETION OF CONSTRUCTION PROJECT

.1 Upon completion of the construction project or, when applicable, the takeover of a facility, the Contractor shall remove all remaining construction material, tools and equipment that are not specified to remain in the Institution as part of the construction contract.

END OF SECTION

Part 1 General

PSPCC Update on Asbestos Use
Effective April 1, 2016, all Public Works and Government Services Canada (PWGSC) contracts for new construction and major rehabilitation will prohibit the use of asbestos-containing materials. Further information can be found at http://www.tpsgc-pwgsc.gc.ca/comm/vedette-features/2016-04-19-00-eng.html

1.1 REFERENCES

.1 Government of Canada.

.1 Canada Labour Code - Part II

.2 Canada Occupational Health and Safety Regulations.

.2 National Building Code of Canada (NBC):

.1 Part 8, Safety Measures at Construction and Demolition Sites.

.3 The Canadian Electric Code (as amended)

.4 Canadian Standards Association (CSA) as amended:

.1 CSA Z797-2009 Code of Practice for Access Scaffold

.2 CSA S269.1-1975 (R2003) Falsework for Construction Purposes

.3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures

.4 CSA Z1006-10 Management of Work in Confined Spaces.

.5 CSA Z462- Workplace Electrical Safety Standard

.5 National Fire Code of Canada 2010 (as amended)

.1 Part 5 – Hazardous Processes and Operations and Division B as applicable and required.

.6 American National Standards Institute (ANSI):

.1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.

.7 Province of British Columbia:

.1 Workers Compensation Act Part 3-Occupational Health and Safety.

.2 Occupational Health and Safety Regulation

1.2 RELATED SECTIONS

.1 Refer to the following current NMS sections as required:

.1 Section 01 01 50 – General Instructions

.2 Section 02 41 19 – Selective Demolition

1.3 WORKERS' COMPENSATION BOARD COVERAGE

.1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.

.2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

1.4 COMPLIANCE WITH REGULATIONS

.1 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.

.2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

1.5 SUBMITTALS

.1 Submit to Departmental Representative submittals listed for review in accordance with Section 01 01 50 General Instructions.

.2 Work effected by submittal shall not proceed until review is complete.

.3 Submit the following:

- .1 Health and Safety Plan.
- .2 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.
- .3 Copies of incident and accident reports.
- .4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
- .5 Emergency Procedures.

.4 The Departmental Representative will review the Contractor's site-specific project Health and Safety Plan and emergency procedures, and provide comments to the Contractor within 10 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative.

.5 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit additional certifications for any new site personnel to Departmental Representative.

.6 Submission of the Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:

- .1 Be construed to imply approval by the Departmental Representative.
- .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.
- .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

1.6 RESPONSIBILITY

.1 Assume responsibility as the Prime Contractor for work under this contract.

.2 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.3 Comply with and enforce compliance by employees with safety requirements of Contract documents, applicable Federal, Provincial, Territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.7 HEALTH AND SAFETY COORDINATOR

.1 The Health and Safety Coordinator (Registered Occupational Hygienist, Certified Industrial Specified Hygienist) must:

.1 Be responsible for completing all health and safety training, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.

.2 Be responsible for implementing, daily enforcing, and monitoring the site specific Health and Safety Plan.

.3 Be on site during execution of work.

1.8 GENERAL CONDITIONS

.1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.

.2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.

.1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.

.2 Secure site at night time or provide security guard as deemed necessary to protect site against entry.

1.9 PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with:

.1 Multi-employer work site.

.2 Federal employees and general public.

.3 Energized electrical services.

.4 Working from heights

.5 Working in the open exposed to unpredictable weather.

.6 High volumes of vehicular and pedestrian traffic

1.10 UTILITY CLEARANCES

.1 The Contractor is solely responsible for all utility detection and clearances prior to starting the work.

.2 The Contractor will not rely solely upon the Reference Drawings or other information provided for utility locations.

1.11 REGULATORY REQUIREMENTS

.1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.

.2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.

1.12 WORK PERMITS

.1 Obtain specialty permit related to project before start of work.

1.13 FILING OF NOTICE

.1 The General Contractor is to complete and submit a Notice of Project as required by Provincial authorities.

.2 Provide copies of all notices to the Departmental Representative.

1.14 HEALTH AND SAFETY PLAN

.1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.

.2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:

.1 Primary requirements:

.1 Contractor's safety policy.

.2 Identification of applicable compliance obligations.

.3 Definition of responsibilities for project safety/organization chart for project.

.4 General safety rules for project.

.5 Job-specific safe work, procedures.

.6 Inspection policy and procedures.

.7 Incident reporting and investigation policy and procedures.

.8 Occupational Health and Safety Committee/Representative procedures.

.9 Occupational Health and Safety meetings.

.10 Occupational Health and Safety communications and record keeping procedures.

.2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.

.3 List hazardous materials to be brought on site as required by work.

.4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.

.5 Identify personal protective equipment (PPE) to be used by workers.

.6 Identify personnel and alternates responsible for site safety and health.

.7 Identify personnel training requirements and training plan, including site orientation for new workers.

.3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.

.4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.

.5 Departmental Representative's review: the review of Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

1.15 EMERGENCY PROCEDURES

.1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:

.1 Designated personnel from own company.

.2 Regulatory agencies applicable to work and as per legislated regulations.

.3 Local emergency resources.

.4 Departmental Representative.

.2 Include the following provisions in the emergency procedures:

.1 Notify workers and the first-aid attendant, of the nature and location of the emergency.

.2 Evacuate all workers safely.

.3 Check and confirm the safe evacuation of all workers.

.4 Notify the fire department or other emergency responders.

.5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.

.6 Notify Departmental Representative.

.3 Provide written rescue/evacuation procedures as required for, but not limited to:

.1 Work at high angles.

.2 Work in confined spaces or where there is a risk of entrapment.

.3 Work with hazardous substances.

.4 Underground work.

.5 Work on, over, under and adjacent to water.

.6 Workplaces where there are persons who require physical assistance to be moved.

.4 Design and mark emergency exit routes to provide quick and unimpeded exit.

.5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

1.16 HAZARDOUS PRODUCTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and

regarding labeling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.

.2 Where use of hazardous and toxic products cannot be avoided:

.1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 01 50 General Instructions.

.2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.

.3 Provide adequate means of ventilation in accordance with Section 01 01 50 – General Instructions.

.4 The contractor shall ensure that the product is applied as per manufacturers recommendations.

.5 The contractor shall ensure that only pre-approved products are brought onto the work site in an adequate quantity to complete the work.

1.17 ASBESTOS HAZARD

.1 Carry out any activities involving asbestos in accordance with applicable Provincial Regulations.

.2 Removal and handling of asbestos will be performed as indicated in Division 2 specifications.

1.18 PCB REMOVALS

.1 Mercury-containing fluorescent tubes and ballasts which contain polychlorinated biphenyls (PCBs) are classified as hazardous waste.

.2 Remove, handle, transport and dispose of as indicated in Division 2 specifications.

1.19 ELECTRICAL SAFETY REQUIREMENTS

.1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.

.1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with Departmental Representative.

.2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

1.20 ELECTRICAL LOCKOUT

.1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.

.2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/authorization form. Have procedures available for review upon request by the Departmental Representative.

.3 Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

1.21 OVERLOADING

.1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation.

1.22 FALSEWORK

.1 Design and construct falsework in accordance with CSA S269.1- 2014.

1.23 SCAFFOLDING

.1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA Z797-2009 Code of Practice for Access Scaffold and BC Occupational Health and Safety Regulations.

1.24 CONFINED SPACES

.1 Carry out work in confined spaces in compliance with Provincial regulations.

1.25 POWER-ACTUATED DEVICES

.1 Use powder-actuated devices in accordance with ANSI A10.3 only after receipt of written permission from the Departmental Representative.

1.26 FIRE SAFETY AND HOT WORK

.1 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.

.2 Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.

1.27 FIRE SAFETY REQUIREMENTS

.1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

.3 Portable gas and diesel fuel tanks are not permitted on most federal work sites. Approval from the Departmental Representative is required prior to any gas or diesel tank being brought onto the work site.

1.28 FIRE PROTECTION AND ALARM SYSTEM

.1 Fire protection and alarm systems shall not be:

.1 Obstructed.

.2 Shut off.

.3 Left inactive at the end of a working day or shift.

.2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.

.3 Be responsible/liable for costs incurred from the fire department, the building owner and the tenants, resulting from false alarms.

1.29 UNFORESEEN HAZARDS

.1 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of the work, immediately stop work and advise the Departmental Representative verbally and in writing.

1.30 POSTED DOCUMENTS

.1 Post legible versions of the following documents on site:

.1 Health and Safety Plan.

.2 Sequence of work.

.3 Emergency procedures.

.4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.

.5 Notice of Project.

.6 Floor plans or site plans. Must be posted in a non-inmate access are and locked up when not being used.

.7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.

.8 Workplace Hazardous Materials Information System (WHMIS) documents.

.9 Material Safety Data Sheets (MSDS).

.10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.

.2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.

.3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

1.31 MEETINGS

.1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

1.32 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.

.3 The Departmental Representative may issue a "stop work order" if non-compliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a "stop work order".

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.

.2 Acronyms:

AFD - Alternate Forms of Delivery, service provider.

BMM - Building Management Manual.

Cx - Commissioning.

EMCS - Energy Monitoring and Control Systems.

O&M - Operation and Maintenance.

PI - Product Information.

PV - Performance Verification.

TAB - Testing, Adjusting and Balancing.

.3 Provide third party commissioning agent(s) for mechanical and electrical systems. Provide costs of commissioning in tender price.

.4 Refer to sections of Mechanical, Electrical and Communications disciplines for specific requirements

1.2 GENERAL

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.

.2 Ensure appropriate documentation is compiled into the BMM.

.3 Effectively train O&M staff.

.2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.

.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

1.3 COMMISSIONING OVERVIEW

.1 Cx Agent:

.1 Hired and paid for by the Contractor.

.2 Responsibilities:

.1 Plan, coordinate, and carry out the Cx process.

.2 Develop Cx plan and Cx check forms (component, system and integrated system verification).

.3 Undertakes the component, system and integrated system performance verification testing and commissioning.

.4 Plans and carry out equipment demonstration and acceptance tests.

.5 Complete all Cx verification documentations.

.6 Chair Cx meetings.

.2 Cx to be a line item of Contractor's cost breakdown.

.3 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.4 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.

.5 Commissioning work to be completed prior Contractor’s request for Substantial Performance:

.1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.

.2 Equipment, components and systems have been commissioned.

.3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the non-functional system(s), including related systems as deemed required by Departmental Representative, to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

.1 Before Construction:

.1 Review contract documents, confirm by writing to Departmental Representative.

.1 Adequacy of provisions for Cx.

.2 Aspects of design and installation pertinent to success of Cx.

.2 .During Construction:

.1 Coordinate provision, location and installation of provisions for Cx.

.3 Before start of Cx:

.1 Have completed Cx Plan up-to-date.

.2 Ensure installation of related components, equipment, sub-systems, systems is complete.

.3 Fully understand Cx requirements and procedures.

.4 Have Cx documentation shelf-ready.

.5 Understand completely design criteria and intent and special features.

.6 Submit complete start-up documentation to Departmental Representative.

.7 Have Cx schedules up-to-date.

.8 Ensure systems have been cleaned thoroughly.

.9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.

.10 Ensure "As-Built" system schematics are available.

.4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 01 01 50 – General Instructions.

.2 Submit immediately after award of Contract:

.1 Name of Contractor’s Cx Agent.

.3 Submit no later than 4 weeks after award of Contract:

.1 Draft Cx documentation.

.2 Preliminary Cx schedule.

.4 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 2 weeks prior to start of Cx.

.5 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 2 weeks prior to start of Cx.

.6 Provide additional documentation relating to Cx process required by Departmental Representative.

1.8 COMMISSIONING DOCUMENTATION

.1 Provide the following verification check sheets.

.1 Installation Check Lists and Product Information (PI) forms.

.2 Performance Verification (PV) forms.

.2 Departmental Representative to review and approve Cx documentation.

.3 Provide completed and approved Cx documentation to Departmental Representative.

1.9 COMMISSIONING SCHEDULE

.1 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

.1 Approval of Cx reports.

.2 Verification of reported results.

.3 Repairs, retesting, re-commissioning, re-verification.

.4 Training.

1.10 COMMISSIONING MEETINGS

.1 Convene Cx meetings following project meetings.

.2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.

.3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.

.4 At 60% construction completion stage. Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:

.1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.

.2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.

.5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.

.6 Meeting will be chaired by Cx Agent who will record and distribute minutes.

1.11 QUALITY ASSURANCE

.1 Testing organization: current member in good standing of AABC certified to perform specified services.

.2 Comply with applicable procedures and standards of the certification sponsoring association.

.3 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

1.12 REFERENCES

.1 Associated Air Balance Council (AABC): National Standards for Field Measurement and Instrumentation, Total Systems Balance, Air Distribution-Hydronics Systems.

1.13 SUBMITTALS

.1 Prior to start of Work, submit name of organization proposed to perform services. Designate who has managerial responsibilities for coordination of entire testing, adjusting and balancing.

.1 Submit documentation to confirm organization compliance with quality assurance provision.

.2 Submit 3 preliminary specimen copies of each of report forms proposed for use.

.3 Ten (10) days prior to Substantial Performance, submit 3 copies of final reports on applicable forms.

.4 Submit reports of testing, adjusting and balancing postponed due to seasonal, climatic, occupancy, or other reasons beyond Contractor's control, promptly after execution of those services.

1.14 PROCEDURES

.1 Comply with procedural standards of certifying association under whose standard services will be performed.

.2 Notify Departmental Representative 3 days prior to beginning of operations.

.3 Accurately record data for each step.

.4 Report to Departmental Representative any deficiencies or defects noted during performance of services.

1.15 CONTRACTOR’S RESPONSIBILITIES

.1 Prepare each system for testing and balancing.

.2 Cooperate with testing organization and provide access to equipment and systems.

.3 Provide personnel and operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.

.4 Notify testing organization 7 days prior to time project will be ready for testing, adjusting, and balancing.

.5 Commission cost to be borne by Contractor.

1.16 PREPARATION

.1 Provide instruments required for testing, adjusting, and balancing operations.

.2 Make instruments available to Departmental Representative to facilitate spot checks during testing.

.3 Retain possession of instruments and remove at completion of services.

.4 Verify systems installation is complete and in continuous operation.

.5 Verify lighting is turned on when lighting is included in cooling load.

.6 Verify equipment such as computers, laboratory and electronic equipment are in full operation.

1.17 FINAL REPORTS

.1 Organization having managerial responsibility shall make reports.

.2 Ensure each form bears signature of recorder, and that of supervisor of reporting organization.

.3 Identify each instrument used, and latest date of calibration of each.

1.18 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx deliverables have been submitted and accepted by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 23 05 00 – Common Work Results for HVAC

1.2 DESCRIPTION

.1 Demonstrate scheduled operation and maintenance of equipment and systems to Departmental Representative and maintenance personnel two weeks prior to date of interim completion.

.2 Departmental Representative will provide list of CSC personnel to Contractor and coordinate dates and times.

1.3 QUALITY CONTROL

.1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Departmental Representative's personnel, and provide written report that demonstration and instructions have been completed.

1.4 SUBMITTALS

.1 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.

.2 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.3 Give time and date of each demonstration, with list of persons present.

1.5 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation.

.2 Testing, adjusting, and balancing has been performed and equipment and systems are fully operational.

.3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.6 PREPARATION

.1 Verify that conditions for demonstration and instructions comply with requirements. Prepare supplemental literature and handouts.

.2 Verify that designated personnel are present.

1.7 DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the equipment location. All operational modes shall be demonstrated.

.2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.

.3 Review contents of manual in detail to explain all aspects of operation and maintenance.

.4 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Removal and or salvage of designated construction.

.2 Disposal of materials.

1.2 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

.2 National Building Code Part 8

1.4 GENERAL

.1 Submit detailed schedule for any and all work affecting the existing building. Consult with CSC regarding work required. Submit schedule minimum 10 calendar days prior to scheduled work.

.2 Comply with requirement of the Waste Management and Disposal Requirements in Section 01 01 50 – General Instructions.

1.5 SCHEDULING

.1 Submit with the project schedule a coordinated complete series of drawings, diagrams, details and supporting data clearly showing sequence of demolition and removal work, reconstruction, occupant moves required, material storage, temporary barriers for all phases of the demolition construction work.

.2 Perform noisy, malodorous, dusty, work as directed by CSC and the Departmental Representative.

1.6 SITE CONDITIONS

.1 Review the Project Specific Hazardous Building Materials Assessment for the Kent Institution with the Departmental Representative.

.1 Remove hazardous materials in a manner consistent with the Occupational Health & Safety Regulation, General Hazard Requirements of the Work Safe BC, and other applicable regulations. Changes to the Work will be dealt in accordance with the provisions of the Contract Documents.

.1 All plumbing gaskets shall be considered asbestos containing materials (ACM).

.2 Handle and dispose of all hazardous and banned materials in accordance with the Special Waste Regulation, and Regional and Municipal regulations. These hazardous and banned materials include but are not limited to asbestos, drywall (banned from disposal), Polychlorinated Biphenyls (PCBs), abandoned chemicals (gasoline, pesticides, herbicides, flammable and combustible substances), all refrigerant from cooling equipment, lead-based paints, smoke detectors, and mercury containing switches.

.2 Should material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Departmental Representative immediately.

.1 Do not proceed until written instructions have been received from the Departmental Representative.

.3 Notify Departmental Representative minimum 5 working days before disrupting building access or services.

.4 The Contractor shall accept the site as it exists and will be responsible for all deconstruction work as required.

1.7 DEMOLITION PROCEDURES

.1 Materials: As specified in Product sections; match existing Products and work for patching and extending work.

.2 Employ skilled and experienced installer to perform alteration work.

.3 Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

.4 Remove, cut, and patch Work in a manner to minimize damage and to provide means of restoring Products and finishes to original condition.

.5 Refinish existing visible surfaces to remain in renovated rooms and spaces, to renewed condition for each material, with a neat transition to adjacent finishes.

.6 Where new Work abuts or aligns with existing, provide a smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

.7 When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and submit recommendation to Departmental Representative for review.

.8 Where a change of plane of 6 mm or more occurs, submit recommendation for providing a smooth transition; to Departmental Representative for review. Request instructions from the Departmental Representative.

.9 Patch or replace portions of existing surfaces which are damaged, lifted, discoloured, or showing other imperfections.

.10 Finish surfaces as specified in individual Product sections.

1.8 PROTECTION

.1 Prevent movement, settlement, or other damage to adjacent structures, utilities, and parts of building to remain in place. Provide bracing and shoring required.

.2 Keep noise, dust, and inconvenience to occupants to a minimum. Noisy work will only be permitted at times agreed to and accepted by the Departmental Representative.

.3 Protect building mechanical and electrical systems, services and equipment.

.4 Provide temporary dust screens, covers, railings, supports and other protection as required.

.5 Do not overload any portion of the structure with material or equipment

.6 Where existing load bearing partitions are to be removed, do not commence work until new support structure is installed, inspected and approved by the Departmental Representative.

.7 Cease operations and notify the Departmental Representative if safety of any adjacent work or structure appears to be endangered. Take all precautions to support the structure. Do not resume operations until reviewed with the Departmental Representative.

.8 Ensure safe passage of building occupants around area of demolition. Remove debris and clean areas of access immediately.

.9 Conduct demolition to minimize interference with adjacent and occupied building areas.

1.9 QUALITY ASSURANCE

.1 Salvage or Demolition Firm: Company (ies) must be experienced and specializing in performing the work of this section with documented experience in similar types of deconstruction work.

.2 Qualifications of Workers: Provide a supervisor who shall be present at all times during the deconstruction work and who shall be thoroughly familiar with the work required and who shall direct all work. Provide one (1) person on site who is responsible for maintaining the safety barriers and protection of the workers and the public.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 PREPARATION

.1 Inspect building & site with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

.2 Provide, erect, and maintain temporary barriers security partitions at locations indicated agreed to with CSC and the Departmental Representative.

.1 Erect and maintain temporary partitions to prevent spread of dust, odours, and noise to permit continued occupancy. Refer to complete project drawings. The extent of the partitions required may exceed the information shown on the demolition drawings.

.3 Erect and maintain weatherproof closures for exterior openings.

.4 Protect existing materials which are not to be demolished.

.5 Prevent movement of structure; provide bracing and shoring.

3.2 PROTECTION

.1 Maintain public safety and traffic control precautions at all times during the demolition work, using properly trained qualified persons to control all Contractor's activities, vehicles, equipment, traffic and all public pedestrian and vehicles traffic that are coming to and from the site or passing along the vicinity of the site access locations.

.2 Prevent movement, settlement, or damage to adjacent structures, utilities, and parts of building to remain in place. Provide bracing and shoring required.

.3 Keep noise, dust, and inconvenience to occupants to minimum.

.4 Protect building systems, services and equipment.

.5 Do Work in accordance with Section 01 35 33 - Health and Safety.

3.3 SITE REMOVALS

.1 Remove items as indicated.

3.4 DEMOLITION

.1 The electrical, BSCS, or mechanical services MUST NOT be terminated within the building at any time. Notify the building Departmental Representative of any requirements for partial termination of services in accordance with Division 1 requirements. Keep down time at a minimum.

.2 Remove parts of existing building to permit new construction. Sort materials into appropriate piles for reuse, recycling, or disposal.

.1 Demolish in an orderly and careful manner. Protect existing supporting structural members.

.2 Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

.3 Remove temporary Work.

3.5 DISPOSAL

.1 Dispose of removed materials, to appropriate recycling facilities except where specified otherwise, in accordance with authority having jurisdiction.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 01 50 – General Instructions.

.2 Section 01 35 33 – Health and Safety Requirements.

1.2 REFERENCES

.1 CSA International

.1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

.2 National Research Council Canada (NRC)

.1 National Building Code of Canada (2015) (NBC)

.2 National Fire Code of Canada (2015) (NFC)

.3 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

.4 Federal Halocarbon Regulations

.1 For removal of refrigerant containing equipment and piping, ensure compliance with Federal Halocarbon Regulations.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 01 50 – General Instructions.

.2 Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management highlighting recycling and salvage requirements.

.2 Erosion and Sedimentation Control: submit erosion and sedimentation control plan in accordance with authorities having jurisdiction.

1.4 SITE CONDITIONS

.1 Review "Designated Substance Report" and take precautions to protect environment.

.2 If material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Departmental Representative immediately.

.1 Proceed only after receipt of written instructions have been received from Departmental Representative.

.3 Notify Departmental Representative before disrupting building access or services.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 EXAMINATION

.1 Inspect building and site with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

.2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.

.3 Notify and obtain approval of utility companies before starting demolition.

.4 Disconnect, cap, plug or divert, as required, existing public utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.

.1 Immediately notify Departmental Representative and utility company concerned in case of damage to any utility or service, designated to remain in place.

.2 Immediately notify the Departmental Representative should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

3.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to: sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during demolition.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of demolition work..

.2 Protection of In-Place Conditions:

.1 Prevent movement, settlement, or damage to adjacent structures, utilities, and landscaping features and parts of building to remain in place. Provide bracing and shoring required.

.2 Keep noise, dust, and inconvenience to occupants to minimum.

.3 Protect building systems, services and equipment.

.4 Provide temporary dust screens, covers, railings, supports and other protection as required.

.5 Do Work in accordance with Section 01 35 33 - Health and Safety Requirements.

.3 Demolition/Removal:

.1 Remove items as indicated.

.2 Removal of Pavements, Curbs and Gutters:

.3 Remove parts of existing building to permit new construction.

.4 Trim edges of partially demolished building elements to tolerances as defined by Departmental Representative to suit future use.

.5 Dispose of all equipment and material legally.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 01 50 – General Instructions.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 01 50 – General Instructions.

.3 Refer to demolition drawings and specifications for items to be salvaged for reuse.

.4 Waste Management: separate waste materials for reuse or recycling in accordance with Section 01 01 50 – General Instructions.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Refer to the following reports (further referred to herein as the “Assessment Reports”), attached in the Appendices of the Project Specifications, for information pertaining to hazardous building materials that have been identified and may require disturbance (removal and disposal) during the Work:

.1 Appendix A: Stantec Consulting Ltd. Entitled “Occupational Exposure Assessment-CSC Kent Institution, Agassiz, BC”

.2 Appendix B: Stantec Consulting Ltd. Report No. 123221940 entitled Pre-Renovation Hazmat Assessment, Site Review Report; Kent Institution Exhaust Ventilation Upgrade, dated August 30, 2021

.3 Appendix C: Stantec Consulting Ltd. Report entitled Hazardous Building Materials Assessments, 42 Buildings/Structures at CSC Kent Institution, 4732 Cemetery Road, Agassiz, BC, dated February 2019

1.2 DEFINITIONS

.1 Dangerous Goods: product, substance, or organism that is specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.

.2 Hazardous Building Material: component of a building or structure that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when altered, disturbed or removed during maintenance, renovation or demolition.

.3 Hazardous Material: product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.

.4 Hazardous Waste: any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment or disposal.

1.3 REFERENCE STANDARDS

.1 Canadian Environmental Protection Act, 1999 (CEPA 1999).

.1 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 National Research Council Canada Institute for Research in Construction (NRC-IRC)

.1 National Fire Code of Canada 2015.

.4 Department of Justice Canada

.1 Transportation of Dangerous Goods Act (TDG Act) 1999, (c. 34).

.2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2003-400).

.5 Government of Canada

.1 The Canada Labour Code, Part II, Canada Occupational Health and Safety Regulations (COHSR)

.2 The Federal PCB Regulations (SOR/2008-273).

.3 The Federal Halocarbons Regulation (July 2003).

.6 Public Services and Procurement Canada

.1 Asbestos Management Directive (June 5, 2017)

.2 Asbestos Management Standard (June 5, 2017)

.7 WorkSafe BC

.1 British Columbia's Occupational Health and Safety Regulation (BC Reg. 296/97), including amendments to date of work)

.2 "Safe Work Practices for Handling Asbestos" (2017)

.3 "Lead-Containing Paints and Coatings; Preventing Exposure in the Construction Industry" (2011)

.4 "Safe Work Practices for Handling Lead" (2017)

.8 Government of British Columbia

.1 British Columbia Hazardous Waste Regulation (BC Reg. 63/88)

.9 Canadian Construction Association

.1 Standard Construction Document CCA 82 "Mould Guidelines for the Canadian Construction Industry" (2018 – further referred to herein as "CCA 82").

1.4 SUBMITTALS

.1 Provide submittals in accordance with 01 01 50 – General Instructions.

.2 Product Data for hazardous materials to be used by the Contractor to complete the Work:

.1 Submit manufacturer's instructions, printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS to Departmental Representative for each hazardous material required prior to bringing hazardous material on site.

.3 Submit hazardous materials management plan to Departmental Representative that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Co-ordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.

.2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.

.3 Store and handle flammable and combustible materials in accordance with current National Fire Code of Canada 2015 requirements.

.4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.

.1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.

.2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Departmental Representative.

.5 Transfer of flammable and combustible liquids is prohibited within buildings.

.6 Do not transfer of flammable and combustible liquids in vicinity of open flames or heat-producing devices.

.7 Do not use flammable liquids having flash point below 38 degrees C, such as naphtha or gasoline as solvents or cleaning agents.

.8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.

.9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.

.10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:

.1 Store hazardous materials and wastes in closed and sealed containers.

.2 Label containers of hazardous materials and wastes in accordance with WHMIS.

.3 Store hazardous materials and wastes in containers compatible with that material or waste.

.4 Segregate incompatible materials and wastes.

.5 Ensure that different hazardous materials or hazardous wastes are not mixed.

.6 Store hazardous materials and wastes in secure storage area with controlled access.

.7 Maintain clear egress from storage area.

.8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.

.9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.

.10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.

.11 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.

.12 Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within 24 hours of incident.

1.6 TRANSPORTATION

.1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.

.2 If hazardous waste is generated on site:

.1 Co-ordinate transportation and disposal with Departmental Representative.

.2 Ensure compliance with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.

.3 Use licensed carrier authorized by provincial authorities to accept subject material.

.4 Prior to shipping material obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept this material.

.5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.

.6 Ensure that trained personnel handle, offer for transport, or transport dangerous goods.

.7 Provide photocopy of shipping documents and waste manifests to Departmental Representative.

.8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide a photocopy of completed manifest to Departmental Representative.

.9 Report discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate provincial authority. Take reasonable measures to control release.

1.7 EXISTING CONDITIONS

.1 Reports and information pertaining to hazardous building materials present within the building that may be handled, removed, or otherwise disturbed and disposed of during this Project are included in the Appendix A, B and C of the Project Specifications.

.2 Notify Departmental Representative of suspected hazardous building material discovered during Work and not apparent from drawings, specifications, or reports pertaining to the Work. Do not disturb such material until such time as instructions are received from Departmental Representative.

Part 2 Products

2.1 MATERIALS

.1 Only bring on site quantity of hazardous materials required to perform work.

.2 Maintain MSDS in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

Part 3 Execution

3.1 HAZARDOUS BUILDING MATERIALS ABATEMENT

.1 Abatement shall be conducted to handle, alter, remove and dispose of hazardous building materials as identified in the Assessment Reports in accordance with applicable regulations, guidelines, standards and/or best practices for such work, only to the extent that such identified hazardous building materials will be impacted (handled, altered, damaged, removed) by the Work.

.2 Contractor is responsible for reviewing plans, specifications and reports such that they understand the locations and amounts of hazardous building materials that will be impacted by the Work of this Contract.

.3 Where there is a discrepancy between the information in this specification as compared to the information in the Assessment Reports as it pertains to identities, locations and/or quantities of identified hazardous building materials, the information in the Assessment Reports will prevail.

.1 If discrepancies are present pertaining to identities, locations and/or quantities of identified hazardous building materials, it is the Contractor's responsibility to request information to clarify such discrepancies during the bidding period. No additional costs will be allowed by the Contractor for additional labour or materials required to complete required abatement related to such discrepancies.

.4 The Contractor is responsible to prepare a project-specific Risk Assessment and Exposure Control Plan in relation to the site-specific tasks and materials to be impacted as part of their Work. This documentation must be submitted to the Departmental Representative at least 10 days prior to initiation of work, and must indicate whether or not hazardous building materials listed herein or in the Assessment Reports will be impacted by the Contractor during the Work.

.5 The listing below is a summary of the identified hazardous building material categories that are anticipated to require disturbance, along with the associated removal and disposal regulations, guidelines and/or standards.

.1 Asbestos-Containing Materials (ACMs)

.1 Refer to the Assessment Reports for identities and locations of ACMs. Although the Contractor is responsible to review this information in light of their proposed methods for completing the Work, a preliminary review indicates that the following ACMs will require consideration:

.1 Red HVAC ducting applied to seams HVAC ducting

.2 12"x12" cream floor tile with brown smears

.3 Cement panels on electrical penetrations

.2 If ACMs are to be impacted as part of the Contractor's work plan, actions that will disturb identified ACMs are to be conducted in accordance with the requirements of the 2017 WorkSafe BC publication "Safe Work Practices for Handling Asbestos", by appropriately trained personnel.

.1 Submit Provincial and/or local requirements for Notice of Project Form.

.2 Submit proof of Contractor's Asbestos Liability Insurance.

.3 Submit to Departmental Representative necessary permits for transportation and disposal of asbestos containing waste and proof that asbestos containing waste has been received and properly disposed.

.4 Submit proof that all asbestos workers and/or supervisor have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene and work practices while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing. Instruction and training related to respirators is to include, at a minimum:

.1 Fitting of equipment.

.2 Inspection and maintenance of equipment.

.3 Disinfecting of equipment.

.4 Limitations of equipment.

.3 If ACMs are to be impacted as part of the Contractor's work plan, Contractor is to conduct a Risk Assessment and document site-specific Safe Work Practices for actions/tasks that will or may disturb identified ACMs.

.1 Contractor is to submit the documented work procedures to the Departmental Representative for review, at least 10 days prior to initiation of work.

.2 Contractor must not proceed with work that will impact identified ACMs without approval from Departmental Representative.

.3 If, in the opinion of the Departmental Representative, the work procedures developed by the Contractor do not meet the intent of the 2017 WorkSafeBC publication "Safe Work Practices for Handling Asbestos", revisions will be required, at no cost to the Owner, and at no impact to the schedule.

.4 If ACMs are to be impacted as part of the Contractor's work plan, Contractor shall retain an independent, competent third party to provide the required air monitoring and inspections.

.1 Air samples will be taken inside and outside of Asbestos Work Areas in accordance with the most stringent of the recommendations set forth in the Canada Labour Code Part II, Occupational Health and Safety Regulations, BC Reg. 296/97 and the 2017 WorkSafeBC Manual "Safe Work Practices for Handling Asbestos".

.1 Air samples will be collected and analyzed in accordance with NIOSH method 7400.

.2 Air sample results will be provided to the Contractor and Departmental Representative within 24-hours of sample collection.

.3 Analysis will be conducted by qualified persons or laboratories that take part in a documented QA/QC program for such analysis.

.2 During abatement, Contractor will be notified to stop Work when airborne fibre measurements exceed 0.05 fiber/cubic centimetre (f/cc), when PPE and protection factors are considered, and to correct procedures.

.3 Subsequent to abatement, post-abatement ("air clearance") sample results must indicate airborne fibre measurements less than 0.01 f/cc prior to the Contractor being provided with notification that containment structures can be removed.

.4 Additional monitoring will be conducted, where possible, to verify procedural corrections were effective.

.5 If air monitoring shows that areas outside Asbestos Work Area are contaminated as determined by the Departmental Representative, Contractor will be notified to maintain and clean these areas in same manner as that applicable to Asbestos Work Area, at no additional cost to the Contract.

.1 When asbestos leakage from Asbestos Work Area has occurred, or is likely to occur, Departmental Representative may order Work shutdown and correction of deficiencies.

.6 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

.5 If and when generated, asbestos waste transportation and disposal to be conducted in accordance with BC Reg. 63/88 and the Federal Transportation of Dangerous Goods Regulation.

.2 Lead and Lead-Containing Paints (LCPs)

.1 Refer to the Assessment Reports for identities and locations of identified lead-containing materials (including paints with varying concentrations of lead) that may require impacts during the Work.

.2 Actions that will disturb lead-containing materials (including paints and materials coated with paints) are to be conducted in accordance with the requirements of the 2017 WorkSafe BC publication "Safe Work Practices for Handling Lead", keeping airborne exposure to lead dust to less than COHSR and BC Reg. 296/97 regulated 8-hour Occupational Exposure Limit (OEL) for lead of 0.05 milligram per cubic metre (mg/m^3).

.1 The actual methods to be used by the Contractor to complete the general Work of this Project may impact how and to what extent various lead-containing items and LCPs will require removal and disposal.

.3 The work tasks required and the ways in which lead-containing materials (including LCPs) will be impacted will determine the appropriate respirators, measures and procedures that should be followed to protect workers from lead exposure. This is to be determined by the Contractor through their own Risk Assessment and development of Safe Work Practices that are prepared in relation to the site-specific tasks and materials to be impacted as part of their Work.

.1 Contractor is to submit the documented Risk Assessment and site-specific Safe Work Practices pertaining to lead to the Departmental Representative for review, at least 10 days prior to initiation of work.

.2 Contractor must not proceed with work that will impact identified LCPs without approval from Departmental Representative.

.4 Although paints and items coated with paints may be disturbed and/or removed for disposal during the Work, unless deemed necessary through risk assessment or cost analysis conducted by the Contractor, comprehensive removal of paints from items or surfaces is not expected to be required during the Work.

.5 Refer to the provisions of the 2017 WorkSafeBC document "Safe Work Practices for Handling Lead" for removal of LCPs from surfaces before any welding and torch-cutting, should the Contractor plan to use such methods to complete the Work.

.1 Contractor will be responsible for verification testing of surfaces where LCPs have been removed. Confirmation of acceptable results is to be provided to the Departmental Representative for review before proceeding with any welding or torch-cutting on surfaces where LCPs were present.

.6 Waste transportation and disposal to be conducted in accordance with BC Reg. 63/88 and the Federal Transportation of Dangerous Goods Regulation.

.3 Polychlorinated Biphenyls (PCBs)

.1 Removal, alteration and/or disposal of PCB-containing equipment is not anticipated to be required during the Work.

.4 Mould

.1 Removal, alteration and/or disposal of mould-impacted materials is not anticipated to be required during the Work.

.5 Mercury

.1 Removal, alteration and/or disposal of mercury-containing equipment or items is not anticipated to be required during the Work.

.6 Ozone-Depleting Substances (ODSs)

.1 Removal, alteration and/or disposal of ODS-containing equipment is not anticipated to be required during the Work

.7 Silica

.1 According to the Assessment Reports, silica is expected to be present in the following, which may be impacted by work of the Project:

.1 Concrete floors, walls, ceilings

.2 Masonry units and associated grout and mortar

.3 Gypsum and associated wall finishing materials

.4 Asphalt and asphalt products containing rock or stone (e.g., roof membrane)

.2 When silica-containing materials are to be disturbed and/or removed (e.g., demolition of concrete slabs, removal of gypsum board, impacts to roof membrane, etc.), Contractor must develop and submit a project-specific Exposure Control Plan that will ensure dust control measures are employed such that airborne silica dust concentrations do not exceed the exposure limit as stipulated by the COHSR and BC Reg. 296/97. (Cristobalite and Quartz – each 0.025 mg/m^3).

.1 Contractor is to submit the Exposure Control Plan pertaining to silica to the Departmental Representative for review, at least 10 days prior to initiation of work.

3.1 DISPOSAL

.1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.

.2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.

.3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.

.4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.

.5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.

.6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.

.7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.

.8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:

.1 Hazardous wastes recycled in manner constituting disposal.

.2 Hazardous waste burned for energy recovery.

.3 Lead-acid battery recycling.

.4 Hazardous wastes with economically recoverable precious metals.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 01 50 – General Instructions. Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 01 50 – General Instructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Editions of all Referenced Standards to be the ones designated by the applicable Building Code in force at the time of building permit application, as indicated on Structural Drawings. For Standards not referenced by the Building Code, use the latest editions.

.2 CSA Group (CSA):

.1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA S16, Limit States Design of Steel Structures.

.3 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.

.4 CSA W59, Welded Steel Construction (Metal Arc Welding).

.3 ASTM International Inc.:

.1 ASTM A123/A123M, Standard Specification for Zinc (Hot Dip Galvanized) coating on Iron and Steel Products.

.2 ASTM A36/A36M, Standard Specification for Carbon Structural Steel.

.3 ASTM A992, Standard Specifications for Structural Steel Shapes.

.4 ASTM F1554, Standard Specification for Anchor Bolts, Steel 36, 55 and 105 ksi Yield Strength.

.4 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA):

.1 CISC Handbook of Steel Construction.

.2 CISC/CPMA Standard 1-73a, A Quick-drying One-coat Paint for Use on Structural Steel.

.3 CISC/CPMA Standard 2-75, Quick-drying Primer for Use on Structural Steel.

.4 CISC Code of Standard Practice, Appendix I, Architecturally Exposed Structural Steel (AESS).

.5 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International:

.1 SSPC-SP 1, Solvent Cleaning.

.2 NACE No. 3 / SSPC-SP 6, Commercial Blast Cleaning.

.3 NACE No.4 / SSPC-SP 7, Brush Off Blast Cleaning.

.4 NACE No.2 / SSPC-SP 10, Near White Blast Cleaning.

.5 SSPC Technology Guide No.14 – Guide for the Repair of Imperfections in Galvanized, Organic or Inorganic Zinc-Coated Steel Using Organic Zinc Rich Coating.

.6 SSPC Paint Specification No. 20 – Zinc Rich Coating, Type I – Inorganic and Type II - Organic.

1.2 QUALITY ASSURANCE

.1 Qualifications

.1 Structural steel fabricator and erector to be certified by the Canadian Welding Bureau under the requirements of CSA W47.1, Division 1 or 2 for fusion welding and/or CSA W55.3, Division 1 or 2 for resistance welding of structural steel components.

.2 Welders to be appropriately qualified, working under direction of a qualified welding supervisor.

1.3 QUALITY CONTROL

.1 Source Quality Control Submittals:

.1 Provide all submittals 4 weeks prior to starting fabrication of structural steel.

.2 Tolerances

.1 Conform to the fabrication and erection tolerances of CAN/CSA S16.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Shop Drawings:

.1 Provide fabrication and erection documents

.2 If additional information is required from Departmental Representative, allow a minimum of five working days for Departmental Representative to review and respond to the request for information.

.2 Fabrication documents:

.1 Submit shop details showing designed assemblies, member sizes, components and connections. Show on drawings:

.1 Material specifications.
.2 Surface preparation.
.3 Shop painting / galvanizing.
.4 Section splices.
.5 Types of shop and field connections.
.6 Net weld lengths.

Part 2 Products

2.1 MATERIALS

.1 Structural steel:

.2 Materials (to CSA G40.21 unless noted otherwise):

.1 Wide flange sections, channels and angles: grade 350W

.2 Plates, bars: grade 300w

.3 Steel joists: CSA G40.21, ASTM A1085, or ASTM A500

.4 Bolts, nuts and washers: ASTM F3125, GRADE A325

.5 Anchor rods: grade 300W; or ASTM F1554 GRADE 36

.6 Shop paint: CISC/CPMA 1-73A

.7 Shop primer paint: CISC/CPMA 2-75

.8 Welding materials: CSA W48 AND CSA W59

.3 Load indicating washers: to ASTM F959.

.4 Maximum percentage of boron in all structural steel elements and fasteners not to exceed 0.0008%.

.5 Welding materials: to CSA W48 and CSA W59, certified by Canadian Welding Bureau. For members in seismic force resisting system, refer to additional brittleness requirements in CSA S16.

.6 Shop paint primer interior steel only: to CISC/CPMA 2-75, solvent reducible alkyd, red oxide, compatible with specified topcoat.

.7 Coating of fasteners: to ASTM F2329 (hot dip galvanizing), ASTM B695 (mechanical galvanizing) or ASTM F1136 (Zn/Al coating). All fastening elements (bolts, nuts, washers) to be coated using the same process and to be obtained from a single supplier. Nuts to have visible dye lubricant.

.8 Steel exposed to weather: to ASTM A123/123M, hot dip zinc galvanized, including bolts, welds, and fasteners.

2.2 FABRICATION

.1 Fabricate structural steel in accordance with CSA S16 and with reviewed shop drawings.

.2 Weld in accordance with CSA W59 and CSA W186.

.3 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left unpainted, place marking at locations not visible from exterior.

.4 Match marking: shop mark bearing assemblies and splices for fit and match.

.5 Where shop inspection is required, do not ship material to the site before it has been inspected.

.6 Fabricate in stages complex members for which steel inspection is impossible or difficult once completed, and arrange for the Inspection and Testing Agency to do intermediate shop inspections.

2.3 SHOP PAINTING

.1 Clean all members to SSPC-SP 1 – Solvent Cleaning. Remove loose mill scale, rust, oil, dirt and foreign matter using any suitable method.

.2 In addition, for members receiving shop primer paint: Clean steel to SSPC-SP 7 Brush-Off Blast Cleaning.

Part 3 Execution

3.1 GENERAL

.1 Structural steel work: in accordance with CSA S16.

.2 Welding: in accordance with CSA W59 and CSA W186.

3.2 CONNECTION TO EXISTING WORK

.1 Verify dimensions and condition of existing works prior to start of fabrication. Report discrepancies, modify connection details if required and submit to WSP-S for review. Determine any potential interference with existing services and report problem areas to Departmental Representative for direction before commencing work.

.2 Take precautions to protect existing works from damage. Provide temporary shoring as required. Repair damage to adjacent materials caused by structural steel installation.

3.3 ERECTION

.1 Erect structural steel in accordance with CSA S16 and reviewed erection drawings.

3.4 FIELD PAINTING

.1 Touch up damaged surfaces with the same paint as the shop coat.

.2 Touch up of HDG exposed steel with High-zinc-dust content paint.

3.5 INSPECTION AND TESTING:

.1 Field inspection:

.1 Arrange for the Departmental Representative to start field inspection as soon as each section of the Work is completed, plumbed, bolts tightened, and field welding finished.

END OF SECTION

Part 1 General

1.1 SUMMARY OF SECTION

.1 As summarized and described, but not restricted to the following:

.1 Provide exterior load bearing stud wall construction, in areas as indicated.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM):

.1 ASTM A307-14, Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 ASTM A653/A653M-15E1, Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process.

.3 ASTM A780/A780M-09 (2015), Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

.2 Canadian Standards Association (CSA):

.1 CSA S136-12, North American Specification for the Design of Cold Formed Steel Structural Members.

.2 CSA W59-13, Welded Steel Construction (Metal Arc Welding)

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, MSDS sheets, specifications and data sheets in accordance with Division 01.

.2 Submit product data for mechanical fasteners, indicating sizes, load capacities, and type of corrosion protection.

.2 Manufacturer's Information:

.1 Submit mill reports covering chemical and mechanical properties, and coating designation of steel used in the Work.

.3 Samples:

.1 Submit Samples of all framing components and fasteners if requested.

.4 Shop Drawings:

.1 Submit shop drawings, stamped and signed by Structural Engineer registered to work in the Province where the work is being done.

.2 Indicate design loads, member sizes and spacing, materials, thicknesses exclusive of coatings, section properties, coating specifications, connection and bridging details, types, sizes, and spacing of fasteners or welds, and tolerances. Indicate locations, dimensions, openings, tolerances, and requirements for coordination of adjoining Work.

.3 Show nominal weld leg sizes for materials less than 3 mm thick. For such welds the throats are not to be less than the thickness of the thinnest connected part.

.4 Show coordination with masonry connectors for exterior cladding and for steel girts for exterior cladding.

.5 Do not construct Work until review of submittals other than field review reports is completed.

.6 Submit copies of field review reports.

1.4 QUALITY ASSURANCE

.1 Companies engaged in welding: certified by the Canadian Welding Bureau, with welding procedures approved and welders qualified for the base material types and thicknesses that are to be welded.

.2 Field reviews to include review of mill test reports, welded connections, member sizes and material thickness, coating thickness, screwed connections, erection tolerances, and all field cutting, including cutting and patching for other trades.

1.5 QUALITY CONTROL

.1 Employ a Professional Structural Engineer registered in the place of the Work to design metal stud systems; to prepare, seal, and sign all Shop Drawing; and to perform field reviews during construction, one during and one at substantial performance.

.2 Do welding in accordance with CAN/CSA S136 and CSA W59.

.3 All stamped shop drawings, certifications and field reviews will become part of the Closeout Submittals, refer to Division 01.

1.6 DESIGN CRITERIA

.1 At structural cross bracing and steel stud infill walls, wind bearing steel stud designer to make provision and supply details for wind loading that is notched and repaired on site around structural cross bracing. Refer to structural and architectural Drawing for locations.

.2 Structural properties in accordance with CAN/CSA S136, limit states design principles using factored loads and resistances.

.3 Loads and load factors in accordance with the National Building Code of Canada (NBC) 2015.

.4 Select studs which will deflect under specified lateral loads not more than for wall studs supporting veneer cladding. Limit free play and movement in connections perpendicular to the plane of the framing to 1.5 mm relative to the building structure.

.5 Space wall studs at 400 mm maximum intervals.

.6 Stud depth is shown on the Drawing. Adjust stud material thickness, stud spacing, or both as required by design criteria.

.7 Design metal stud systems and attachments to accommodate the full range of tolerances permitted in adjoining materials.

.8 Take into account local loadings due to anchorage of cladding and interior wall mounted fixtures where shown.

.9 Design bridging to prevent member rotation and member translation perpendicular to the minor axis for lateral load bearing studs. Provide for secondary stress effects due to torsion between lines of bridging. Sheathing may be used to help restrain member rotation and translation perpendicular to the minor axis for wind bearing studs. Do not rely on cladding, sheathing, or insulation for lateral bracing. Provide metal bridging at 1500 mm o.c. maximum. Use closer spacing if required by structural design.

1.7 WASTE MANAGEMENT

.1 Separate and recycle waste materials in accordance with Division 01, Construction Waste Management and Disposal.

1.8 DELIVERY, STORAGE AND PROTECTION OF PRODUCT

.1 Deliver and store materials in compliance with Division 01, Common Product Requirements.

.2 Comply with manufacturer's recommendations for handling, storage and protection during installation.

.3 Protect and store materials off the ground, away from physical damage and from becoming wet, soiled or covered with ice or snow before, during and after installation.

.4 Label packages to include material name, production date and/or product code.

Part 2 Products
2.1 MATERIALS

.1 Cold Formed Steel Structural Member:

.1 To CAN/CSA S136, with Hot-Dip Zinc Galvanized Metallic Coating.

.2 Hot-dip Zinc Galvanized Coating:

.1 To ASTM A653M.

.3 Welding Materials:

.1 To CSA W59

.4 Welding Electrodes:

.1 480 MPa minimum tensile strength series (e.g. E480XX, E480S-X).

.5 Touch up Primer:

.1 To GreenSeal Standard GC-03, 1997, VOC < 250 g/l.

.6 Framing:

.1 Steel studs: roll-formed of electrolytic Zinc coated galvanized Aluminum-Zinc coated steel sheet of thickness, material, and profile dictated by design, identified as to thickness by indelible markings or colour coded by thickness as follows:

.2 Colour: Nominal Base Metal

.3 Code: Green

.4 Thickness: 1.52 mm

.5 Tracks: cold-formed of same kind of steel sheet as studs, of same or greater thickness, identified or colour coded in the same manner.

.6 Bridging channels: 38.1 mm x 12.7 mm x 1.52 mm 1min. cold-formed of galvanized steel sheet.

.7 Bridging clips: angles of 1.52 mm (0.06") min. galvanized steel sheet, with 38 mm (1.5") legs and length less than stud depth by up to 13 mm (1/2") , prepunched for screw attachment to studs and bridging.

.8 Cutouts: provide cutouts to fit bridging at intervals of 1200 mm (47") o.c.; centre cutouts on web of studs; limit unreinforced cutouts to the following dimensions (in metric):

Max. Across Member Depth	Max. Along Member Depth	Min.Centre Member Length	Min. to Centre Spacing	from End*
92	40	105	600	300
102	40	105	600	300
152	65	115	600	300
203	65	115	600	400

*to cutout centre line

.7 Fasteners:

.1 Concrete anchors: threaded fasteners designed to screw into in pre-drilled holes in concrete, expansion anchors, or drilled adhesive-set stud anchors; with minimum shank diameter of 6 mm 400 Series stainless steel coated with zinc and dichromate conversion. Concrete anchors are called up but extreme care in drilling must be taken in areas of post tensioning cables.

.2 Bolts and nuts: to ASTM A307, with large flat washers, hot dip galvanized steel.

.3 Screws: hex, pan, or wafer head, self-drilling, self-tapping sheet metal screws, zinc or cadmium plated with 0.008 mm minimum coating. Select fasteners known not to strip with the combination of material thicknesses being fastened and tools to be used.

Part 3 Execution

3.1 INSTALLATION

.1 Cut members using saw or shears.

.2 Construct framing piece by piece.

.3 Erect framing true and plumb within specified tolerances. Take actual built dimensions of previously constructed Work into account and accommodate them by adjusting position of framing. Make all field measurements necessary for fit of all members.

.4 Provide temporary bracing, if required for framing to sustain loads applied during erection and subsequent construction.

.5 Anchor tracks securely to structure at 600 mm o.c. maximum. Place one additional anchor within 102 mm of each end of each piece of track, and additionally as required by structural design.

.6 Erect studs plumb and in alignment, and attach both flanges to legs of top and bottom tracks with one screw, No. 8 minimum diameter, at each connection (four per stud). Do not splice studs.

.7 Reinforce cutouts which occur within 12.7 mm of the end of a stud. Align stud cutouts horizontally. Do not allow additional cutouts to be made in the field, except as approved by the Engineer responsible for preparation of Shop Drawings.

.8 Install additional studs at not more than 50 mm from abutting walls, openings, terminations against other materials, and on each side at corners.

.9 Frame all openings in stud walls, except openings less than 102 mm in any dimension, and provide framing at points of attachment of wall mounted fixtures to adequately carry loads by using additional framing members and bracing as required structurally.

.10 Brace steel studs with horizontal bridging channels through stud cutouts, flat strap bridging at maximum vertical centers of 1200 mm for brick veneer. Fasten horizontal bridging channels to each stud with bridging clips using four (4) No. 8 min. diameter screws or by welding.

.11 Install bridging in longest practical lengths. Where splices are required, make them more than one stud space long, with each end fastened at a stud, or reinforce splices with inverted channel bridging pieces 300 mm long, centered on the joint, and fastened at ends (4 screws or welds, 1 at each end of reinforcement, one at end of each spliced piece).

.12 Install metal studs to cover structural steel/open web steel joist framing and steel beam framing on the exterior of the building.

.13 Install structural studs in upstand parapets with fastening requirements to the Structural Engineer of record for this section.

.14 Coordinate erection of studs with installation of service lines.

.15 Use screws long enough to penetrate beyond joined materials by more than three (3) exposed threads. Use wafer-head fasteners or welds where panel products will be installed against the attachment.

.16 Use screws with drilling and holding capabilities recommended by the manufacturer for the materials being fastened. Select different screws if initial selection fails to drill effectively, or tends to strip out.

.17 Repair damaged zinc coating and all welds using zinc-rich primer in accordance with ASTM A780.

.18 Tolerances

.1 Plumb: 1/500 of member length maximum.

.2 Straightness (camber and sweep): 1/1000 of member length, maximum. Replace members with local buckling or bends.

.3 Spacing: not more than 3 mm from design spacing, non-cumulative.

.4 Location: within 10 mm of indicated alignment, and within 6 mm where alignment of structure permits.

.5 Gap between end of stud and web of track (when connected): 3 mm maximum.

.6 Alignment of adjoining or abutting members in the same plane, where supporting continuous cladding or sheathing: 3 mm maximum.

3.2 SCHEDULE

.1 Parapet Construction and Anchorage:

.1 Heavy duty steel studs, gauge as per Engineer’s design.

.2 Spacing: as per Engineer’s design.

.3 Direct Fasteners

.2 Exterior Stud Walls and Parapet Design:

.1 heavy duty steel studs, gauge as per Engineer’s design

.2 Spacing: as per Engineer’s design

.3 Direct Fasteners

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes, but is not necessarily limited to:

.1 Steel framing and supports for mechanical, electrical, and communications equipment.

.2 Steel framing and supports for applications where framing and supports are not specified in other Sections.

.3 Steel pipe support frames.

.2 Products supplied, but not installed, under this Section:

.1 Loose steel lintels.

.2 Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

.3 Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.2 REFERENCE STANDARDS

.1 Metal Fabrications to Canadian Institute of Steel Construction (CISC) “Code of Standard Practice for Structural Steel for Buildings”.

.2 Design, fabrication and erection to CAN/CSA-S16”, Limit States Design of Steel Structures”.

.3 Cold formed steel Work to CAN/CSA-S136-M, “Cold Formed Structural Steel Members”.

.4 Galvanizing to CSA G164-M, “Hot Dip Galvanizing of Irregularly Shaped Articles”.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

.2 Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing all anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

.3 Coordinate installation of components required to penetrate fireproofing to be placed prior to installation of fireproofing.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Division 01.

.2 Product Data: Submit manufacturer's printed product literature, specifications and data sheets.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by a professional engineer registered in the Province of British Columbia.

.2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories. Indicate locations of field welds.

1.5 QUALITY ASSURANCE

.1 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Fabricator Qualifications: company with adequate plant, equipment, and skilled tradespersons to perform work expeditiously, and has been responsible for satisfactory installations similar to that required in the Work. Fabricators shall have experience working with all metal types specified in this Section.

.4 Welding Qualifications Qualify procedures and personnel according to the following:

.1 Structural steel components: weld structural components to CSA W59, by fabricators certified to CSA W47.1 and W55.3 as applicable.

1.6 PROJECT CONDITIONS

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

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Protection: Provide protective covering to shop finished metal fabrications. Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

.2 Minimize construction waste sent to the landfill, separate and recycle materials as specified in Division 01.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Primers: VOC quantities lower than limits stated in Green Seal’s Standards GC-03 and GS-11 and SCAQMD Rule #1113.

2.2 MATERIALS

.1 Metal Surfaces, General:

.1 Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

.2 Include materials, products, accessories, and supplementary parts necessary to complete assembly and installation of this Section.

.3 Incorporate only metals free from defects that are visible, or that impair strength or durability. Provide only new materials of best quality, free from rust, waves and buckles, and are clean, straight, and with sharply defined profiles.

.2 Steel sections and plates: to CAN/CSA-G40.20/G40.21, and as follows:

.1 Rolled sections: Grade 300W.

.2 Hollow structural sections (HSS): Grade 350W, Class C.

.3 Plate: to CAN/CSA-G40.20/G40.21, Grade 260 W.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: comply with CSA and AWS Codes for type of fabricated metal.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Pit frames: galvanized, size indicated, complete with minimum 5 by 38 mm fillet, 3 by 25 by 100 mm long anchors, minimum 600 mm o.c. For short frames, provide minimum two anchors per length.

.7 Stainless steel plate, strip and sheet: to A240/A240M, Type 304, No. 4 finish except where otherwise specified, thickness indicated.

2.3 MISCELLANEOUS MATERIALS

.1 Grout:

.1 Epoxy grout: non-shrink, non-expanding.

.1 Acceptable products: Sika Canada Sikadur Injection Gel Fast-Set, Hilti HY-150, W.R. Meadows Rezi-Weld 3/2 Epoxy Grout/Patch or equivalent.
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.2 Cementitious grout: non-shrink, non-expanding.

1. Acceptable products: Sika Canada Sika Grout 212, W.R. Meadows Sealtight CG-86 Construction Grout or non-shink construction grout by Sakrete or equivalent.

.2 Construction adhesive: CAN/CGSB 71-GP-26, and ASTM D 3498, waterproof, high solids content, polyurethane for bonding metal to metal, and metal to wood.

.1 Acceptable products: LePage PL Premium Construction Adhesive or equivalent.

.3 Stainless steel repair compound: machineable repair compound with stainless steel filler to seal pin holes, voids and cracks in stainless steel fabrications.

.1 Acceptable products: Aremco Pyro-Putty, Devcon Stainless Steel Putty, Loctite Fixmaster Stainless Steel Putty or equivalent.

2.4 FABRICATION

.1 Shop Assembly: Preassemble items in the shop to 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.

.2 Incorporate means for fastenings of other work secured to work of this Section.

.3 Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1 mm unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

.4 Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

.5 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.6 Fabricate work to remain free of warping, buckling, opening of joints and seams, distortion and permanent distortion.

.7 Do welding work in accordance with CSA W59 and W59.2, unless specified otherwise.

.1 Weld corners and seams continuously to comply with the following:

.1 Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

.2 Obtain fusion without undercut or overlap.

.3 Remove welding flux immediately.

.4 At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

.2 Perform stainless steel welding in accordance with CSA W47.1 and AWS D1.6 as applicable.

.8 Use self-tapping shake-proof flat oval headed screws on items requiring assembly by screws or as indicated.

.9 Use screws for interior metal work. Use welded connections for exterior metal work.

.10 Exposed fastenings: same material, colour and finish as metal to which applied unless indicated otherwise.

.11 Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

.12 Seal exterior steel fabrications to provide corrosion protection in accordance with CAN/CSA-S16.1.

.13 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, 3 by 38 mm, with a minimum 150-mm embedment and 50-mm hook, not less than 200 mm from ends and corners of units and 600 mm o.c., unless otherwise indicated.

.14 Assembly:

.1 Accurately cut, machine and fit joints, corners, copes and mitres so that junctions between components fit together tightly and in true planes.

.2 Corners: mitred, unless otherwise indicated.

.3 Fasten work using concealed methods unless otherwise indicated.

.4 Weld connections where possible, bolt where welding is not possible, and cut off bolts flush with nuts. Countersink bolt heads, and incorporate method to prevent loosening of nuts. Ream holes drilled for fasteners.

.5 Allow for differential movement within assemblies and at junctions of assemblies with adjacent work.

.15 Finish Work:

.1 Incorporate holes and connections for work installed as part of work of other Sections.

.2 Cleanly and smoothly finish exposed edges of materials, including holes.

.3 Cap open ends of sections exposed to view.

.4 Machine or grind floor plates, gratings, covers, bearings to obtain level support.

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

.1 General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

.2 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, or equivalent, where indicated.

.2 Fabricate pipe support frames, and supports for lighting, lifts, and other equipment from steel sections of sizes recommended by manufacturer of equipment, or equivalent, complete with bearing plates, anchors, and bracing.

.3 Furnish inserts for units installed after concrete is placed.

.3 Finishes:

.1 Galvanize miscellaneous exterior framing and supports where indicated.

.2 Prime miscellaneous framing and supports with primer specified in Division 09 Section where indicated.

.3 Pipe support frames: paint.

2.6 SHELF ANGLES

.1 Fabricate shelf angles from steel angles of sizes indicated and for attachment to structural steel framing. Provide horizontally slotted holes to receive 19-mm bolts, spaced not more than 150 mm from ends and 600 mm o.c., unless otherwise indicated.

.1 Provide mitred and welded units at corners.

.2 Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 50 mm larger than expansion or control joint.

.2 For cavity walls, provide steel angle brackets of sizes indicated from structural steel frame to support angles. Space brackets not more than 150 mm from ends of individual angle segments and 600 mm o.c.

.3 Galvanize shelf angles and brackets located in exterior walls.

2.7 MISCELLANEOUS BRACKETS, SUPPORT CLIPS AND FASTENINGS

.1 Provide steel brackets, supports, angles, seats, clips, and other fastenings indicated, or as required for installation in other Sections for their work.

.2 Pre-drill for countersunk screw, bolts, and other fasteners.

.3 Form to profiles indicated, or as required.

.4 Coordinate fabrication of supports for millwork with Architectural Woodwork trade.

.5 Shop prime brackets and supports after fabrication.

2.8 STEEL WELD PLATES AND ANGLES

.1 Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.9 LOOSE BEARING AND LEVELING PLATES

.1 Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.Shop prime paint after fabrication.

.2 Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

.3 Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.10 STEEL FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m^2 to CAN/CSA-G164.

.2 Shop primers: provide primers, comply with Division 09 painting Sections.

.3 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

.4 Galvanizing repair paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

.5 Stainless Steel: Directional Satin Finish: No. 4.

2.11 SHOP FINISHING

.1 General:

.1 Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

.2 Finish metal fabrications after assembly.

.3 Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

.2 Steel and iron finishes:

.1 Galvanizing: Hot-dip galvanize items installed on exterior side of air/vapour barrier, except as indicated. Comply with ASTM A 153M for steel and iron hardware and with ASTM A 123M for other steel and iron products.

.2 Shop Priming:

.1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.3 Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning.

.4 Clean surfaces to be field welded; do not paint.

.3 Stainless steel finishes:

.1 Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

.2 Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

.3 Run grain of directional finishes with long dimension of each piece.

.4 When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

Part 3 Execution

3.1 INSTALLATION, GENERAL

.1 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.

.2 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 limitations. 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.

.3 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.

.4 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.

.5 Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 ERECTION

.1 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.2 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.3 Exposed fastening devices to match finish and be compatible with material through which they pass.

.4 Provide components for building by other sections in accordance with shop drawings and schedule.

.5 Make field connections with bolts to CAN/CSA-S16.1, or weld.

.6 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.7 Grout metal posts, balustrades and similar components in metal sleeves cast into concrete with epoxy grout, unless indicated otherwise. Sleeve depth: minimum 75 mm.

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.

.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.3 MISCELLANEOUS FRAMING AND SUPPORTS

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

.2 Mount overhead supports securely to concrete slabs. Use drilled-in concrete anchors, or other Departmental Representative approved devices.

.3 Install items mounted on roof to meet requirements of Authority having Jurisdiction.

3.4 INSTALLING BEARING AND LEVELING PLATES

.1 Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

.2 Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

.1 Use non-shrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations unless otherwise indicated.

.2 Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

.1 Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

.1 Apply by brush or spray to provide a minimum 0.05-mm dry film thickness

.2 Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

.3 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes, but is not necessarily limited to:

.1 Metal stairs and handrails

.2 Exterior handrails attached to walls adjacent to stairs and ramps.

.3 Guardrails.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

.2 Coordinate installation of anchorages for metal stairs and railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

.3 Coordinate stair floor finish thickness.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Division 01.

.2 Product Data: Submit manufacturer's printed product literature, specifications and data sheets.

.3 Shop Drawings

.1 Include plans, elevations, sections, details, and attachments to other work.

.2 Indicate construction details, sizes of steel sections and thickness of steel members.

.3 Indicate welds by standard CWB symbols. Distinguish between shop and field welds, show size, length, and type of each weld. Identify grinding, finish and profile of welds.

.4 Submit shop drawing bearing stamp of a qualified professional engineer registered in British Columbia.

.4 Samples:

.1 Duplicate 300 mm long sample of each type and finish of handrail and bracket, and guardrail.

.2 Duplicate 200 by 200 mm sample of each type, colour and sheen of specified finish on specified base metal.

.3 Fabrication Sample: of metal handrail connections to each different type of substrate, showing details of anchorage, including countersunk connectors.

.5 Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

.6 Informational Submittals:

.1 Welding certificates.

.2 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

.3 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.4 Qualification data.

1.4 QUALITY ASSURANCE

.1 Installer Qualifications: Fabricator of products.

.2 NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

.3 Welding Qualifications: Qualify procedures and personnel according to the following:

.1 CSA W47.1, Certification of Companies for Fusion Welding of Steel

.2 CSA W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Adhesives, sealants, and sealant primers: VOC quantities lower than stated in SCAQMD Rule #1168.

.2 Primers: VOC quantities lower than limits stated in Green Seal’s Standards GC-03 and GS-11 and SCAQMD Rule #1113.

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Delegated Design: Design stairs, railings, ladders, and safety cages, including comprehensive engineering analysis by qualified professional engineer, using performance requirements, criteria indicated.

.2 Design Requirements:

.1 Detail and fabricate stairs to NAAMM Metal Stairs Manual, NAAMM Commercial quality.

.2 Design metal stair, balustrade and landing construction and connections to BCBC vertical and horizontal live load requirements.

.3 Design stringers to limit vibration as specified in CAN/CSA-S16.1, Appendix G, Guide for Floor Vibrations

.4 Design hand railings, balustrades, and connections to support loads per BCBC Section 3.4.6.5.

.5 Design guards to support loads per BCBC Section 4.1.5.14.

.6 Design ladders to withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

.7 Tolerances: non-cumulative.

.1 Maximum variation from plumb in vertical lines: 3.2 mm in 3 m.

.2 Maximum variation from level: 3.2 mm in 9 m.

.3 Maximum variation from straight: 3.2 mm in 3 m under a 3 m straight edge.

.4 Maximum variation from angle indicated: 10 seconds.

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

.4 Steel sections: to CAN/CSA-G40.20/G40.21, Grade 300W.

.5 Steel plate, angles and channels: to CAN/CSA-G40.20/G40.21, Grade 260W.

.6 Steel HSS and tubing: to G40.21, Grade 350W Class C, or ASTM A500 Grade C, wall thickness as required to meet specified codes, sizes and dimensions as indicated.

.7 Steel pipe: to ASTM A53/A53M, standard weight, schedule 40 seamless black.

.8 Bar grating: steel grating, hot-dip galvanized, pressure-locked construction, minimum 38 mm bearing bar depth based on performance criteria, Type 19-4; cross bars at right angle to bearing bars at maximum 100 mm o.c., serrated surface. Fabrication tolerances in accordance with ANSI/NAAMM Metal Bar Grating Manual.

.9 Welded steel wire fabric: to ASTM A185/A185M, 100 mm square pattern, minimum 2.0 mm diameter.

.10 Bolts: to ASTM A307.

.11 High strength bolts: to ASTM A325M.

.12 Isolation Coating: alkali-resistant coating or separation gasket.

2.3 FABRICATION, GENERAL

.1 Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

.1 Join components by welding unless otherwise indicated.

.2 Use connections that maintain structural value of joined pieces.

.2 Fabricate to NAAMM, Metal Stair Manual.

.3 Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

.4 Weld connections where exposed and to greatest extent possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur. Obtain approval from Departmental Representative for bolted and exposed connections.

.5 Fabricate balustrades and railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings, except where indicated otherwise.

.6 Accurately form connections with exposed faces flush; mitres and joints tight. Make risers of equal height.

.7 Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1 mm unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

.8 Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

.9 Form exposed work with accurate angles and surfaces and straight edges.

.10 Weld connections to comply with the following:

.1 Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

.2 Obtain fusion without undercut or overlap.

.3 Remove welding flux immediately.

.4 Weld exposed corners and seams continuously unless otherwise indicated.

.5 At exposed connections, finish exposed welds to comply with CISC Guide for Specifying Architecturally Exposed Structural Steel or NOMMA's "Voluntary Joint Finish Standards" as follows:

.1 NOMMA Type 2 welds with completely sanded joints, some undercutting and pinholes okay.

.11 Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.4 STEEL-FRAMED STAIRS

.1 Stair Framing:
- .1 Form stringers from minimum 250 mm structural steel MC channel. Provide outer stringers with 5 mm thick plate fascia welded on.
- .2 Close ends of stringers where exposed.
- .3 Weld stringers to headers; weld framing members to stringers and headers.
- .4 Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

.2 Treads:
- .1 Exterior Stairs: Form steel grating treads and landings from pre-manufactured stair treads and secure to stringers and supports with bolted connections. Reinforce landings as required.

.3 Provide clip angles for fastening of furring channels, where applied finish is indicated for underside of stairs and landings.

.4 Finish:
- .1 Exterior Stairs and Ladders:
  - .1 Stringers: Shop primed, shop painted, powder coated steel.
  - .2 Treads and Landings: Shop primed, shop painted, powder coated steel.

2.5 PIPE/TUBING BALUSTRADES

.1 Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacing, and anchorage, but not less than that needed to withstand indicated loads.

- .1 Exterior Handrails: Construct handrails and vertical supports from steel pipe or steel tubing, with steel bar balusters at exterior stairs. Shop painted powder coated steel finish at exterior handrails.
- .2 Construction:
  - .1 Cap and weld exposed ends of balustrades and handrails.
  - .2 Terminate at abutting wall with end flange.
  - .3 Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

2.6 ACCESS LADDERS

.1 Stringers: HSS or channel, size and spacing indicated.

.2 Steel rungs: round bar, 19 mm dia. or size indicated, welded to stringers at spacing indicated.

.3 Wall anchors/brackets: sizes and shapes as indicated, weld to stringers at 1200 mm o.c., complete with fixing anchors.

.4 Landing: bar grating.

.5 Finish:

.1 Exterior: Galvanized, after fabrication.

2.7 FINISHES, GENERAL

.1 Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

.2 Finish metal fabrications after assembly.

.3 Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

.4 Provide exposed fasteners with finish matching appearance, including colour and texture, of railings.

2.8 STEEL FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m2 to CAN/CSA-G164.

.1 Hot-dip galvanize indicated steel railings, including hardware, after fabrication.

.2 Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

.3 Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

.2 For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

.3 Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

.4 For non-galvanized-steel railings, provide non-galvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

.5 Shop Primers: Provide primers that comply with Sections 09 91 00 - Painting.

.6 Shop coat primer: to CAN/CGSB-1.40, rust-inhibitive, high solids, low VOC, grey.

.7 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181, and compatible with topcoat.

.8 Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.9 SHOP FINISHING

.1 Clean surfaces in accordance with Steel Structures Painting Council Manual Volume 2.

.1 Exterior Stairs and Ladders: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

.2 Interior Stairs: SSPC-SP 3, "Power Tool Cleaning".

.2 Primer Application:

.1 Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

.2 Apply one coat of shop primer except on interior surfaces of pans, and to parts inaccessible after final assembly.

.3 Apply two coats of primer of different colours to parts inaccessible after final assembly.

.4 Use primer as prepared by manufacturer without thinning or adding admixtures. Paint on dry surfaces, free from rust, scale, grease, do not paint when temperature is below 7 degrees C.

.3 Do not paint surfaces to be field welded.

Part 3 Execution

3.1 INSTALLATION, GENERAL

.1 Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

.2 Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

.3 Install exterior metal stairs, ladders and other components using galvanized anchors, bolts and washers.

3.2 INSTALLATION OF STAIRS AND LADDERS

.1 Install in accordance with NAAMM, Metal Stair Manual.

.2 Install plumb and true in exact locations, using welded connections wherever possible to provide rigid structure. Provide anchor bolts, bolts and plates for connecting stairs to structure.

.3 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.4 Do welding work in accordance with CSA W59 unless specified otherwise.

.5 Touch up shop primer to bolts, welds, and burned or scratched surfaces at completion of erection.

.6 Place and finish concrete fill and reinforcement for treads and platforms to comply with Sections 03 20 00 - Concrete Reinforcing, and Section 03 30 00 - Cast-in-Place Concrete.

3.3 INSTALLATION OF BALUSTRADES AND HANDRAILS

.1 Space posts at spacing indicated. Secure posts and rail ends to building construction as follows:

.1 Anchor posts to steel by welding directly to steel supporting members.

.2 Attach handrails to wall with wall brackets. Provide bracket with 50 mm clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:

.1 For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

.2 For hollow masonry anchorage, use toggle bolts.

.3 For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.4 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

.3 Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

.1 Apply by brush or spray to provide a minimum 0.05-mm dry film thickness.

.4 Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Rough carpentry materials and accessories.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Division 01.

.2 Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

.3 Informational Submittals:

.1 Certificates:

.1 For products treated with preservative and fire-retardant by pressure impregnation submit following information certified by authorized signing officer of treatment plant:

.1 Information listed in AWPA M2 and revisions specified in CSA O80 Series, Supplementary Requirement to AWPA M2 applicable to specified treatment.

.2 Moisture content after drying following treatment with water-borne preservative, and fire-retardant.

.3 Acceptable types of paint, stain, and clear finishes that may be used over treated materials to be finished after treatment.

1.3 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards. Factory mark panels to indicate compliance with applicable standard.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Keep materials under cover and dry. Protect from weather and contact with damp surfaces. Provide for air circulation within and around stacks and under temporary coverings.

Part 2 Products

2.1 SUSTAINABILITY REQUIREMENTS

.1 Adhesives, sealants, and sealant primers: VOC quantities lower than stated in SCAQMD Rule #1168.

.2 Provide engineered wood products with no added formaldehyde and low VOC emissions when tested in accordance with ASTM D6330.

2.2 REGULATORY REQUIREMENTS

.1 Each panel of fire-retardant treated material to bear ULC label indicating Flame Spread Classification, and smoke developed.

2.3 LUMBER MATERIAL

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:

.1 CAN/CSA-O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Dimension lumber:

.1 Light framing: S4S, species SPF, construction grade.

.2 Stud: S4S, species group Hem-Fir, stud grade.

.3 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:

.1 S2S is acceptable.

.2 Board sizes: "Standard" or better grade.

.3 Dimension sizes: "Standard" light framing or better grade.

2.4 PANEL MATERIAL

.1 Plywood, and wood based composite panels: to CSA O325.

.2 Douglas fir plywood (DFP): to CSA O121, standard construction, grade indicated.

.3 Canadian softwood plywood (CSP): to CSA O151, standard construction, grade indicated.

.4 Fire-retardant: for plywood, to CSA O80.27, to provide:

.1 Flame Spread Classification: 25 or less.

.2 Smoke developed of not more than: 25.

2.5 ACCESSORIES

.1 General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 38 mm into wood substrate.

.2 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.3 General purpose adhesive: to CSA O112.9.

.4 Nails, spikes and staples: to ASTM F1667-11ae1.

.5 Bolts: 12.5 mm diameter unless otherwise indicated, complete with nuts and washers.

.6 Threaded Rod: 12.5mm diameter unless otherwise indicated, galvanized steel, complete with nylon spacers, nuts and washers.

.7 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

2.6 FASTENER FINISHES

.1 Galvanizing: to ASTM A153, Class D, and ASTM F2329, use galvanized fasteners for exterior work, interior highly humid areas, and pressure-preservative treated lumber.

2.7 WOOD PRESERVATIVE

.1 Pressure-preservative:

.1 Treat material to CAN/CSA-O80 using alkaline copper quaternary (ACQ) Type C.

.2 Materials: dried after treatment to moisture content of 19% or less.

.3 Identify each piece of treated material with tag or ink mark bearing Canadian Wood Preservers' Bureau quality mark.

.2 Pressure preservative treated materials as follows:

.1 Wood nailers, curbs, equipment support bases, blocking, stripping, and similar members related to roofing, flashing, vapour barriers, and waterproofing, except for wood that comes in direct contact with roofing membrane.

.2 Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

.3 Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

.4 Wood framing members that are less than 460 mm above the ground in crawlspaces or unexcavated areas.

.5 Wood floor plates that are installed over concrete slabs-on-grade.

.6 Other material as indicated.

.3 Surface-applied wood preservative:

.1 Copper napthenate or pentachlorophenal base water repellent preservative. Use clear for materials exposed in final assembly, coloured elsewhere.

2.8 FIRE-RETARDANT-TREATED MATERIALS

.1 General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

.2 Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when test is extended additional 20 minutes, and with flame front not extending more than 3.2 m beyond centreline of burners at any time during test.

.1 Use treatment that does not promote corrosion of metal fasteners.

.3 Kiln-dry lumber to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

Part 3 Execution

3.1 PREPARATION

.1 Surface apply wood preservative to heartwood of pressure preservative treated wood resulting from cutting, trimming or boring, before installation.

.2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.

.3 Apply end sealer to cut ends of wood decking before installation.

3.2 INSTALLATION

.1 Comply with requirements of British Columbia Building Code 2012 supplemented as follows:

.1 Install furring and blocking as required to space-out work as required.

.2 Align and plumb faces of furring and blocking to tolerance of 1:600.

.3 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.4 Install wood cants, fascia backing, nailers, curbs, parapet caps and other wood supports as required and secure using galvanized fasteners.

.5 Secure with galvanized 9 mm corrosion resistant bolts where indicated, galvanized nails elsewhere. Locate fastening within 300 mm from ends, and uniformly spaced between. Space bolts at 1200 mm on centre and nails at 600 mm on centre except where indicated otherwise.

.2 Nailing strips, grounds and rough bucks:

.1 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, electrical equipment mounting boards, and other work as required.

.2 Align and plumb faces of furring and blocking to tolerance of 1:600.

.3 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work. Except where indicated otherwise, use material at least 38 mm thick.

.3 Curbs, and fascia backing:

.1 Install wood fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.

.2 Install wood backing, dressed, tapered and recessed slightly below top surface of roof membrane for roof drains.

.3 Wood to be pressure treated. Wood that comes in contact with roofing membrane to be treated with a preservative which is compatible with roof membrane and membrane adhesive.

.4 On roof deck provide strips of roofing vapour retarder sheet under curbs, nailers and sleepers installed directly onto roof deck. Extend vapour retarder minimum 300 mm onto roof deck both sides of curbs or sleeper to allow for overlap and sealing to roofing vapour retarder. Apply as continuous strips, with 200 mm overlap at joints. Seal joints. Use same material used for roofing vapour retarder. Coordinate with roofing sub-trade.

3.3 ERECTION

.1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other work.

3.4 SCHEDULE

.1 Electrical backboards: fire-retardant treated plywood, DFP or CSP, SEL TF grade.

.2 Subfloor at flooring in elevators: as recommended by elevator manufacturer for finished floor.

.3 Plywood related to roofing: Plywood, DFP or CSP, exterior SHG grade, thickness indicated. Use pressure-preservative treated plywood, compatible with roofing membrane.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Provide acoustic interior insulation batt as indicated.

1.2 SUBMITTALS

.1 Submit manufacturer's printed product literature, including installation instructions, MSDS sheets, specifications and data sheets in accordance with Division 01.

1.3 DELIVERY, HANDLING AND HANDLING

.1 Store insulation at a location where humidity and temperature duplicates those during installation and occupancy in order to stabilize the sheathing. Store in covered area, protected from the weather at all times

Part 2 Products

2.1 MATERIALS GENERAL

.1 Insulation value thicknesses per inch based on values listed in the latest edition of NRC-Evaluation listings.

2.2 ACOUSTIC BATT INSULATION - MINERAL WOOL (INTERIOR)

.1 Stone wool insulation from basalt rock and slag to CAN/ULC S702.

.1 Batt size: to fit stud spacing

.2 Batt thickness: as noted on drawings

.3 Non-combustible to ASTM E136, CAN/ULC S114, ASTM E84,

.4 STC Value: refer to drawing details for STC wall assembly

.5 Standard of Acceptance: Roxul Safe n' Sound Mineral Wool Insulation Batts or equivalent.

2.3 THERMAL BATT INSULATION – MINERAL WOOL (EXTERIOR WALL)

.1 Standard of Acceptance: Roxul Comfort Batt ™ Insulation, or equivalent:

.1 Stone wool insulation from basalt rock and slag to CAN/ULC S702, type 1

.2 Batt size: to fit stud spacing

.3 Batt thickness: as noted on drawings

.4 Non-combustible to ASTM E136, ULC 114, ASTM E84

.5 Thermal Resistance to ASHRAE 90.1

.6 Fungal Resistance Criteria, ASTM C1338

2.4 ACCESSORIES

.1 Acoustic Caulking: refer to Section 07 92 00 Joint Sealants.

Part 3 Execution

3.1 EXAMINATION AND PREPARATION

.1 Examine substrates and do not proceed with installation until defects have been corrected. Examine the areas and conditions under which work of this section will be installed.

.2 Substrates are to be free of dust and debris, and ready to receive insulation.

.3 Verify that adjacent materials are dry and ready to receive insulation.

.4 Verify mechanical and electrical services within walls have been tested and inspected.

.5 Provide written report listing conditions detrimental to performance of work in this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INTERFACE WITH OTHER SYSTEMS

.1 Fit insulation tight around electrical boxes, plumbing and heating pipes, ducts and other protrusions as indicated.

.2 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC S604 Type A chimneys and CAN/CGA B149.1 and CAN/CGA B149.2 Type B and L vents.

3.3 INSTALLATION

.1 General Notes:

.1 Install insulation to maintain continuity of acoustic performance to building elements and spaces.

.2 Offset joints in multiple layer applications.

.3 Do not enclose insulation until it has been inspected and approved by Consultant.

.4 Compliance: comply with manufacturer’s written data, including product technical bulletins, product catalogue installation instructions, and data sheets for all insulation products

.2 Application for Sound Rated Assemblies:

.1 Install insulation to full thickness of framing or as indicated on partition schedule.

.2 Install rigid insulation by pinning to u/s of gypsum board acoustic membrane and exposed ductwork as recommended by manufacturer. Ensure finished edge where exposed to view.

.3 Place sound attenuation insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.

.4 Penetrations are to be acoustically caulked.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Air/vapour barrier materials and assemblies to provide continuous seal between components of building envelope, building penetrations, and tie-ins at junctions and openings.

.2 Provide air vapour barrier to the following components to ensure overlap to the field applied system:

.1 Roof / wall junctions.

.2 All junctions of dissimilar substrate materials.

.3 Wall sheathing.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meeting: Convene one week prior to commencing Work of this section.

.1 Review air/vapour barrier requirements including surface preparation, substrate condition and pretreatment, special details and flashings, installation procedures, and protection and repairs.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Division 01.

.1 Product Data for each type of product specified.

.2 Manufacturer's installation instructions.

.3 Compatibility: Provide letter(s), provided and signed by manufacturer of membrane air/vapour barrier material(s), that products used on the project are compatible with adjacent materials, and materials with which the membrane will be in contact or sealed.

.4 Field quality control reports as noted herein.

1.4 MOCK-UP

.1 Construct typical air/vapour barrier and flashing around exterior windows and frames, junction with roof system; and interface with dissimilar substrates, refer to installation methods noted and manufacturer’s recommendations.

.2 Locate where directed by Departmental Representative.

.3 Allow forty-eight (48) hours for inspection of mock-up by Departmental Representative before proceeding with air/vapour barrier Work.

.4 When accepted, mock-up will demonstrate minimum standard for this work. Approved mock-up may remain as part of the Work.

1.5 QUALITY ASSURANCE

.1 Installer Qualifications: Company specializing in performing work of this section with qualified and experienced tradespersons with installation of air/vapour barrier systems. Completed installation must be approved by the material manufacturer.

1.6 QUALITY CONTROL

.1 Inspect air/vapour barrier after installation, prior to covering by insulation. Provide daily reports to Departmental Representative during A/V Barrier installation period.

.2 Field Quality Control Reports - Content:

.1 Continuous structural support of air-barrier system has been provided.

.2 Site conditions for application temperature and dryness of substrates have been maintained.

.3 Maximum exposure time of materials to UV deterioration has not been exceeded.

.4 Surfaces have been primed.

.5 Termination mastic has been applied on cut edges.

.6 Air/vapour barrier has been firmly adhered to substrate.

.7 Compatible materials have been used.

.8 Transitions at changes in direction and structural support at gaps have been provided.

.9 Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.

.10 Penetrations have been sealed.

.11 Interfaces between different assemblies, air/vapour barriers and openings including curtain wall and window tie-in: report specifically on tie-in methodology and installation between materials.

.3 Provide photographs of air/vapour barrier work in process, condition of wall surfaces, submit with written reports. Photographs shall state vantage point, date taken, object element of visual inspection represented in photograph, any peculiarities or comments.

.4 Non-conforming Work: repair non-conforming work as follows:

.5 Repair work where inspections indicate non-conformance to specified requirements.

.6 Manufacturer's Services: Review complete installation for conformance to manufacturer's written instructions. Provide written report approving completed installation.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Store away from weather exposure in enclosed area not subject to heat over 49°C.

1.8 AMBIENT CONDITIONS

.1 Provide forced air circulation during installation and curing periods for enclosed applications.

.2 Exercise caution for proper adhesion, curing when temperature below 4 degrees C.

.3 Do not install solvent curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.

.4 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

1.9 SEQUENCING AND PHASING

.1 Work is to be so scheduled as to provide an air tight seal at the end of each working day on the portion of the wall face being worked on.

.2 Coordinate with other related trades to provide a continuity of the air seal.

.3 Air vapour barrier is not designed for permanent exposure; confirm manufacturer's recommendations of limited exposure time before final cladding is installed.

Part 2 Products

2.1 MATERIALS

.1 Components used to be single source from the same manufacturer.

.2 Membrane air/vapour barrier: SBS modified bitumen membrane or rubberized asphalt coated polyethylene or cross-laminated polyethylene bonded to modified asphalt, self-adhesive grade, 1.0 mm minimum thickness, 0.1 mm thickness polyethylene face.

.1 Acceptable materials:

.1 Bakor Inc. "Blueskin SA" flexible air/vapour barrier membrane

.2 W.R. Grace Construction Products "Perm-A-Barrier" flexible air/vapour barrier membrane

.3 IKO Industries Ltd. "Superseal Type III" air/vapour barrier membrane

.4 W.R. Meadows, "Air-Shield"

.5 Soprema "Sopraseal Stick 1100T" air/vapour barrier membrane

.6 Carlisle CCW-705 Air & Vapour Barrier

.7 Or equivalent.

.3 Water and Air Barrier: Self-adhering reinforced modified polyolefin tri-laminate water resistive air barrier:

.1 Air Leakage: < 0.2 L/s m2 @ 75 Pa, to ASTM E2178.

.2 Water Resistance: Pass, to AATCC 127.

.3 Vapour Permeance: 29 perms minimum, to ASTM E96 Method B.

.4 Acceptable Products:

.1 BlueskinVP 160 by Henry,

.2 Delta-VentSA by Corsella-Dorken Products,

.3 WrapShield SA by VaproShield.

.4 Transition Barrier: Zinc coated steel sheet: Minimum 1.2 mm base metal thickness, sheet steel, zinc-coated, commercial steel Type B, ASTM A653/A653M, Coating Designation Z275. Surface: smooth, flat. Bend to shape required.

.5 Transition Barrier Tape: Double-sided butyl tape, minimum 50 mm wide.

.6 Substrate cleaner: Non-corrosive type recommended by sealant manufacturer compatible with adjacent materials.

.8 Termination Sealant: Single component, moisture cure, medium modulus sealing compound compatible with barrier materials, and substrates as recommended by membrane manufacturer.

.9 Backer rod: polyethylene, closed cell foam backer rod, compatible with membrane air/vapour barrier, recommended by manufacturer, diameter 50% larger than deflection joint dimensions indicated.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that surfaces and conditions are ready to accept the Work of this section.

.2 Ensure surfaces are clean, dry, sound, smooth, continuous, and comply with air/vapour barrier manufacturer’s requirements.

.3 Report unsatisfactory conditions to Design Builder in writing.

.4 Proceed with Work once unsatisfactory conditions are corrected.

.5 Start of Work implies acceptance of conditions.

3.2 PREPARATION

.1 Remove loose or foreign matter which might impair adhesion of materials.

.2 Ensure substrates are clean of oil or excess dust; masonry joints struck flush, and open joints filled; and concrete surfaces free of large voids, spalled areas and sharp protrusions.

.3 Ensure substrates are free of surface moisture prior to application of membrane and primer.

.4 Ensure metal closures are free of sharp edges and burrs.

.5 Prime substrate surfaces to receive membrane, adhesive, and sealants in accordance with manufacturer's instructions.

.6 Prior to application of covering material, i.e. insulation, etc., the manufacturer's representative is to review the entire field and overlap areas to verify joints are completely sealed, also refer to Section 07 92 00 Joint Sealants.

3.3 PRIMER INSTALLATION

.1 Apply primer by brush or heavy nap, natural-material roller at rate recommended by manufacturer prior to membrane installation.

.2 Allow primer to dry completely before membrane application.

3.4 INSTALLATION – GENERAL

.1 Install membrane air/vapour barrier to dry surfaces at air and surface temperatures of minus 4 degrees C and above in accordance with manufacturer's recommendations, to locations indicated.

.2 Slit barriers to fit over, and around anchors, reinforcing wires, ties, and other penetrations.

.3 Seal around masonry anchors, reinforcing, ties, and other penetrations with applicable termination sealant.

.4 Overlap adjacent pieces and roll seams: 50 mm side lap, 75 mm end lap.

.5 At end of each working day seal top edge of sheet materials to substrate with applicable termination sealant.

.6 Inspect installation prior to enclosing. Repair punctures, damaged areas and inadequately lapped seams with a patch of membrane sized to extend 150 mm in all directions from perimeter of affected area.

3.5 INSTALLATION – MEMBRANE AIR/VAPOUR BARRIER

.1 Precut pieces of air/vapour barrier into easily-handled lengths.

.2 Remove silicone-coated release paper, where applicable, and position membrane carefully before placing length horizontally against surface.

.3 When properly positioned, place against surface by pressing firmly into place by means of hand roller ensuring full contact

.4 Install membrane into openings in walls, including but not limited to doors and windows. Terminate at points that will prevent visibility from interior. Apply membrane over junctions, at changes in wall construction, and other construction. Reinforce corners with additional piece of membrane cut and formed to seal corners. Caulk to ensure complete seal. Position lap seal over firm bearing.

.5 Deflection Joints: Install backer rod full length of deflection joint to provide convex profile surface for air/vapour barrier membrane installation. Loop air/vapour barrier over backer rod in positive shingle application. Roll seams to ensure full contact. Repair fishmouths.

.6 Do not allow rubberized asphalt surface of air/vapour barrier membrane to come in contact with polysulfide sealants, creosote, uncured coal tar products or EPDM.

.7 Do not expose air/vapour barrier membrane to sunlight for more than thirty days prior to enclosure.

.8 When required by dirty or dusty site conditions, by surfaces having irregular or rough texture, or if difficultly is encountered in adhering air/vapour barrier to substrate, apply surface conditioner by spray, brush, or roller at rate recommended by manufacturer, before membrane installation. Allow surface conditioner to dry completely before applying primer or membrane.

3.6 INSTALLATION – WATER AND AIR BARRIER

.1 Install water and air barrier to exterior face of parapet sheathing, at curtain wall penetrations, and where indicated.

.2 Install fillet bead of termination sealant at inside corners.

.3 Position membrane carefully before placing length horizontally against surface.

.4 Remove protective film from self-adhesive surface, press firmly in place.

.5 Openings: Install membrane air/vapour barrier sill flashings. Adhere strips of water and air-barrier to jambs and head in positive shingled fashion. Seal to interior vapour retarder with applicable termination sealant.

3.7 INSTALLATION – TRANSITION BARRIER

.1 Install transition barrier transition at roof/wall junction. Minimum 150mm overlap at joints, sealed with double-sided butyl tape. Position lap over firm bearing. Provide screw fasteners at vertical and horizontal joints, and at 400mm on centre. No fasteners permitted within 150mm of corner/fold. Cover fasteners with air/vapour barrier membrane.

3.8 PROTECTION, REPAIR, AND CLEANING

.1 Protect work from damage and wear during remainder of construction period.

.2 Correct deficiencies in or remove work that does not comply with requirements; repair substrates, reapply air/vapour barrier, and repair flashings.

.3 Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Provide preformed metal siding wall system c/w support system, flashings and accessories as indicated.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, including installation instructions, MSDS sheets, specifications and data sheets in accordance with Division 01.

.2 Samples:

.1 Submit duplicate 200mm x 200mm samples of styles of siding and soffit material, of colour and profile specified.

.2 Submit sample of wall girt.

.3 Shop Drawings:

.1 Indicate dimensions, profiles, attachment methods, sub-girt locations, schedule of wall elevations, trim and closure pieces, soffits, fascia, etc. Structurally related items by Division 05 are to be coordinated and noted on the shop drawings.

.2 Drawings to indicate large scale details interfacing with other elements as aluminum window framing, louvers, etc. Air/vapour overlaps are to be shown from the preformed metal siding system to the adjoining materials or components

.4 Engineer’s Stamp:

.1 Submit shop drawings stamped and signed by a Professional Engineer registered in the province where the Work is taking place indicating girt spacing and sizing applicable to BCBC 2012 and local codes.

.5 Coordination Drawings: Exterior elevations, drawn to scale, and coordinating penetrations and wall-mounted items. Show the following:

.1 Wall panels and attachments.

.2 Girts and stud framing.

.3 Penetrations of wall by pipes and utilities.

1.3 PERFORMANCE CRITERIA

.1 Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall.

.2 Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.

.3 Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

.4 Field Measurements: Verify locations of structural members adjoining construction and wall opening dimensions by field measurements before metal wall panel fabrication. Indicate measurements on Shop Drawings.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

.2 Unload, store, and erect metal wall panels in accordance with manufacturer’s instructions to prevent bending, warping, twisting, and surface damage.

.3 Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

.4 Retain strippable protective covering on metal wall panels for period of metal wall panel installation.

1.5 AMBIENT CONDITIONS

.1 Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.

1.6 QUALITY ASSURANCE / QUALITY CONTROL

.1 Review: the manufacturer’s representative to carry out three site reviews of the installation of the siding system and provide a written report to the Departmental Representative.

.2 All walls and openings are to within ± 3m of location shown on architectural drawings. Also, structure is to be plumb within 1:1000 of overall height.

.3 Final reviews and approval of completed work to be carried out by the manufacturer’s representative and the Contractor.

.4 Manufacturer: company with minimum five (5) years of experience in producing metal siding, with sufficient production capacity to produce and deliver required units without causing delay in work.

1.7 WARRANTY

.1 Manufacturer's written limited warranty providing panels to be free from defects in materials and workmanship, excluding coil coatings covered under separate warranty.

.1 Warranty Period: Two years from date of Substantial Completion.

.2 Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

.1 Finish Warranty Period:

.1 20 year limited warranty from the date of substantial completion on the exterior paint finish for chalk and fade.

Part 2 Products

2.1 MATERIALS - GENERAL

.1 At exterior cladding, provide pressure equalized cavity with top and bottom openings in panel design; use rainscreen principles.

.2 Arrange panel support girt to allow for free drainage to exterior of water/moisture within rainscreen cavity.

.3 Bituminous material to be provided between dissimilar panels.

.4 Sealant to match colour of siding types as per manufacturer’s recommendations, refer to Section 07 92 00 Joint Sealants.

.5 Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitred to required angles. Mitred internal corners to be back braced with precoated sheet stock to maintain continuity of profile.

.6 Expansion Joints: Same material, thickness and finish as exterior sheets type, of profile to suit system.

.7 Miscellaneous Trim, Caps, Flashings and Closures: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

2.2 PREFORMED METAL SIDING

.1 Thickness: 22 gauge

.2 Panel Finishes:

.1 Coating shall be a fluoropolymer coating utilizing 70% Kynar 500 resins.

.2 Colour as selected by Departmental Representative from manufacturer’s standard colours.

.3 Coating shall be factory applied on a continuous process paint line. Coating shall consist of a 0.2 mil prime coat, a 0.75 mil barrier coat, a 0.75 mil metallic/colour coat containing 70% Kynar resins (Note mil thickness is approximate).

.3 Sub Girts: Thermally broken, spacing as per manufacturer’s recommendations.

.4 Recycled Content: 20 % minimum.

.5 Acceptable standard Profile:

.1 VicWest, corrugated 22 mm (7/8") or profile or equivalent selected by Department Representative

2.3 ACCESSORIES

.1 General: Provide fabricator's standard accessories including fasteners, clips, anchorage devices and attachments for specific applications indicated on contract documents.

.2 Cold Formed Steel Wall Girts:
- .1 Thermally broken at exterior locations.
- .2 Size, gauge and spacing as per metal panel manufacturer's recommendations to fasten directly to the lateral load bearing stud wall system.
- .3 Fasteners: galvanized or stainless steel.

.3 Fasteners: non-corrosive, stainless steel and concealed.
- .1 Panel system subgirt system in accordance with manufacturer's recommendation, thickness, spacing etc., and to NBC 2015 wind loading requirements.
- .2 Exposed trim: inside corners, outside corners, cap strip, drip cap, under sill trim, starter strip and window/door trim of same materials, colour and gloss as cladding, with fastener holes pre-punched.
- .3 Screws: ANSI B18.6.4 Purpose made stainless steel.

.4 Provide thermal break / thermal tape separator between metal girts and subgirts at exterior systems.

.5 Flashings: Where flashings are required, use prefinished material to match colour of composite sheet.

.6 Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant; colour as selected.
- .1 Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

.7 Field Touch-up Paint: As recommended by panel manufacturer.

.8 Sealants: as per Section 07 92 00 Joint Sealants as indicated.

Part 3 Execution

3.1 EXAMINATION

.1 Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.

- .1 Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

.2 Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

.3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INTERFACE WITH OTHER SYSTEMS

.1 Coordinate with Division 05 for location of framing members, metal siding and soffit directly applied over structure.

.2 Accessories and metal siding units to be pre-punched to accept fasteners.

.3 Coordinate with Section 07 62 00 Sheet Metal Flashing and Trim.

3.3 INSTALLATION

.1 Girt Installation:

.1 Coordinate girt location with the location of the laterally load bearing studs.

.2 Provide galvanized fasteners and spacing of same in accordance with the approved shop drawings.

.3 Install thermal break material with girt system.

.2 Metal Siding Installation:

.1 Attach shop prepared sub-girt system to building framing system in accordance with shop drawings and manufacturer's instructions.

.2 Install continuous starter strips, inside and outside corners, edgings, soffit, drip, cap, sill and window/door opening flashings as indicated.

.3 Install outside corners, fillers and closure strips with carefully formed and profiled work.

.4 Joints in exterior cladding, true to line, tight fitting, hairline joints.

.5 Components in manner not restricting thermal movement.

.6 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07 92 00 - Joint Sealants.

.7 Form sections true to shape, accurate in size, square, and free from distortion or defects.

.8 Installation of girts, insulation and cladding to conform with manufacturer's recommendations.

.9 Voids between supporting girt and rigid insulation to be properly sealed.

.3 Provide factory-authorized service representative to inspect completed insulated metal panel installation, including accessories. Report results in writing.

.4 Remove and replace metal wall panels where inspections indicate that they do not comply with specified requirements.

3.4 CLEANING AND PROTECTION

.1 Protect wall panel assemblies from damage during construction. Use temporary protective coverings where needed as approved by the wall panel manufacturer.

.2 Clean exposed surfaces of wall panels that are not protected by temporary covering to remove fingerprints and soil during construction period.

.3 Clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

.4 Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

.5 After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

.6 Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touch-up or similar minor repair procedures.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 Rough Carpentry

.2 Section 07 62 00 Sheet Metal Flashing and Trim

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Convene pre-installation meeting one month prior to beginning waterproofing Work to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Coordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Division 01.

.2 Product Data:

.1 Provide two copies of most recent technical roofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.

.4 Shop Drawings:

.1 Indicate flashing, control joints, tapered insulation details.

.2 Provide layout for tapered insulation.

.5 WHMIS MSDS – Material Safety Data Sheets. Indicate VOC content for Primers and Sealers.

.6 Certificates:

.1 Manufacturer's Certificate: certify that products meet or exceed specified requirements.

.2 Installer’s Certificate: Issued by membrane manufacturer.

.7 Test and Evaluation Reports:

.1 Submit laboratory test reports certifying compliance of membrane with specification requirements.

.8 Closeout Submittals:

.1 Warranty, copies of inspection reports, and Roof Maintenance Guide.

.2 Manufacturer's field report: in accordance with Section 01 45 00 - Quality Control.

.1 Reports: indicate procedures followed, ambient temperatures and wind velocity during application.

1.4 QUALITY ASSURANCE

.1 Installer qualifications: company or person specializing in application of modified bituminous roofing systems approved by manufacturer with documented experience.. Employ skilled applicators approved by membrane manufacturer.

.2 Source Limitations: Obtain components including roof insulation and fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.

1.5 FIRE PROTECTION

.1 Fire Extinguishers:

.1 Maintain one cartridge operated type or stored pressure rechargeable type with hose and shut-off nozzle,

.2 ULC labeled for A, B and C class protection.

.3 Size 14 kg or as indicated on roof per torch applicator, within 6 m of torch applicator.

.2 Maintain fire watch for 1 hour after each day's roofing operations cease.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Storage and Handling Requirements:

.1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.

.2 Provide and maintain dry, off-ground weatherproof storage.

.3 Store rolls of felt and membrane in upright position. Store membrane rolls with salvage edge up.

.4 Remove only in quantities required for same day use.

.5 Place plywood runways over completed Work to enable movement of material and other traffic.

.6 Store sealants at +5 degrees C minimum.

.7 Store insulation protected from daylight, weather and deleterious materials.

.3 Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Division 01.

1.7 SITE CONDITIONS

.1 Ambient Conditions

.1 Do not install roofing when temperature remains below -18 degrees C for torch application, or -5 degrees C to manufacturers' recommendations for mop application.

.2 Minimum temperature for solvent-based adhesive is -5 degrees C.

.2 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.

1.8 WARRANTY

.1 Provide manufacturer’s written no dollar limit extended warranty signed and issued in name of Owner stating Work will be free from water infiltration resulting from manufacturing defects workmanship, and installation deficiencies, and defective products will be repaired, and replaced without cost to Owner as necessary to enable Work to perform as warranted.

.1 Warranty Period: 20 years from date of Substantial Completion.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Adhesives, sealants, and sealant primers: VOC quantities lower than stated in SCAQMD Rule #1168. Maximum VOC content in accordance with Division 01, LEED Product Requirements.

.2 Primers, paints, sealers, coatings and wood finishes: VOC quantities lower than limits stated in Green Seal’s Standards GC-03 and GS-11 and SCAQMD Rule #1113. Maximum VOC content in accordance with Division 01, LEED Product Requirements.

.3 Regional Content: Provide materials classified as Regionally Manufactured Material, as defined and in accordance with the content values listed in Division 01, LEED Requirements.

.4 Recycled Content: Provide roofing materials with a minimum recycled content, quantified as post-consumer + pre-consumer recycled content as defined in Division 01, LEED Product Requirements.

.5 Composite wood products must not contain added urea-formaldehyde or resins containing urea-formaldehyde.

.6 Forest Stewardship Council (FSC): Provide wood products that are FSC Certified and are accompanied by a valid FSC chain-of-custody certificate number in accordance with content value listed in Division 01, LEED Product Requirements.

2.2 PERFORMANCE CRITERIA

.1 Compatibility between components of roofing system is essential. Provide written declaration stating materials and components, as assembled in system, meet this requirement.

.2 Standards: conform to appropriate CSA, CGSB, ULC, and ASTM Standards for materials used in the roofing system specified.

.3 Use only components supplied or accepted by membrane manufacturer.

.4 Roofing System: to CSA A123.21 for wind uplift resistance.

2.3 DECK COVERING AND FASTENERS

.1 Glass faced gypsum sheathing: to ASTM C1177 / C1177M – 08, pre-primed, mold resistant, moisture-resistant, non-combustible, gypsum core, glass mat facings, 13 mm thick, 1 200 mm x 2 400 mm sheets. To be used for roof deck and vertical surfaces.

.1 Acceptable Product: G-P DensDeck Prime or equivalent.

.2 Plywood: to CSA O121 or CSA O151 in accordance with Section 06 10 00 – Rough Carpentry, panel materials, Sheathing Grade, thickness indicated, maximum practical lengths.

.3 Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

.4 Roofing nails: to CSA B111, No. 10 corrosion resistant, ring thread roofing nails 9 mm heads.

2.4 PRIMER

.1 For use as vapour retarder primer, parapet/curb primer, and self-adhesive transition primer: Composed of SBS synthetic rubber, adhesive enhancing resins, and volatile solvent used to prime substrates to enhance adhesion of self-adhesive membranes at temperatures above -10 deg C, compatible with vapour retarder.

.1 Acceptable product: Soprema Elastocol Stick or equivalent.

2.5 VAPOUR RETARDER

.1 Vapour retarder: to CGSB 37.56M, polyester reinforced, Type 2, Class C, Grade 1, glass fleece reinforcement, coated both sides with styrene butadiene styrene (SBS) modified asphalt, 2.2 mm thick,. Top surface: sanded. Bottom surface: thermofusible plastic film.

.1 Acceptable product: Soprema Elastophene SP 2.2 or equivalent.

2.6 INSULATION

.1 Primary Insulation: Board Insulation Type G to Section 07 21 13 - Board Insulation, total thickness 100 mm.

.2 Cricket, tapered insulation: Board Insulation Type G to Section 07 21 13 - Board Insulation. Tapered thickness: 13 mm minimum, 150 mm maximum, engineered to consistent slope, and in accordance with roof plan.

.3 Insulation overlay: Multi-ply, semi-rigid asphaltic roofing substrate board composed of a mineral fortified asphaltic core formed between two asphaltic saturated fiberglass liners. Length 1.2 m x width 2.43 m x thickness 4.8 mm.

.1 Acceptable Product: SOPRABOARD, by Soprema or equivalent.

.4 Insulation adhesive: Urethane adhesive compatible with insulation types, insulation overlay, membrane types acceptable to roofing system manufacturer.

.1 Acceptable Product: DUOTACK, by Soprema or equivalent.

.5 Insulation Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer, penetrate steel deck minimum 19 mm.

2.7 SEALERS

.1 Mastic: solvent based, containing SBS modified bitumen, fibres and mineral fillers.

.2 Sealing compound: to CAN/CGSB-37.29, rubber asphalt type.

2.8 MEMBRANE

.1 Membrane base sheet (torch-on): to CGSB 37-GP-56M, Type 2, Class C, Grade 2 modified bitumen roofing membrane: Composite reinforcement, coated both sides with styrene butadiene styrene (SBS) modified asphalt, thermofusible plastic film, 10 m long x 1 m wide, 3.0 mm thick.

.1 Acceptable Product: SOPRAPLY BASE 520, by Soprema or equivalent.

.2 Membrane cap sheet (torch-on): to CGSB 37-GP-56M, Type 1, Class A, Grade 2, modified bitumen roofing membrane: Composite reinforcement, coated both sides with styrene butadiene styrene (SBS) modified asphalt, bottom face covered with thermofusible plastic film, top face with highly reflective white granules, 10 m long x 1 m wide, 3.7 mm thick. Roof covering A classification in accordance with CAN/ULC-S107-M. Minimum SRI: 86 to ASTM E1980

.1 Acceptable Product: SOPRASTAR FLAM HD GR, by Soprema or equivalent.

.3 Membrane flashing:

.1 Base strip (self-adhesive): to CGSB 37.56M, Type 2 Class C, Grade 2, modified bitumen membrane: Glass grid reinforcement, coated both sides with styrene butadiene styrene (SBS) modified asphalt, thermofusible plastic film top, self-adhesive bottom covered by silicone release film, 15 m long x 1 m wide, 3.0 mm thick.

.1 Acceptable Product: SOPRAFLASH FLAM STICK, by Soprema or equivalent.

.2 Cap strip: as specified for membrane cap sheet.

.4 Flame stop membrane (self-adhesive): to CGSB 37.56M, Type 2 Class C, Grade 1, modified bitumen membrane: Glass fleece reinforcement, 1.6 mm thick, 150 mm wide, sanded top, self-adhesive bottom covered by silicone release film.

.1 Acceptable Product: SOPRAGUARD, by Soprema or equivalent.

.5 Traffic membrane walkways: to CGSB 37-GP-56M, Type 1, Class A, Grade 2, modified bitumen roofing membrane: Composite reinforcement, coated both sides with styrene butadiene styrene (SBS) modified asphalt, bottom face covered with thermofusible plastic film, top face with coloured granules, 8 m long x 1 m wide, 4.0 mm thick. Colour selected by Departmental Representative.

.1 Accepted Product: SOPRAPLY TRAFFIC CAP 560, by Soprema or equivalent.

2.9 MISCELLANEOUS

.1 Roofing nails: to CSA B111, No. 10 corrosive resistant, ring thread roofing nails 9.5mm heads.

.2 Bituminous paint: to CAN/CGSB-1.108, Type 2.

.3 Metal flashings: as specified in Section 07 62 00 – Sheet Metal Flashing and Trim.

.4 Transition Barrier: Zinc coated steel sheet: Minimum 1.2 mm base metal thickness, sheet steel, zinc-coated, commercial steel Type B, ASTM A653/A653M, Coating Designation Z275. Surface: smooth, flat. Bend to shape required.

.5 Vent Stack Flashing: to CSA B272-93, vandal proof, 1.6 mm mill finish 1100-0T alloy aluminum, diameter to suit vents, aluminum hood and perforated collar, premolded urethane insulation liner, bituminous painted deck flange.

.1 Acceptable Product: Thaler SJ-31 Vandal Proof Stack Jack Flashing or equivalent.

Part 3 Execution

3.1 WORKMANSHIP

.1 Do examination, preparation and roofing Work in accordance with ARCA Roofing Application Standards Manual.

3.2 PREPARATION

.1 Ensure membrane substrate is rigid, dry, smooth, compatible, free of tins and sharp edges, and clean of all debris and foreign matter.

.2 Ensure all openings, walls, and projections through the roof are firmly affixed and cant strips, reglets and nailing strips are in place.

.3 Satisfy the membrane manufacturer’s specifications for substrate preparation prior to membrane application.

3.3 PROTECTION

.1 Cover walls and adjacent work where materials hoisted or used.

.2 Clean off drips and smears of bituminous material.

.3 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.

.4 Prevent traffic over completed roofing except where required by work above roof level. Comply with precautions deemed necessary by Departmental Representative. Repair damage caused by non-compliance with Departmental Representative's requirements.

.5 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed work and materials out of storage.

.6 Wherever openings or exposed roof decks cannot be sealed during the work day, provide temporary membrane coverings satisfactory to the Departmental Representative.

3.4 EXAMINATION OF ROOF DECKS

.1 Prior to beginning of work ensure:

.1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.

.2 Curbs have been built.

.3 Roof drains have been installed at proper elevations relative to finished roof surface.

.4 Plywood and lumber nailer plates have been installed to deck, walls and parapets as indicated.

.2 Do not install roofing materials during rain or snowfall.

3.5 DECK COVERING

.1 Mechanically fasten glass faced gypsum board sheathing to steel deck with screws to steel deck's upper rib surfaces, spaced minimum 300 mm o.c. at perimeter, 400 mm o.c. each way over field.

.2 Install continuous plywood deck covering under curbs and parapets, as indicated. Mechanically fasten to steel deck's upper rib surfaces, spaced minimum 300 mm o.c. at perimeter.

.3 Place with long axis of each sheet transverse to steel deck ribs, with end joints staggered and fully supported on ribs.

3.6 INSTALLATION – TRANSITION BARRIER

.1 Install transition barrier at vertical deflection joints abutting parapet construction, locations indicated. Minimum 150mm overlap at joints, sealed with double-sided butyl tape. Position lap over firm bearing. Provide screw fasteners at vertical and horizontal joints, and at 400mm on centre. No fasteners permitted within 150mm of corner/fold. Cover fasteners with air/vapour barrier membrane.

.1 Locations:

.1 Junction of parapet and vapour retarder

.2 Junction of parapet and membrane

3.7 VAPOUR RETARDER

.1 Prime decks in strict accordance with manufacturer's instructions.

.2 Prime galvanized edges of roof expansion joints before applying membrane.

.3 Apply primer by roller, brush or sprayer to surfaces where vapour retarder is to be applied at rate of 6 to 8 L/10m2, and allow to dry.

.4 Apply vapour retarder in accordance with manufacturer's directions, without wrinkles, stretches, ensure adequate bond.

.5 Unroll vapour retarder and align membrane centered at low point of roof or drain. Reroll and torch apply single layer of membrane to concrete slab or deck covering. Apply even heat across width of roll. Apply sufficient heat to melt lower surface and provide flow of bitumen.

.6 Lap vapour retarder 75 mm on sides and 150 mm on ends.

.7 Ensure compatibility of vapour barrier materials. Provide suitable interlayer between materials if materials are not compatible.

.8 Carry strip vapour barrier material under, through parapet construction where indicated.

.9 Form transition barrier to profiles indicated to accommodate vertical deflection. Mechanically fasten barrier to metal framing components

.10 Lap and seal vapour retarder onto transition barrier at parapet junction.

3.8 INSULATION

.1 Install tapered insulation in single layer to provide slopes, crickets indicated, minimum 12.7 mm thick. Adhere tapered insulation using acceptable adhesive. Install to slopes indicated.

.2 Apply adhesive in 19 mm - 25 mm diameter beads, first bead 75 mm from outer edges of insulation board. Apply seven additional parallel beads approximately 150mm apart so that eighth bead is 75mm from opposite edge of insulation board.

.3 Install primary insulation in multi-layer application using specified insulation adhesive in continuous beads. Offset joints minimum 150 mm from joints of preceding layer. Ensure adhesion.

.4 Neatly fit insulation to all penetrations, projections, and nailers.

.5 Butt insulation boards tightly together without gaps.

.6 At end of each work period, apply membrane over exposed surfaces and edges of insulation and onto vapour retarder to render watertight. Remove this seal on resumption of work.

.7 Dish or taper insulation at roof drains.

3.9 INSULATION OVERLAY

.1 Install insulation overlay in single layer using specified adhesive in continuous beads. Apply adhesive in 19 mm - 25 mm diameter beads, first beads 75 mm from outer edges of insulation board. Apply additional parallel beads approximately 300 mm apart. Firmly embed overlay to insulation.

.2 Butt overlay boards moderately together without gaps, stagger end joints.

.3 Install only as much overlay as can be covered by roofing membrane in one day.

3.10 FLAME STOP MEMBRANES

.1 Adhere the membrane directly onto an approved substrate by peeling back silicone release film

.2 Apply membrane at insulation overlay joints prior to torch application of membrane base sheet.

3.11 EXPOSED ROOFING MEMBRANE APPLICATION

.1 Torch applied base sheet:

.1 Start roofing applications at the lowest point to ensure water runs over the laps of membrane.

.2 Apply base sheet beginning at low point of roof and align membrane along centre line of roof drain. Re-roll and torch apply to substrate following manufacturer’s printed instructions.

.3 Unroll and torch base sheet onto substrate taking care not to burn membrane or its reinforcement or substrate.

.4 Lap sheets 75mm minimum for side and 150mm minimum for end laps.

.5 Carry minimum 100mm to vertical surfaces or top of cant strips.

.6 Gusset reinforce at corners, projections, and drains using additional ply of base sheet per manufacturer’s instructions.

.7 Application to be free of blisters, wrinkles, and fishmouths.

.2 Base Membrane Flashing

.1 Complete installation of base sheet flashing prior to installing membrane cap sheet.

.2 Apply primer to surfaces to enhance adhesion of base sheet flashing.

.3 Adhere base sheet flashing onto substrate in 1 metre wide strips.

.4 Position pre-cut base sheet flashing. Peel back 100 to 150 mm of release paper to hold membrane in place at top of parapet. Nail base sheet flashing 25 mm from top edge of flashing at 300 mm oc.

.5 Gradually peel back remaining release paper, pressing down on membrane with applicator to ensure good adhesion.

.6 Lap base sheet flashing onto membrane base sheet. Extend base sheet flashing 100 mm out onto roof from toe of cant, and to exterior side of parapet or curb, concealing the blocking and metal counter flashing, as applicable, and seal.

.7 Overlap side laps minimum 75 mm. Seal joints.

.8 Stagger joints in flashing and joints in roof membrane minimum 100 mm to avoid excessive layering

.3 Torch applied cap sheet.

.1 Apply cap sheet beginning at low point of roof or centre of drain. Torch apply to base sheet following manufacturer’s printed instructions.

.2 Carry up minimum 100mm on vertical surfaces or top of cant strips.

.3 Plan work so that both side and end laps of cap sheet are offset from those of base sheet minimum 300mm for side and 450mm for end laps.

.4 At all end or head laps of cap sheets, where T joint occurs, cut corner of membrane to be overlapped, on a 45° angle.

.5 Adhere strictly to manufacturer’s instructions.

.6 Application to be free of blisters, wrinkles, and fishmouths.

.7 Perform membrane application in accordance with manufacturer's recommendations.

.4 Cap Membrane Flashing

.1 Cut membrane in 1 m wide, the roll width, by the length required to suit detail.

.2 Draw chalk line on roof cap sheet 150 mm from upstand or parapet base, parallel to roof edge. Use torch and round-nose trowel to embed surface granules in layer of hot bitumen starting from chalk line on field surface to bottom edge of upstand or parapet, and on granulated vertical surfaces to be overlapped.

.3 Extend membrane cap flashing from minimum 150 mm out onto roof from toe of cant, and to exterior side of parapet or curb, concealing blocking and metal counter flashing, as applicable.

.4 Stagger side laps in membrane cap flashing 150 mm from side laps of membrane base flashing and from side and end laps of roof membrane cap sheet. Securely nail to wood fascia at approximately 100 mm staggered centres.

.5 Install membrane cap flashing torch-adhered according to membrane manufacturer's details.

.6 Press firmly into place using a roller; remove air pockets.

.5 Walkways

.1 Install walkway membrane in accordance with manufacturer's instructions and as indicated.

.2 Draw chalk line on roof cap sheet to layout locations of walkway. Use torch and round-nose trowel to embed surface granules in layer of hot bitumen starting from chalk line and working in 150 mm from each edge of walkway.

.3 Apply primer to field of cap sheet membrane between degranulated edges and torch apply.

3.12 ROOF PENETRATIONS

.1 Install roof drain pans, vent stack covers and other roof penetration flashings and seal to membrane in accordance with manufacturer's recommendations and ARCA flashing details.

3.13 FLASHING VENTS AND PITCH POCKETS

.1 Install polyethylene back-up rope between roof deck and vent stack, pitch pocket and caulk joint.

.2 Embed vent stack, pitch pocket flashing flange in 3 mm thickness of sealing compound on top of roofing membrane.

.3 Torch membrane flashings onto cap sheets, extend plies onto roof beyond outer edge of flange in accordance with manufacturer’s written instructions.

.4 Fill retainers with mastic, sloping from inside to outside when flashed.

.5 Install vent stack flashings per manufacturer’s written instructions.

3.14 CAULKING TO ROOF WORK

.1 Install caulking, sealing to roofing, sheet metal work required. Provide waterproof, weathertight roofing system.

3.15 EXAMINATION AND TESTING

.1 Testing Agency: Engage qualified roof specialist examining and testing agency to perform tests and inspections.

.2 Roof specialist, examining and testing company shall review all aspects of roofing work, metal flashings, deck, and blocking.

.3 Roof specialist examiner has authority to initiate minor ‘no cost’ changes to details, to suit job site conditions.

.4 Perform roof examination in accordance with inspection procedures outlined by ARCA, including following:

.1 Preliminary roof deck examination to ensure deck surfaces are in proper condition to receiving roofing, notify Contractor of deleterious conditions not corrected.

.2 Study of roofing specification, notification of any variances, discrepancies between good roofing practices, that specified.

.3 Examination of roofing materials on site, notification of variances from specified materials.

.4 Examination of workmanship, installation of roofing materials, minimum one trip per day during any roofing operation, made early each working day.

.5 Reports: Specialist examining and testing company shall submit:

.1 Daily, written reports.

.2 Duplicate final report, typewritten, within one week final examination of any completed roof area, based on examination trips, results of examinations, in accordance with outlined procedures for roof examinations.

.6 Specialist examining and testing company shall take photographs of roofing work in process, condition of roof surfaces, submit with written reports. Photographs shall state vantage point, date taken, any peculiarities or comments.

Non-conforming Work: repair and retest non-conforming work as follows:

.1 Repair work where test results and inspections indicate non-conformance to specified requirements.

.2 Re-test system by same standard and test one additional location within the same system for every failed test result to determine compliance of replaced or additional work with specified requirements.

.3 Pay costs associated with non-conforming work.

3.16 CLEANING

.1 Provide cleaning during construction in accordance with Section 01 74 00 – Cleaning and Waste Management.

.2 Remove bituminous markings from finished surfaces.

.3 In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their instructions.

.4 Repair or replace defaced or disfigured finishes caused by Work of this Section.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Provide base of wall and curb flashings

.2 Provide sheet metal flashing over the up stand parapets.

.3 Provide cap flashings for areas where roofing membrane abuts vertical wall surfaces.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, including installation instructions, MSDS sheets, specifications and data sheets in accordance with Division 01.

.2 Samples:

.1 Submit 50 mm x 50 mm samples of each type of sheet metal material, colour and finish.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

.2 Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.4 QUALITY ASSURANCE

.1 Perform work to RCABC details and requirements

.2 Perform Work to CRCA Manual standard details and requirements.

.3 Installer Qualifications: Company specializing in performing the work of this section and approved by the manufacturer.

.4 Fabricator Qualifications: Company specializing in manufacturing the Products specified in this section.

Part 2 Products

2.1 MATERIALS - PREFINISHED SHEET STEEL

.1 Prefinished steel with factory applied silicone modified polyester coating:

- .1 Class F1S.
- .2 Colour to complement colour of adjacent materials, i.e. metal siding painted concrete. Departmental Representative to choose colour from full colour range.
- .3 Specular gloss: 30 units +/- 5 in accordance with ASTM D523.
- .4 Coating thickness: not less than 25 micrometres.
- .5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20 % to ASTM D822 as follows:
  - .1 Outdoor exposure period 1000 hours.
  - .2 Humidity resistance exposure period 1000 hours.

.2 Thickness steel: Minimum 20 gauge for flashings

.3 Break formed prefinished steel to profiles indicated.

- .1 Flashing to have 50 mm vertical leg.
- .2 Parapet flashings should be secured with a hem strip at the front and color matched fasteners on the back. Lengths should be interlocked using “s lock”, mitered and sealed at the corners.
- .3 Flashings should have a positive slope, 5 degrees or greater unless noted otherwise.

.4 Drip edges from same colour, material and thickness as adjacent metal cladding.

2.2 ACCESSORIES

.1 Isolation Coating: alkali resistant bituminous paint.

.2 Underlay for metal flashing: dry sheathing

.3 Sealants: as per Section 07 92 00 Joint Sealants.

.4 Cleats: of same material as flashing specified, and temper as sheet metal, minimum 50 mm wide. Thickness 20 gauge.

.5 Fasteners: of same material as sheet metal, to ASTM F1667, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.

.6 Washers: of same material as sheet metal with soft neoprene washers.

.7 Plastic Cement: to ASTM D4586 Type I.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets in place, and nailing strips located.

.3 Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION OF SUBSTRATE

.1 Provide underlay under sheet metal. Secure in place and lap joints 100 mm.

.2 Install starter, edge strips and cleats before starting installation.

.3 Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

3.3 INTERFACE WITH OTHER SYSTEMS

.1 Apply isolation coating to metal surfaces to be embedded in concrete.

.2 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock forming tight fit over hook strips.

3.4 INSTALLATION

.1 Fabrication and Installation of flashings is .to comply with the requirements of the RCABC Roofing Practices Manual.

.2 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details as indicated.

.1 Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

.2 Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

.3 Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

.4 Torch cutting of sheet metal flashing and trim is not permitted.

.5 Do not use graphite pencils to mark metal surfaces.

.3 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.

.4 All flashings are to be hemmed.

.5 Hem exposed edges on underside. Miter and seal corners with sealant.

.6 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.7 Form flashings, copings to profiles indicated on drawings.

.8 Use concealed fastenings except where approved before installation; fasteners should be installed at 300 mm o.c. maximum.

.9 Lock end joints and caulk with sealant.

.10 Caulk flashing at reglet cap with sealant.

.11 Cut triangle or diagonal joint to minimize cut joint

.12 Metal protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

.1 Coat back side of uncoated aluminum flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.

.2 Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet. Secure in place and lap joints 100 mm.

.13 Insert metal flashing into reglets, under cap flashing to form weathertight junction.

.14 Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 3 000 mm with no joints allowed within 1 000 mm of corners and intersections. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 25 mm deep, filled with sealant concealed within joints.

.15 Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 38 mm, except reduce pre-tinning where pre-tinned surface would show in completed Work.

.1 Do not solder metallic-coated steel and aluminum sheet.

.2 Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

.16 Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 75 mm centers.

.17 Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.

.1 Interlock both exterior and interior bottom edge of coping with continuous cleat anchored to substrate at 300mm centers max.

3.5 ERECTION TOLERANCES

.1 Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 6 mm in 6 000 mm on slope and location lines as indicated and within 3 mm offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING AND PROTECTION

.1 Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

.2 Clean and neutralize flux materials. Clean off excess solder.

.3 Clean off excess sealants.

.4 Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

.5 Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Firestopping: completed by single firestopping subtrade.

.2 Firestop systems consisting of a material, or combination of materials installed to retain integrity of fire-rated construction by maintaining a barrier against spread of flame, smoke, and hot gases through penetrations, blank openings, construction joints, or at perimeter fire containment in, or adjacent to fire-rated barriers in accordance with requirements of British Columbia Building Code.

1.2 DEFINITIONS

.1 Barrier/Assembly: A wall, floor, or other partition with a fire-smoke rating of 1, 2, 3 or up to 4 hours.

.2 Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, water and hot gases through penetrations in/ joints between fire rated wall and floor assemblies.

.3 Fireblocking: building materials installed to resist the free passage of flame, smoke and noxious gases to other areas of the building through concealed spaces.

.4 Fire resistive joint: any joint or opening, whether static or dynamic, within or between adjacent sections of fire rated interior or exterior walls, floors, ceilings or roof decks.

.5 Intumescent: materials that expand with heat to seal around objects threatened by fire.

.6 Membrane penetration: Any penetration of a fire rated barrier that breaches one side, but does not pass completely through to the other side.

.7 Multi-penetration: two or more service penetrations through a fire separation where the minimum space between pipes must exceed 50 mm and where sizes of pipe are larger than 50 mm, the space must be larger than the largest pipe between.

.8 Non-rated fire separations: a fire separation with no fire-resistance rating that acts as a barrier to the spread of fire and smoke for a time period that allows the fire suppression system to activate and control a fire. Non-rated fire separations indicated on drawings, shall be fire stopped on both sides of the separation based on a fire-resistance rating of 1-hour.

.9 Through-penetration: Pipes, conduits, ducts, cable trays, cable, wire or any other element passing completely through an opening in a fire rated barrier/assembly.

.10 Single penetration: one service penetration through a fire separation.

.11 System: The combination of specific materials and/or devices, including the penetrating item(s) required to complete the firestop, as tested by an independent third party test facility.

.12 F-Rating: the time a Firestop, penetrating item, building, material, firestop material, can withstand direct flame without a burn through as tested to ASTM E814/UL 1479.

.13 L-Rating: based on a volume of air flowing per unit of time through the opening around a penetration and/or joint under a specified pressure difference applied across the surface of the system.

.14 T-Rating: The amount of time a through-penetration firestop limits the temperature rise on the cold side-outside the test furnace - as tested to ASTM E814/UL 1479.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings: convene pre-installation meeting minimum two weeks prior to beginning work of this Section, with Contractor's representative, firestopping subcontractor, Owner, and Departmental Representative to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.5 Project sequencing.

.6 Environmental conditions.

.7 Marriage details.

.8 Top-of-wall joints (shrinkage, expansion, contraction requirements).

.9 Perimeter joints.

.10 Multi-penetration.

.11 Close-out submittals

.12 Inspection guidelines.

.2 Site Meetings: as part of Manufacturer's Field Services described in Part 3, schedule site visits, to review Work, at stages listed.

.1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

.3 Sequencing and Scheduling:

.1 Inform parties involved with firestopping process of roles and how they can affect firestopping.

.2 Coordinate Work of trades to allow access for complete installation of firestopping assemblies without interference from related trades and/or adjacent construction.

.3 Coordinate Work of other trades to ensure that fire stopping material is not damaged or removed.

.4 Do not cover up firestopping installations until Departmental Representative or Authorities Having Jurisdiction have examined installation.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Division 01.

.2 Shop Drawings: Submit shop drawings to show proposed material, fastenings, methods of installation. Construction details should accurately reflect actual job conditions.

.3 Samples: Submit duplicate 300 by 300 mm samples showing actual firestop material proposed for project.

.4 Product Data:

.1 Submit system design listings, including illustrations from qualified testing and inspection agency applicable to each firestop configuration. Indicate proposed material, reinforcement, anchorage, fastenings, and method of installation. Construction details should accurately reflect actual job conditions.

.2 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

.5 Informational Submittals:

.1 Applicator qualifications.

.2 Certificates: Certification by manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs), are non-toxic to building occupants, are asbestos-free, and comply with applicable regulations.

.3 Manufacturer's field reports.

.4 Testing agencies inspection reports.

.5 Installer qualifications.

.6 Contractor’s Quality Control Program for Firestopping

.6 Closeout Submittals:

.1 Submit operations and maintenance manual in accordance with Division 01. Provide a schedule with the following information:

.1 Label (reference tag)
.2 Room number/name
.3 Location within room
.4 Fire barrier rating
.5 Service penetration or joint description including size
.6 Firestop design listed system or engineering judgements
.7 Photographs (if required)
.8 Notes (unique installation requirements)

.2 Product description

.3 Maintenance requirements.

.4 Certificates

1.5 QUALITY ASSURANCE

.1 Fire-Test-Response Characteristics: Provide firestop design listed system by independent testing and inspection agency in accordance with appropriate ASTM standard(s). Qualified independent testing and inspection agencies include UL, ULC, cUL, Intertek Testing Services, or another agency performing testing and follow-up inspection services for firestop materials that is acceptable to authority having jurisdiction.

.2 Manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to review contractor personnel in following procedures:

.1 Selecting correct firestop design listed system.

.2 Verifying environmental conditions in accordance with product data.

.3 Verifying service penetration annular opening and/or joint width/height.

.4 Preparing service penetration and/or joint, as well as substrate.

.5 Installing damming material to correct compression (width and depth).

.6 Installing firestop product to correct width and depth.

.7 Installing firestop labels.

.3 Installer qualifications:

.1 Firestop Contractors International Association Contractor (FCIA) member in good standing.

.2 Licensed by local authority, where applicable.

.3 Single Source Installation: Installation of firestop systems is to be performed by one qualified installer.

.4 Single Source Responsibility: Obtain firestop systems for each type of penetration and construction conditions indicated, from a single primary firestop systems manufacturer.

.1 Do not intermix materials of different manufacturers than allowed by tested and listed system in same firestop system or opening.

.2 Tested and listed firestop systems are to be used first. If such systems are not possible, provide Engineering Judgement (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA).

.5 Schedule pre-construction meeting for parties involved prior to start of construction.

.6 Quality-Control Program For Firestopping: Prepare a written quality-control program for firestopping to systematically demonstrate the ability of contractor to properly install, test and inspect application of fireproofing.

.1 Program to include field quality control testing and inspection procedures, and schedule.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver firestopping products to Project Site in original, unopened containers, or packages with intact and legible manufacturer's labels identifying product and manufacturer.

.2 Store and handle firestopping materials in accordance with manufacturer's written instructions.

.3 Do not use damaged or expired material.

1.7 AMBIENT CONDITIONS

.1 Environmental Conditions: Install firestopping in accordance with manufacturers written instructions.

.2 Ventilation: Ventilate in accordance with firestopping manufacturers' instructions or Material Safety Data Sheet (MSDS).

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

.1 Penetrations: firestopping systems produced to resist spread of fire and passage of smoke and other gases according to requirements indicated, including but not limited to:

.1 Firestop penetrations passing through fire resistance rated wall and floor assemblies, and other locations as indicated.

.2 Complete penetration firestopping systems tested and approved by third party testing agency.

.2 Where no specific third party tested and classified firestop system is available for a particular firestop configuration, obtain Engineering Judgement (EJ) or Equivalent Fire Resistance Rated Assembly (EFFRA) for submittal from firestop manufacturer.

.3 Comply with manufacturer's product data, including product technical bulletins, product catalogue installation instructions, and product carton instructions for installation.

2.2 MATERIALS

.1 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

.1 Asbestos-free materials and systems capable of maintaining an effective barrier against the passage of flame, smoke, water and toxic gases in compliance with requirements of CAN4-S115 or ASTM E814, and not to exceed opening sizes for which they are intended, in accordance with ULC or cUL Design Numbers or other Design System Listings acceptable to local Authority Having Jurisdiction.

.2 Firestopping materials/systems shall be flexible to allow for movement of building structure (refer to architectural and structural) and penetrating item(s) without affecting the adhesion or integrity of the system.

.2 Firestop products may include, but not be limited to:

.1 Sealants, sprays, mortars, fire straps, and breaks.

.2 Fire barrier mouldable putties, with or without backing.

.3 Fire barrier self-locking pillows containing intumescent composition.

.4 Fire barrier composite sheets used to cover large or blank openings, made up of steel sheet on one side with intumescent composition inside and steel wire mesh/foil on back side.

.5 Firestop devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

.3 Firestopping and smoke seal systems: in accordance with ULC-S115.

.4 Firestop products: produced by FCIA Manufacturer Members in good standing.

.5 Service penetration assemblies: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.

.6 Service penetration firestop components: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.13 and ULC Guide No.40 U19.15 under the Label Service of ULC.

.7 Fire-resistance rating of installed firestopping assembly in accordance with British Columbia Building Code.

.8 Firestopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.9 Firestopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical and electrical items requiring sound and vibration control: firestop collars or wrap devices; elastomeric seal.

.10 Firestopping at large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways: blocks and boards.

.11 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.12 Sealants for vertical joints: non-sagging, non-shrinking, asbestos-free.

.13 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.14 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.15 Labels: self-adhering-type metal or plastic labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed.

.1 The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."

.2 Contractor's name, address, and phone number.

.3 Designation of applicable testing and inspecting agency.

.4 Date of installation.

.5 Manufacturer's name.

.6 Installer's name.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written recommendations and specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 EXAMINATION

.1 Examine substrates and conditions with installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Notify Departmental Representative of unsatisfactory conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

.2 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.

.3 Verify that penetrating elements and supporting devices have been properly installed, and that temporary lines, and markings, have been removed.

.4 Verify that field dimensions are as indicated and as recommended by manufacturer.

.5 Ensure no additional items have been installed through openings that do not appear on approved Design Listing.

.6 Ensure areas that are to be firestopped are accessible for proper application and conditions are suitable for installation and inspection of firestop system.

.7 Report in writing to the Departmental Representative defective surfaces or conditions affecting the firestop system installation, immediately and prior to commencing any installations.

.8 Proceed only when defected surfaces or conditions have been corrected.

3.3 PREPARATION

.1 Prepare surfaces in contact with firestopping materials and smoke seals to manufacturer's instructions.

.2 Maintain insulation around pipes and ducts penetrating fire separation without interruption to air/vapour barrier.

.3 Mask where necessary to avoid spillage and over coating onto adjoining surfaces.

.4 Remove masking as soon as possible, without disturbing seal between firestopping and substrates. Remove stains on adjacent surfaces.

.5 Ensure temperature within areas of installation meets or exceeds minimum temperature range for products that will be installed in those areas, as based on manufacturer's recommendations for minimum two days prior and three days after installation.

3.4 INSTALLATION

.1 General:

.1 Install fire-stop material to obtain fire-resistance rating not less than the fire resistance rating of surrounding floor and wall assembly.

.2 Install firestopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.

.3 Seal holes or voids made by through penetrations, poke-through termination devices, and un-penetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.4 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.5 Tool or trowel exposed surfaces to neat finish.

.2 Penetration Firestops:

.1 Coordinate with other trades to ensure pipes, conduit, cable, and other items, which penetrate fire rated construction, have been permanently installed prior to installation of firestop assemblies.

.2 Schedule Work to ensure partitions and other construction that conceals penetrations are not erected prior to installation of firestop and smoke seals.

.3 Install fill materials for through-penetrations firestop systems to produce following results:

.1 Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.

.2 Install materials so they contact and adhere to substrates formed by opening and penetrating items.

.3 For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces.

.3 Firestop Joint Systems:

.1 Install joint fillers to provide support of firestop materials during application. Install joint filler at position required to produce cross-sectional shapes and depths of installed firestop material relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.

.2 Install systems by proved techniques that result in firestop materials:

.1 Directly contacting and wetting joint substrates.

.2 Filling recesses provided for each joint configuration.

.3 Providing uniform, cross-sectional shapes and depths relative to joint width that optimize movement capability.

.3 Tool non-sag firestop materials immediately after application and prior to skinning. Form smooth, uniform beads of configuration indicated or required to:

.1 Produce fire-resistance rating.

.2 Eliminate air pockets.

.3 Ensure contact and adhesion with sides of joint.

.4 Perimeter Fire Barrier Systems:

.1 Install metal framing, mineral wool insulation, mechanical attachments, safing materials, and firestop materials as applicable within system design.

3.5 LABELING

.1 Install labels adjacent to through wall/floor service penetrations and joints that are firestopped, and at joint penetrations. Provide one assembly identification label per penetration opening and one assembly identification plate at every 6 000 mm along bottom and top of wall joints, and wall to wall joints.

3.6 MANUFACTURER'S FIELD SERVICE

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in Article SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.7 INSPECTION

.1 Perform quality control tests and inspections to document conformance with specified requirements. Provide written report to Departmental Representative for testing and inspection activities.

.2 Keep areas of work accessible and notify code authorities, or designated inspectors, of work completion released for inspection.

.3 Document completion, and inspection.

.4 Testing shall examine firestop penetration seals for proper installation, labelling, adhesion and curing as may be appropriate for the respective seal material before concealing or enclosing areas.

.1 Examination shall be based on format similar to ASTM E2174 and ASTM E2393.

.2 Random review of installation will include:

.1 Construction progress.

.2 Construction photographs.

.3 Product storage, handling and delivery.

.4 As-built schedules and drawings.

.5 Penetration / Joint plate installation.

.6 Barrier marking installation

.7 Protection of installed systems.

.3 Nonconforming Work: Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

.4 Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.8 CLEANING

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application. Use methods and cleaning materials approved by manufactures of firestopping products and assemblies in which openings and joints occur.

.2 Remove temporary dams after initial set of firestopping and smoke seal materials.

3.9 PROTECTION

.1 Protect firestopping during and after curing period from contact with contaminating substances.

3.10 SCHEDULE

.1 Firestop and smoke seal at:

.1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.

.2 Edge of floor slabs at curtain wall assemblies.

.3 Top of fire-resistance rated masonry and gypsum board partitions.

.4 Intersection of fire-resistance rated masonry and gypsum board partitions.

.5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.

.7 Openings and sleeves installed for future use through fire separations.

.8 Around mechanical and electrical assemblies penetrating fire separations.

.9 At expansion joints between fire-rated walls and other assemblies.

.10 Openings around structural support members that penetrate floors/walls.

.11 Openings and penetrations in fire rated walls or partitions containing fire doors.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Joint sealants at exterior and interior construction as indicated.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Division 01.

.2 Product Data: Submit manufacturer's printed product literature, including installation instructions, MSDS sheets, specifications and data sheets in accordance with Division 01.

.3 Manufacturer's product information to describe:

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.4 VOC Content

.4 Informational Submittals:

.1 Manufacturer's instructions for installation of each product specified.

.2 Statement of Compatibility: Compatibility between sealants primers, and substrates is essential. Provide written declaration to Departmental Representative stating that materials meet this requirement.

.3 Test Reports.

1.3 AMBIENT CONDITIONS

.1 Do not proceed with installation of joint sealants under following conditions:

.1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.

.2 When joint substrates are wet.

.2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Adhesives, sealants, and sealant primers: VOC quantities lower than stated in SCAQMD Rule #1168.

2.2 GENERAL

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 Where sealants are qualified with primers use only those primers.

.3 Stain-Test-Response Characteristics: Where sealants are specified to be non-staining, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

.4 Colours: match sealant colour to adjacent materials, as selected and approved by the Departmental Representative.

.5 Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant, including those referencing ASTM C920 classifications for type, grade, class and uses.

.6 Compatibility: Provide joints sealants, primers and backings that are compatible with one another, and with joint substrates under conditions of service and application as demonstrated by joint sealant manufacturer based on proven test results and field experience.

.7 Sealants: not exude materials that travel into or onto adjacent materials, causing damage, or attracting soiling, which becomes apparent during service life of building.

2.3 SEALANTS

.1 Neutral cure, one part, low modulus silicone, movement range to ±50%, for exterior and interior use on concrete, precast concrete, masonry, metals, glass, control joints, expansion joints, between insulating glass units of curtain wall assembly, to ASTM C920, Type S, Grade NS, Class 50 (and inactive CAN/CGSB 19.13), colour selected by Departmental Representative.

.1 Acceptable products:

.1 GE SCS2000 Silpruf,

.2 Dow Corning 790,

.3 Tremco Spectrum 1,

.4 Precora 890.

.5 or equivalent..

.2 One component, polyurethane, for interior and exterior use in aluminum, glazing, curtain wall joints, heel beads, toe beads, air seals, to CAN/CGSB 19.13, colour selected by Departmental Representative.

.1 Acceptable products:

.1 Tremco “Vulkem 116”,

.2 Sika Canada “Sikaflex 1-a”,

.3 Tremco “Dymonic”.

.4 or equivalent.

.3 Mildew-resistant caulking, to ASTM C920, Type S, Grade NS, Class 25, one part, high modulus silicone, movement range ±25%, not paintable, for interior use in wet areas around shower stalls and shower bases. Colour selected by Departmental Representative.

.1 Acceptable products:

.1 Dow Corning 786,

.2 Tremco Tremsil 200,

.3 GE Sanitary SCS1700,

.4 Franklin International Titebond Kitchen and Bath Sealant.

.5 or equivalent.

.4 Mildew-resistant, paintable silicone, to ASTM C920, Type S, Grade NS, Class 25, one part, high modulus silicone, movement range ±25%, for interior use around vanity tops, kitchen countertops, other counter surfaces adjacent to painted surfaces.

.1 Acceptable Product:

.1 GE Groov Kitchen/Bath/Plumbing or equivalent.

.5 Acrylics One Part: general purpose, one part, paintable translucent acrylic to CGSB 19-GP-5M, movement range ±10%, for interior use in dry areas around windows, door frames, interior caulking to gypsum board, masonry, and metals.

.1 Acceptable products:

.1 Tremco Mono 555,

.2 Franklin International Titebond Painters Plus Caulk,

.3 GE RCS20 Siliconized Acrylic Sealant.

.4 or equivalent.

.6 Acoustical Sealant, for use at perimeter joints in sound rated gypsum board partitions, and masonry partitions:

.1 For exposed and joints: non-sag, paintable, non-staining latex sealant complying with ASTM C834.

.1 Acceptable products: GE RCS20 Siliconized Acrylic Sealant or equivalent.

.2 For concealed joints: to CAN/CGSB-19.21, non-drying, non-hardening, non-skinning, non-staining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

.1 Acceptable products: Tremco Acoustical Sealant or equivalent.

.7 Joint Cleaner: Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.8 Primer: as recommended by manufacturer, meeting maximum VOC requirements.

.9 Back-up Materials:

.1 Backer rod: polyethylene, closed cell foam backer rod, compatible with sealant, recommended by manufacturer, diameter oversize 30 to 50% to suit joint.

.2 Bond breaker tape: polyethylene, pressure sensitive bond breaker tape which will not bond to sealant.

.3 Expanding Foam Sealant: Pre-compressed, open cell, chemically stabilized acrylic impregnation, adhesive backed, high density polyurethane foam, pre-compressed size indicated, width indicated, grey colour.

Part 3 Execution

3.1 EXAMINATION

.1 Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.2 Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

3.2 PROTECTION

.1 Protect installed Work of other trades from staining or contamination.

3.3 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

.6 Test materials being sealed, caulked for staining, adhesion.

3.4 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.5 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.6 MIXING

.1 For multi-component sealants, mix materials in strict accordance with sealant manufacturer's instructions.

3.7 APPLICATION

.1 Sealant:

.1 Apply sealant in accordance with manufacturer's written instructions.

.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.

.3 Apply sealant in continuous beads.

.4 Apply sealant using gun with proper size nozzle.

.5 Use sufficient pressure to fill voids and joints solid.

.6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.7 Tool exposed surfaces before skinning begins to give slightly concave shape.

.8 Remove excess compound promptly as work progresses and upon completion.

.9 Apply non-paintable silicone sealants after wall surfaces have been painted.

.2 Curing:

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place.

3.8 SCHEDULE

.1 Perimeters of exterior openings where frames meet exterior facade of building.

.2 Coping joints and coping-to facade joints.

.3 Exterior joints in horizontal wearing surfaces.

.4 Seal around electrical and mechanical boxes in exterior walls.

.5 Sealant specified as related work noted in other sections in the specification and as indicated on the drawings.

3.9 CLEANING

.1 Clean adjacent surfaces immediately and leave Work neat and clean.

.2 Remove excess and droppings, using recommended cleaners as work progresses.

.3 Remove masking tape after initial set of sealant.

END OF SECTION

Part 1 General

1.1 SUMMARY OF SECTION

.1 As summarized and described but not restricted to the following:

.1 Provide interior and exterior gypsum board for wall and ceiling assemblies.

.2 Provide accessories as indicated.

.3 Provide installation of access panels. Refer to Mechanical for access panel specification.

.4 Provide shaft wall system as indicated.

.5 Coordinate with Section 09 22 16 Non-Structural Metal Stud Framing and section 05 41 00 Structural Metal Stud Framing.

1.2 REFERENCES

.1 The standards listed form part of this Specification to the extent of reference. The publications are in the text by the basic designation only.

.2 American Society for Testing and Materials International (ASTM):

.1 ASTM A641/A641M-09a(2014), Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

.2 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.3 ASTM C473-15, Test Methods for Physical Testing of Gypsum Panel Products

.4 ASTM C475/ C475M-15, Joint Compound and Joint Tape for Finishing Gypsum Board

.5 ASTM C645-14e1, Standard Specification for Nonstructural Steel Framing Members

.6 ASTM C754-17, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

.7 ASTM C840-13, Application and Finishing of Gypsum Board

.8 ASTM C1002-14, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

.9 ASTM C1047-14a , Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base

.10 ASTM C1177/C1177M-13, Glass Mat Gypsum Substrate for Use as Sheathing

.11 ASTM C1178/C1178M-13, Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel

.12 ASTM C1280-13a, Application of Exterior Gypsum Panel Products for use as Sheathing

.13 ASTM C1396/C1396M-14a, Standard Specification for Gypsum Board

.14 ASTM C1658/C1658M-13, Glass Mat Gypsum Panels

.15 ASTM D3273-12, Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

.16 ASTM E119-16a, Standard Test Methods for Fire Tests of Building Construction and Materials

.3 Gypsum Association:

.1 GA-214-15 Recommended Levels of Gypsum Board Finish

.2 GA-216-13 Application and Finishing Of Gypsum Panel Products

.3 GA-253-16 Application of Gypsum Sheathing

.4 GA-600-12 Fire Resistance Design Manual

.5 GA-801-07 Handling and Storage of Gypsum Panel Products:

A Guide for Distributors, Retailers, and Contractors

.4 Underwriters Laboratories of Canada (ULC)

.5 National Building Code of Canada, 2015.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, including installation instructions, MSDS sheets, specifications and data sheets in accordance with Division 01.

1.4 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of materials.

.2 Maintain temperature minimum 10°C, maximum 21°C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.

.3 Apply board and joint treatment to dry, frost free surfaces.

.4 Ventilation: Ventilate building spaces to remove excess moisture that will prevent drying of joint compound immediately after its application.

1.5 DELIVERY, STORAGE AND PROTECTION OF PRODUCT

.1 Deliver and store materials in compliance with Division 01.

.2 Comply with manufacturer’s recommendations for handling, storage and protection during installation.

.3 Protect and store materials off the ground, away from physical damage and from becoming wet, soiled or covered with ice or snow before, during and after installation.

.4 Label packages to include material name, production date and/or product code.

1.6 QUALITY ASSURANCE/QUALITY CONTROL

.1 Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the province where the Work is being done.

.2 Perform Work in accordance with ASTM C840, GA-214, GA-216, and GA-600. Maintain one (1) copy on site.

.3 Perform Work in accordance with ASTM C1658 for shaft walls and exterior sheathing applications.

.4 Installer Qualifications: Company specializing in performing the work of this section with qualified and experienced tradesperson.

.5 Handling and Storage of Gypsum Board: Comply with GA-801.

1.7 DESIGN AND PERFORMANCE REQUIREMENTS

.1 For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

Part 2 Products

2.1 MATERIALS

.1 Fire Rated Gypsum Board, to ASTM C1396M:

.1 ULC rated board

.2 Fire resistive

.3 Thickness: as indicated on drawings

.4 Edges: square cut ends, beveled long edges.

.2 Mould and Moisture Resistant Gypsum Board: (MRB and VMRB)

.1 Per ASTM C473, the average water absorption for panels is not greater than 5 percent by weight

.2 Mould and Moisture resistance per ASTM D3273 with score of 10.

.3 ULC rated board

.4 Thickness: as indicated on drawings

.5 Edges: square cut ends, beveled long edges.

.6 Approved Manufacturers:

.7 CGC Sheetrock Glass Mat Mold Tough AR Gypsum Panels

.8 Georgia Pacific LLC, Dens Armour Plus.

.3 Exterior Gypsum Sheathing Board:

.1 To ASTM C1177/C1396 and ASTM D3273

.2 Thickness: as indicated on drawings

.3 Fiberglass Facing/Reinforcing

.4 Treated core; water resistant exterior sheathing board.

.5 Standard of Acceptance: Georgia Pacific DensGlass Gold Sheathing

.6 Approved Alternate Products:

.7 CGC Securock Glass-mat Sheathing

.8 CertainTeed GlasRoc Embeded Glass Reinforcing Gypsum Sheathing

.9 Georgia Pacific Dens Glas Gold

.10 National Gypsum Gold Bond e(2)XP.

2.2 ACCESSORIES

.1 Gypsum Board Fasteners: to ASTM C1002, type S12. Corrosion Resistant in exterior applications.

.2 Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

.3 Drywall furring channels: 0.5 mm core thickness (or thickness size to weight of supporting panels) galvanized steel channels for screw attachment of gypsum board.

.4 Acoustic Insulation: Section 07 21 16 Blanket Insulation.

.5 Acoustic Sealant and Firestop Sealant: See Section 07 92 00 Joint Sealants

.6 Corner Beads: GA-216, metal corner bead. Use “pull away” beads adjacent to window frames.

.7 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, Zinc metal, 0.5 mm base thickness, perforated flanges, one piece length per location. Use paper faced metal corner bead and trim with VHI panels.

.8 Stud adhesive: as per manufacturer’s recommendations

.9 Edge Trim: to GA-216

.10 Joint Materials: to ASTM C475.

.1 Reinforcing tape, adhesive, and water.

.2 Joint compound for interior gypsum board:

.3 Prefilling: At open joints, panel edges, and damaged surface areas, use setting-type taping compound.

.4 Embedding and first coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

.5 Fill coat: For second coat, use setting-type, sandable topping compound.

.6 Finish coat: For third coat, use setting-type, sandable topping compound.

.7 Joint compound for exterior applications:

.8 Use setting-type taping compound and setting-type, sandable topping compound.

.9 Joint compound for tile backing panels:

.10 Use setting-type taping compound and setting-type, sandable topping compound.

.11 Mesh tape only where required by ULC design.

.11 Compressible Foam Gasket: sill plate gasket; polyethylene foam, minimum thickness 6 mm x full width of sill plate.

.12 Control Joint:

.1 Zinc control joint No. 093 by CGC

.13 Access Panels: installed by this Section, supplied by mechanical.

2.3 SHAFT WALL ASSEMBLIES

.1 Steel Framing for Shaftliner System:

.1 Studs complying with the requirements for ASTM A653 SS Grade 33.

.2 Stud Form: I, C-H or C-T Studs with J-Tracks.

.3 Stud Width: Galvanized I, C-H or C-T Studs in widths of 64 mm, 102 mm, 152 mm

.4 Stud Thickness: Studs are manufactured from steel having minimum design steel thicknesses of 0.478 mm and 0.836 mm.

.5 Stud Coating: Studs have a G40 or G60 galvanized coating.

.2 Rated Board for Shaftliner System:

.1 To ASTM C1658/C1658M

.2 Refer to Wall/Partition types on drawings for areas requiring Mold and Moisture Resistant Board and rated board systems.

.3 Thickness: 13mm, 16mm, 25.4 mm as required to suit rating indicated on drawings.

.4 Approved Manufacturers:

.5 Certainteed Shaftwall System

.6 Georgia-Pacific Shaftwall system

.7 CGC Cavity Shaft Wall System

.3 Accessories:

.1 Fasteners: 41 mm long No. 6 Type S screws, 25 mm long No. 6 Type S buglehead screws, 10 mm long Type S panhead screws.

.2 Resilient channels.

.3 Joint Finishing: joint compound and joint tape as per manufacturer's recommendations.

.4 Acoustical Sealant: mineral fiber insulation as per manufacturer's recommendations.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

.2 Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical work are reviewed and accepted by Departmental Representative.

3.2 GYPSUM BOARD INSTALLATION

.1 Do not apply gypsum board until anchors, wood blocking, electrical and mechanical work are approved.

.2 Apply single and multi-layer gypsum board to metal furring or framing using screw fasteners for both layers in multi-layer applications, unless specified otherwise. Maximum spacing of screws 300 mm on center.

.1 Single Layer Application:

.2 On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.

.3 Exception: Apply gypsum board on fire rated and sound rated partitions prior to application of gypsum board on ceilings.

.4 Apply gypsum board vertically or horizontally on walls, unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

.5 Stagger abutting end joints not less than one framing member in alternate courses of panels.

.6 At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

.7 On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

.8 Fastening Methods: Apply gypsum panels to supports with steel drill screws.

.9 Comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set or fasteners have been installed.

.10 Multi-Layer Application:

.11 On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 400 mm minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

.12 On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

.13 On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

.14 Fastening Methods: Fasten base layers and face layers separately to supports with screws, except where laminating adhesive is indicated.

.15 Comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set or fasteners have been installed.

.3 Install gypsum board in accordance with ASTM C840, GA-216 and GA-600 and manufacturer’s written instructions.

.4 Apply single and/or double layer gypsum board to metal furring or framing using screw fasteners for first layer, screw fasteners for second layer. Maximum spacing of screws 305 mm o.c.

.5 Remove all debris from partition cavities and clean dust from bottom tracks with Hepa vacuum prior to installation of board.

.6 Install single layer board in most economical direction, with ends and edges occurring over firm bearing.

.7 Install single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing.

.8 Use screws when fastening gypsum board to metal furring or framing. Use wafer-head screws for attachment of backer board.

.9 Provide acoustic sealant and sound batts at all mechanical and electrical penetrations or partitions required to have STC rating. Coordinate with Section 07 84 00 Fire Stopping for all rated partitions.

.10 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm o.c.

.11 Apply 12.7 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board / structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, and similar penetrations, in partitions where perimeter sealed with acoustic sealant.

.12 Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

.13 Bottom of boards to be 12.7 mm above floor.

.14 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.15 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.16 Splice corners and intersections together and secure to each member with 3 screws.

.17 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.18 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.19 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.20 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.21 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

3.3 INSTALLATION ACCESSORIES

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Miter and fit corners accurately, free from rough edges. Secure with joint compound for full length.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.5 Install mouldings and trim where indicated.

.6 Control Joints:

.1 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.

.2 Provide continuous polyethylene dust barrier behind and across control joints.

.3 Locate control joints at changes in substrate construction, at approximate 10 m spacing on long corridor runs, and at approximate 15 m spacing on ceilings.

.4 Install control joints straight and true.

.7 Expansion Joints:

.1 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.

.2 Install expansion joint straight and true.

.3 Splice corners and intersections together and secure to each member with 3 screws.

.8 Install cornice cap where gypsum board partitions do not extend to ceiling.

.9 Fit cornice cap over partition, secure to partition track with two rows of sheet metal screws staggered at 300 mm on center.

.10 Install access doors to electrical and mechanical fixtures specified in respective sections.

.1 Rigidly secure frames to furring or framing systems.

.11 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

3.4 APPLICATION FOR FIRE RATED ASSEMBLIES

.1 Label fire rated assemblies with sign consisting of the following information:

.1 Hour Rating (ie; 1 hour)

.2 Type: Fire Resistance Rating or Fire Separation without a Rating

.3 “Protect All Openings and Penetrations”

.2 Sign to be painted on wall or vinyl sign permanently adhered to wall, locate above ceiling. Minimum size: 280 mm x 380 mm with brightly colored letters.

.3 Construct fire-rated assemblies in accordance with Drawings.

.4 Fire and smoke separations shall be clearly identified on both sides above ceilings. Labeling should be visible from any point in the space above the ceiling. There should be at least one label every 3 m on straight runs and additional labels as needed around corners to meet visibility requirement.

3.5 APPLICATION FOR EXTERIOR GYPSUM SHEATHING

.1 Exterior sheathing installed in accordance with: Gypsum Association document GA-253 or ASTM C1280. Sheathing can be attached to horizontal or vertical metal framing. Use appropriate board orientation for specific fire assemblies and shear wall applications within this document, other reference documents or as required by local authority having jurisdiction.

.2 Fasteners should be driven flush with the panel surface (not countersunk) and into the framing system. Locate fasteners at least 13 mm from the ends and edges of the sheathing.

.3 When a pneumatic fastening system into metal framing is specified to attach sheathing, consult with manufacturer for application specifications and shear resistance data.

.4 Install sheathing with joints staggered. Ends and edges of the sheathing should fit tightly. Sheathing panels shall not be less than 200 mm from the finish grade in fully weather and water-protected siding systems, and not less than 305 mm from the ground properly drained and ventilated crawl spaces. Consult with the design authority for control joint recommendations.

.5 Treat cut edges and holes in moisture resistant gypsum board and exterior sheathing board with sealant.

3.6 SHAFT WALL INSTALLATION

.1 Install steel stud/track shaft wall construction with shaft wall rated gypsum board to complete shaft wall system to locations as indicated on drawings.

.2 Plan and lay out metal framing components plumb and aligned to drawing details.

.3 Install Shaft wall track and gypsum wall board systems to coordinate with adjacent wall/ceiling systems as indicated on the drawings.

.4 Finish exposed rated gypsum board. Conform to same standards as adjacent drywall construction.

.5 Refer to drawings for locations of mold and moisture resistant drywall and sound insulation at adjacent wall/ceiling systems. Match adjacent sound and moisture resistant systems as indicated.

3.7 JOINT TREATMENT

.1 Mix joint compound slightly thinner than for joint taping.

.2 Control Joints:

.1 Provide controls at max. 9 m o.c. for all gypsum board partitions.

.2 Control joint is covered with a roll-formed zinc trim member with a 6 mm slot, protected by a plastic membrane, set in gypsum board facing and supported independently on both sides of joint.

.3 Provide continuous polyethylene dust barrier behind and across control joints.

.4 Install control joints straight and true.

.5 Place control joints consistent with lines of building spaces or as directed.

.3 Finish in accordance with GA-214 and as follows.

.1 Level 1: Above Ceilings (non-fire rated partitions): Embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.

.2 Level 2: Above Ceilings (1 HR fire rated partitions): Embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fasteners heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.

.3 NOTE: For fire separations greater than 1 HR, apply two coats of joint compound over, joints, angles, fastener heads and accessories.

.4 Level 4: All Finished Areas below Ceilings: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

3.8 TOLERANCES

.1 Maximum Variation of Finished Gypsum Board Surface from True Flatness: 3 mm in 3 m in any direction.

.2 Feather coats on to adjoining surfaces so that camber is maximum 0.76 mm

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 As summarized and described but not restricted to the following:

.1 Provide non-load bearing metal stud framing for all gypsum board walls, bulkheads, and other areas.

.2 Provide all necessary accessories.

1.2 REFERENCES

.1 The standards listed form part of this Specification to the extent of reference. The publications are in the text by the basic designation only.

.2 American Society for Testing and Materials International (ASTM):

.1 ASTM C645-14, Non Structural Steel Framing Members.

.2 ASTM C754-15, Installation of Steel Framing Members to Receive Screw Attached Gypsum Panel Products.

.3 ASTM C1002-14, Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS)

.4 Gypsum Association:

.1 GA-216-13, Application and Finishing of Gypsum Panel Products

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, including installation instructions, MSDS sheets, specifications and data sheets in accordance with Division 01.

.2 Provide data describing standard framing member materials and finish, product criteria, load charts, limitations, and recycled content.

.2 Shop Drawings:

.1 Indicate component details, stud layout, framed openings, anchorage to structure, type and location of fasteners and accessories or items required of other related work.

.2 Describe method for securing studs to tracks, splicing and for blocking and reinforcement to framing connections.

1.4 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of materials.

1.5 WASTE MANAGEMENT

.1 Divert steel scraps from landfill by disposal into the on-site metal recycling bin at nearest metal recycling facility.

1.6 DELIVERY, STORAGE AND PROTECTION OF PRODUCT

.1 Deliver and store materials in compliance with Division 01.

.2 Comply with manufacturer's recommendations for handling, storage and protection during installation.

.3 Protect and store materials off the ground, away from physical damage and from becoming wet, soiled or covered with ice or snow before, during and after installation.

.4 Label packages to include material name, production date and/or product code.

1.7 QUALITY ASSURANCE/QUALITY CONTROL

.1 Perform Work to ASTM C754.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section with qualified and experienced tradespersons.

.3 Installer Qualifications: Company specializing in performing the work of this Section with qualified and experienced tradesperson.

.4 For fire resistance rated assemblies, provide materials and construction to tested assemblies to current NBC.

Part 2 Products

2.1 FRAMING MATERIALS

.1 Non-load bearing channel stud framing, to ASTM C645, galvanized sheet steel:

.1 25 gauge thick unless noted otherwise.

.2 Knock-out service holes at 460 mm centers,

.3 Top tracks with 50 mm extended legs

.4 20 gauge steel studs at interior partitions over 3660mm.

.2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height and 50mm deflection type at top of all walls. .

.3 Metal channel stiffener: size to suit framing, 1.2 mm thick cold rolled steel, coated with rust inhibitive coating.

.4 Insulating strip: rubberized, moisture resistant 3 mm thick foam strip, 12 mm wide, with self-sticking adhesive on one face, lengths as required.

.5 Blocking:

.1 Sheet Metal Backing: 16ga material, use 200 mm wide metal sheets for support of accessories and areas as indicated on drawings.

.2 Between steel studs at head connection of all communication and tack boards.

.6 Furring, framing and accessories: ASTM C645 and GA-216.

.7 Fasteners: ASTM C1002 exterior finish to be corrosion resistant.

.8 Anchorage to substrate: tie wire, nails, screws and other metal supports, of type and size to suit application, to rigidly secure materials in place.

.9 Recycled content-framing materials minimum post-consumer recycled content of 50%.

.10 Walls Vapour Retarder:

.1 6 mil (0.15 mm) polyethylene sheet manufactured for building construction to CAN/CGSB 51.34 Type 2.

.2 Continuous layer; refer to installation instructions and detail for overlaps seals, and tie into other vapour barrier/retarder systems in the building

.11 Deflection systems:

.1 Single track: consisting of 50 mm deep leg ceiling track, 38 mm by 1.6 mm thick U-channel, and 38 by 38 mm by 1. 6 mm thick U-channel support clips. U channel installed continuous through top knock-out service hole, maximum 300 mm from top track, with support clip at each stud location.

2.2 SUSPENSION SYSTEMS

.1 Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 1.59-mm diameter wire, or double strand of 1.21-mm- diameter wire.

.2 Hanger Attachments to Concrete:

.1 Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

.2 Type: Post-installed, chemical anchor.

.3 Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 4.12 mm in diameter.

.4 Flat Hangers: Steel sheet, minimum 25 by 5 mm by length required.

.5 Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 1.34 mm and minimum 13-mm- wide flanges.

.6 Furring Channels (Furring Members):

.1 Cold-Rolled Channels: 1.34-mm uncoated-steel thickness, with minimum 13-mm- wide flanges, 19 mm deep.

.2 Steel Studs: to ASTM C645.

2.3 ACCESSORIES

.1 Metal furring runners, hangers, tie wires, inserts, and anchors: to ASTM C1280, galvanized.

.2 Steel drill screws:

.1 For metal framing less than 0.91 mm thick: to ASTM C 1002.

.2 For metal framing 0.91 mm and thicker: to ASTM C 954.

.3 Casing beads, corner beads, control joints and edge trim: to ASTM C 1047, zinc coated by hot dip process, 0.46 mm base thickness, laminated to paper tape, one piece length per location.

.4 Sheet metal backing: 1.0 mm thick cold rolled steel, coated with rust inhibitive coating.

.5 Laminating Adhesive: Adhesive recommended for directly adhering gypsum panels to continuous substrate.

.6 Joint compound: to ASTM C475, asbestos free.

.7 Joint Tape:

.1 Interior Gypsum Board: Paper, except where fibreglass mesh tape is indicated.

.2 Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

.3 Tile Backing Panels: As recommended by panel manufacturer.

.8 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, full width of stud, with self-sticking permanent adhesive on one face, lengths as required.

.1 Acceptable products: Dow Chemical Ethafoam 221, Plasti-Fab Sill Seal or equivalent.

.9 Strip Impalement Clips: 25 mm wide strip of “Insul-Hold” by Insul-Hold Canada Ltd., fabricated from 0.455mm galvanized sheet metal in 30 m rolls with punch-out insulation securement arrows. Alternatively, use special studs with punch-out impalement strips.

.10 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

Part 3 Execution

3.1 PREPARATION

.1 Coordination with Sprayed Fire-Resistive Materials:

.1 Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 600 mm o.c.

.2 After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce

thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.2 FRAMING INSTALLATION

.1 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum. Screw fasten to concrete or steel structure.

.2 Install dampproof course under stud shoe tracks of partitions on slabs on grade.

.3 Place studs vertically at 400 mm oc unless indicated otherwise, and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs at 1200 mm oc as required to provide rigid installation to manufacturer's instructions.

.4 Install studs tight to concrete or concrete masonry unit walls where sound insulated partitions meet these walls.

.5 Erect metal studding to tolerance of 1:1000.

.6 Attach studs to bottom track only for walls extending to underside of structure using screws. Attach studs to bottom and ceiling track for walls not extending to underside of structure.

.7 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.8 Frame openings and around built in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.9 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.10 Extend partitions to underside of structure, except where noted otherwise on drawings.

.11 Maintain clearance under beams and structural elements occurring above steel stud partitions to avoid transmission of structural loads to studs. Provide deflection system accommodating dimensions indicated.

.12 Do not fasten gypsum board to deflection system.

.13 Install continuous insulating strips to isolate studs from uninsulated surfaces.

.14 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut outs around electrical boxes, and ducts, in partitions where perimeter sealed with acoustic sealant.

3.3 INSTALLATION OF HOLLOW METAL FRAMES

.1 Install fire-rated frames in accordance with NFPA 80, and local authority having jurisdiction.

.2 Set frames plumb, square, level and at correct elevation.

.3 Secure anchorages and connections to adjacent construction.

.4 Make allowance for deflection to ensure structural loads are not transmitted to frame product.

3.4 CEILINGS AND BULKHEADS INSTALLATION

.1 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C840 except where specified otherwise.

.2 Install work level to tolerance of 1:1200.

.3 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.4 Frame perimeter of openings for access panels, light fixtures, diffusers, grilles and other openings with furring channels.

.5 Install 19 by 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.

.6 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.7 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated. Extend gypsum board to underside of structure except where indicated otherwise. Allow for 25 mm deflection.

.8 Install wall furring for gypsum board wall finishes in accordance with ASTM C840, except where specified otherwise.

.9 Furr openings and around built in equipment, cabinets, access panels, and other equipment or accessories, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.10 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Not Used.

1.2 REFERENCE STANDARDS

.1 Green Seal Environmental Standards (GS)

.1 GS-11-2008, 2nd Edition, Paints and Coatings.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.3 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

.2 Maintenance Repainting Manual - current edition.

.4 National Research Council Canada (NRC)

.1 BC Building Code 2018 (BCBC).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit for review.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for paint and coating products and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS SDS in accordance with Health and Safety Requirements and Environmental Procedures.

.3 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Submit duplicate 200 x 305 mm sample panels of each special finish paints with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards.

.4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials as prescribed by the manufacturer.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store painting materials and supplies away from heat generating devices.

.3 Store materials and equipment in well ventilated area within temperature as recommended by manufacturer.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse by manufacturer of packaging materials as per manufacturer's recommendation.

1.5 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces.

.2 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.

.3 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Apply paint finishes when ambient air and substrate temperatures at location of installation can be satisfactorily maintained during application and drying process, within MPI and paint manufacturer's prescribed limits.

.2 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Apply paint to adequately prepared surfaces, when moisture content is below paint manufacturer's prescribed limits.

.3 Additional application requirements:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

Part 2 Products

2.1 MATERIALS

.1 General: Unless otherwise specified in other Sections, provide following paint systems indicated.

.1 Acceptable Manufacturer:

.1 Cloverdale Paint

.2 Sherwin Williams

.3 Benjamin Moore

.4 or equivalent

.2 Supply paint materials for paint systems from single manufacturer.

.3 Conform to latest MPI requirements for painting work including preparation and priming.

.4 Materials in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual, "Approved Product" listing.

.1 Use MPI listed materials having E3 or E2 rating where indoor air quality requirements exist.

.2 Primer: VOC limit 100 g/L maximum to GS-1.

.3 Paint: VOC limit 100 g/L maximum to GS-11.

.5 Colours:

.1 Submit proposed Colour Schedule to Departmental Representative for review.

.2 Base colour schedule on selection of 2 base colours.

.6 Mixing and tinting:

.1 Perform colour tinting operations prior to delivery of paint to site, in accordance with manufacturer's written recommendations. Obtain written approval from Departmental Representative for tinting of painting materials.

.2 Use and add thinner in accordance with paint manufacturer's recommendations.

.1 Do not use kerosene or similar organic solvents to thin water-based paints.

.3 Thin paint for spraying in accordance with paint manufacturer's written recommendations.

.4 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

.7 Gloss/sheen ratings:

.1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

Gloss Level-Category	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish	Max. 5	Max. 10
Gloss Level 2 - Velvet	Max.10	10 to 35
Gloss Level 3 - Eggshell	10 to 25	10 to 35
Gloss Level 4 - Satin	20 to 35	min. 35
Gloss Level 5 - Semi-Gloss	35 to 70	
Gloss Level 6 - Gloss	70 to 85	
Gloss Level 7 - High Gloss	More than 85	

2.2 EXTERIOR PAINTING SYSTEMS

.1 Structural Steel and Metal Fabrication: columns, beams joist and miscellaneous metal.

.1 EXT 5.1D – Alkyd, gloss level 6 finish.

.2 Galvanized Metal: railings and handrail, pipes, etc.

.1 EXT 5.3J – Waterborne light industrial coating (over waterborne primer) G5 finish.

2.3 INTERIOR PAINTING SYSTEMS

.1 Structural Steel and Metal Fabrication: columns, beams joist and miscellaneous metal.

.1 INT 5.1E - Alkyd, gloss level 6 finish.

.2 Gypsum board: gypsum wall board, drywall, “sheet rock type material”, and textured finishes.

.1 INT 9.2M – Institutional Low Odour/Low VOC, gloss level 3 finish.

Part 3 Execution

3.1 GENERAL

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

.2 Perform preparation and operations for interior painting in accordance with MPI - Architectural Painting Specifications Manual and MPI - Maintenance Repainting Manual except where specified otherwise.

3.2 EXAMINATION

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative and damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple “cover patch test”. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.3 PREPARATION

.1 Protection of in-place conditions:

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Departmental Representative.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.2 Surface Preparation:

.1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.

.2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.3 Place “WET PAINT” signs in occupied areas as painting operations progress. Signs to approval of Departmental Representative.

.4 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual specific requirements and coating manufacturer's recommendations.

.5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

.6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.7 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements.

.8 Touch up of shop primers with primer as specified.

3.4 APPLICATION

.1 Paint only after prepared surfaces have been accepted by Departmental Representative.

.2 Use method of application approved by Departmental Representative.

.1 Conform to manufacturer's application recommendations.

.3 Apply coats of paint in continuous film of uniform thickness.

.1 Repaint thin spots or bare areas before next coat of paint is applied.

.4 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.5 Sand and dust between coats to remove visible defects.

.6 Finish surfaces both above and below sight lines as specified for surrounding surfaces.

.7 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 00 - Cleaning.

.4 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

.5 Place primer and paint defined as hazardous or toxic waste, including tubes and containers, in containers or areas designated for hazardous waste.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 Read all Divisions of the building specification, Tendering Requirements, Contract Forms, and Conditions of Contract, and Division 1 which contain items affecting Mechanical Work.

.2 If similarity or discrepancies are found between contents of Divisions 21, 22, 23, 25 and Division 1 or other documents stated above, the one with most stringent content shall be applicable.

.3 The Mechanical Work shall consist of the supply and installation of complete and operable systems and shall include all necessary labour, plant, materials, and incidentals for the work involved.

.4 The drawings and specifications are intended to describe complete working systems including all necessary labour and materials. Where items required to complete working system are not specified or shown on drawings, contractor shall include costs at no additional expense to Owner.

.5 Immediately inform the Departmental Representative, in writing, of all discrepancies, errors, omissions, contradictions and ambiguities during tender stage. The necessary Addendum or bulletin will be issued to all Bidders. Include a complete cross-checking of Drawing and Specifications for sizes and quantities to correspond correctly. Data mentioned in the Specifications and not shown on Drawings, and vice-versa, must be interpreted as part of the Work. Bring obvious discrepancies or omissions to the attention of the Departmental Representative during the Tender Period. Where discrepancies still exist within the documents, contractors shall allow for the more demanding installation or more stringent requirement.

1.2 SUBMITTALS

.1 Submittals: in accordance with Section 01 01 50 – General Instructions.

.2 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.3 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify current model production.
- .5 Certification of compliance to applicable codes.

.4 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

.2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.

.3 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.6 Approvals:

.1 Submit four copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.

.2 Make changes as required and re-submit as directed by Departmental Representative.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.2 Prepare and insert into each operation and maintenance manual a CD containing electronic copy of approved O&M manual including approved AS BUILT drawings.

.8 Site records:

.1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.

.2 Transfer information weekly to reproducible, revising reproduciblep to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.9 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Departmental Representative for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings in CADD with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 01 50 – General Instructions.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 – Health and Safety Requirements.

1.4 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 01 50 – General Instructions as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One glass for each gauge glass.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 01 50 – General Instructions.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycle in accordance Section 01 01 50 – General Instructions.

Part 2 Product

2.1 ACCESS DOORS

.1 Provide access doors for maintenance or adjustment purposes for all mechanical system components including:

.1 Valves;

.2 Volume and splitter dampers;

.3 Fire dampers;

.4 Controls, coils and terminal units;

.5 Expansion joints;

.6 Filters;

.7 Strainers

.2 Mark removable ceiling tiles used for access with colour coded dots.

.3 Provide ULC-listed fire rated access doors installed in rated wall and ceilings.

Part 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Division 9 - Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

.1 Clean interior and exterior of all systems including strainers.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 01 50 – General Instructions.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in Section 01 01 50 – General Instructions.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in Section 01 01 50 – General Instructions.

3.4 DEMONSTRATION

.1 Contractor will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Contractor will record these demonstrations on video tape for future reference. Submit the recording media to Owner.

3.5 PROTECTION

.1 Protect equipment, pipes and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Electrical motors, drives and guards for mechanical equipment and systems.

.2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 90.1- Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.2 Electrical Equipment Manufacturers' Association Council (EEMAC)

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Submittals: in accordance with Section 01 01 50 – General Instructions.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 01 50 – General Instructions.

.2 Shop Drawings: submit shop drawings in accordance with Section 01 01 50 – General Instructions.

.3 Quality Control: in accordance with Section 01 01 50 – General Instructions.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 01 50 – General Instructions.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with applicable Provincial /Territorial regulations.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance Division 1 requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 01 50 – General Instructions.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 GENERAL

.1 Motors: high efficiency, in accordance with local power company standards, local by-laws and to ASHRAE 90.1.

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 Motors under 373 W (1/2 HP) : speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 60 Hz, 120 V, unless otherwise specified or indicated.

.3 Motors 373 W (1/2 HP) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, 60Hz, 575 V, unless otherwise indicated.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Departmental Representative for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.

.3 For motors under 7.5 kW (10 HP): standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW (10 HP) and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave determined during commissioning.

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

.8 Supply one set of spare belts for each set installed in accordance with Section 01 01 50 – General Instructions.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;

- .1 Expanded metal screen welded to steel frame.
- .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
- .3 38 mm diameter holes on both shaft centres for insertion of tachometer.
- .4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.-

.5 Guard for flexible coupling:

- .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
- .2 Securely fasten in place.
- .3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

- .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
- .2 Net free area of guard: not less than 80% of fan openings.
- .3 Securely fasten in place.

.4 Removable for servicing.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 01 50 – General Instructions.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in Section 01 01 50 – General Instructions.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in Section 01 01 50 – General Instructions.

3.4 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Vibration isolation materials and components, seismic control measures and their installation including chiller, pumps, all equipment, and piping system.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 National Fire Protection Association (NFPA)

.1 NFPA 13- Standard for the Installation of Sprinkler Systems.

.3 National Building Code of Canada (NBC)

1.3 SUBMITTALS

.1 Submittals: in accordance with Section 01 01 50 – General Instructions.

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 01 50 – General Instructions.

.2 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.

.1 Provide separate shop drawings for each isolated system complete with performance and product data.

.2 Provide detailed drawings of seismic control measures for equipment and piping.

.3 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Manufacturer's Field Reports: manufacturer's field reports specified.

1.4 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 01 50 – General Instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 01 50 – General Instructions.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycle in accordance with Section 01 01 50 – General Instructions.

1.6 WORK INCLUDED

.1 Provide vibration isolation on all motor driven equipment with motors of 0.37 kW (0.5 HP) and greater power output (as indicated on the motor nameplate) and on piping, as specified herein. For equipment less than 0.37 kW, provide neoprene grommets at the support points. Electrical grommets are not acceptable.

.2 Provide seismic restraints for all isolated and non-isolated equipment and piping systems.

.3 Ensure isolators and restraining devices which are factory supplied with equipment meet the requirements of this section. Provide signed and sealed Letter of Assurance as required by this section.

.4 Ensure equipment manufacturers provide attachment points capable of withstanding specified seismic forces.

1.7 DESIGN CRITERIA

.1 Ensure that the minimum distance between adjacent corner isolators is at least equal to the height of the centre of gravity of the equipment. Include height of centre of gravity on shop drawings. Otherwise, design for increased forces on the supports, and submit design calculations with shop drawings for approval.

.2 Ensure isolation systems have a vertical natural frequency no higher than one third of the lowest forcing frequency, unless otherwise specified. Use dynamic stiffness for elastomers and do not exceed 60 durometer.

.3 Design isolators and seismic restraints to meet the structural requirements of the Building Code.

.4 Where integral isolation/snubbing devices do not meet the seismic requirements provide secondary all directional snubbing devices.

.5 Design attachments to both the equipment and the structure to meet the specified forces involved. Have the attachment details to the structure approved by a Professional Engineer registered in British Columbia.

.6 Provide seismic restraints for pipes 65 mm diameter and larger except where the pipe hanger rod length, from attachment to structure to attachment of support hardware (i.e. top of clevis hanger) is less than 305 mm.

.7 Provide seismic restraints for all isolated piping and equipment, regardless of size.

1.8 QUALIFICATIONS

.1 Have all isolation/seismic restraint products tested and certified by an independent testing laboratory, or certified by a registered professional engineer, to demonstrate that the products meet the requirements of this section. If particular tests are carried out to represent an isolator type, the tests shall be valid for the full load range of the isolator. Submit such tests or certification on request.

1.9 DESIGN PROFESSIONAL AND LETTERS OF ASSURANCE

.1 Have the complete and functional seismic restraint system designed and certified by a British Columbia registered professional engineer.

.2 Submit Letters of Assurance for the design Work of this Section, signed and sealed by the design professional engineer.

.3 Have the design professional engineer undertake such field reviews as he or she determines to be necessary to confirm that the construction generally conforms with the design intent.

.4 Submit letters of Assurance of Field Review and Compliance for the design Work of this Section, signed and sealed by the design professional engineer, upon completion of the Work of this Section.

.5 Ensure that Letters of Assurance conform to the standard requirements of the Authority Having Jurisdiction.

1.10 SUBMITTALS

.1 Obtain all relevant equipment information and provide calculations, shop and placement drawings for all vibration isolation elements and steel bases for review before materials are ordered. Provide attachment to both the equipment and the structure meeting the specified forces involved. Have attachment details to the structure approved by a BC registered Professional Engineer.

.2 Submit samples of materials required to complete the work of this section for inspection and review if requested.

.3 Have the vibration isolation vendor provide a full inspection report of isolation/restraint products provided and installed, listing all deficiencies.

Part 2 Products

2.1 GENERAL

.1 Size and shape of bases type and performance of vibration isolation as indicated.

2.2 ELASTOMERIC PADS

.1 Type EP1 - neoprene waffle or ribbed; 9 mm minimum thick; 50 durometer; maximum loading 350 kPa.

.2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.

.3 Type EP3 - neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.

.4 Type EP4 - rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

2.3 ELASTOMERIC MOUNTS

.1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

2.4 SPRINGS

.1 Design stable springs: ratio of lateral to axial stiffness is equal to or greater than 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with levelling devices.

.2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.

.3 Cadmium plate for outdoor 100% relative humidity installations.

.4 Colour code springs.

2.5 SPRING MOUNT

.1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.

.2 Type M2 - stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.

.3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.

.4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.

.5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.

.6 Performance: as indicated.

2.6 HANGERS

.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.

.2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.

.3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.

.4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.

.5 Type H4 - stable spring, elastomeric element with pre-compression washer and nut with deflection indicator.

.6 Performance: as indicated.

2.7 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

.1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

2.8 HORIZONTAL THRUST RESTRAINT

.1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.

.2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

2.9 ISOLATORS

.1 Supply all of the vibration isolation equipment from one approved supplier with the exception of isolators which are factory installed and are standard equipment with the machinery. In the latter case have the manufacturer supply certified calculations of the internal restraints as well as certified calculations for anchorage to the structure.

.2 Provide isolators of the following types

.1 Pad Isolators

.1 Neoprene pad isolators, as defined by CAN/CSA-S6. Select pads for a 15% static deflection. Hold down equipment mounted on neoprene pad isolators using anchor bolts, nuts, washers, and hemi-grommets.

.2 Neoprene Floor Isolators

.1 Neoprene-in-shear isolators designed to meet specified seismic requirements. Select isolators for a 5 mm minimum static deflection, and bolt to structure. In the case of rubber isolators, provide protection in the design of the isolator to avoid contact of the rubber element with oil in the mechanical room.

.3 Spring Floor Isolators

.1 Spring mounts, with a minimum 25 mm deflection, complete with levelling devices, and minimum 6 mm thick ribbed neoprene sound pads with 1.3 mm minimum deflection. Design isolator to meet specified seismic requirements and bolt down using neoprene grommets.

.4 Hanger Isolators

.1 Spring hangers within minimum 25 mm deflection, complete with 6 mm thick sound pads sized for 0.5 mm minimum deflection, or neoprene hangers. A neoprene element alone, without a hanger box, is acceptable provided no short-circuiting occurs and equipment rotates above 1170 rpm.

.3 Select isolators at the supplier's optimum recommended loading, and do not load beyond the limit specified in the manufacturer's literature.

.4 Design springs with stiffeners ratio of kx/ky = 1.0 to 1.5 with a working deflection between 0.3 and 0.6 of solid deflection.

.5 Provide hot-dipped galvanized housings and neoprene coated springs, or other acceptable weather protection, for all isolation equipment located out-of-doors or in areas where moisture may cause corrosion.

2.10 FLEXIBLE PIPE CONNECTORS

.1 Install Neoprene of EPDM flexible connectors between vibrating equipment and piping over 65 mm, except those pumps handling domestic water.

2.11 SEISMIC ROD CLAMP

.1 Use seismic rod clamps where the length of the threaded support rod for equipment/pipe/ductwork is over 50 times the rod diameter.

.2 Use 25 mm x 25 mm x 6.4 mm angle for threaded rod size 9.5 to 15.9 mm diameter.

.3 Use 38 mm x 38 mm x 6.4 mm angle for threaded rod size 19 to 32 mm diameter.

.4 Provide rod clamps complete with locking bolt.

2.12 SEISMIC SOLID BRACE FOR NON-ISOLATED EQUIPMENT/PIPING/DUCTWORK

.1 Provide two solid braces at 90E to each other at attachment point, for non-isolated hung equipment, piping, and ductwork.

.2 Use braces complete with formed steel solid brace anchors with two bolts holds for the solid brace and swivel hinge on a support bracket on each end of the brace.

2.13 MECHANICAL EQUIPMENT ANCHORS

.1 Anchors shall be provided by vibration isolation/seismic restraint supplier. The responsibility for the seismic restraint of resiliently mounted equipment, from attachment to structure to point of attachment to equipment, is that of the vibration isolation/seismic restraint supplier.

2.14 EPOXY PUTTY

.1 Steel reinforced epoxy putty with an ultimate compressive strength of 82,700 kPa.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Seismic control measures to meet requirements of NBC.

.2 Install vibration isolation equipment in accordance with manufacturer’s instructions and adjust mountings to level equipment.

.3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.4 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:

.1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and Over: first 6 points of support.

.2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.

.5 Where isolation is bolted to floor use vibration isolation rubber washers.

.6 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

.7 Chiller CH-1 is to be mounted on seismic spring isolators with 65 mm static deflection.

3.3 ISOLATORS

.1 Execute the work in accordance with the specifications, and where applicable, in accordance with the manufacturer's instructions and only use workmen experienced in this type of work.

.2 For all equipment mounted on vibration isolators, provide a minimum clearance of 50 mm to other structures, piping, equipment, and similar items.

.3 Isolate all floor or pier mounted equipment on spring floor isolators, unless otherwise specified.

.4 Isolate pumps and axial fans rotating at more that 1170 RPM on neoprene floor isolators. Use the lowest RPM scheduled for two speed equipment in determining isolator deflection.

.5 Before bolting isolators to the structure, start equipment and balance the systems so that the isolators can be adjusted to the correct operating position before installing seismically rated drilled inserts.

.6 For equipment mounted on a slab on grade, chillers and in-line pumps, mount on neoprene floor isolators, unless otherwise specified.

.7 For all electrical connections to isolated equipment, provide a 90° bend of flexible conduit for 25 mm conduit and smaller or 90° Crouse-Hind EC couplings for larger conduit. Use connections long enough so that the conduit will remain intact if the equipment moves laterally 300 mm from the installed position, and flexible enough to transmit less vibration to the structure than is transmitted through the springs.

.8 Select Spring Hangers for a minimum static deflection of 25 mm for all ceiling hung fans, and air handling units, and any other vibrating sources.

.9 Provide Spring Hangers on all piping, tanks, etc. connected to a vibrating source, if the piping is in excess of 40 mm dia. Provide the hangers for a distance of 6.5 m for a 50 mm pipe and 11.5 m for a 250 mm pipe. Isolate other pipe sizes for a proportionate distance. Isolate all piping in mechanical rooms. If neoprene hangers are proposed for non-critical spaces, change to spring hangers at no additional cost in the event that the isolation proves inadequate.

.10 Where piping connected to noise generating equipment is routed from the mechanical room through walls and plumbing chases, position piping to avoid contact with the concrete structure, future framing, drywall and other finishes which may radiate noise.

3.4 EQUIPMENT INSTALLATION

.1 Bolt all equipment to the supporting structure. Do not bridge isolation elements.

3.5 NON-ISOLATED HANGING SYSTEM

.1 Follow the Seismic Restraint manual Guidelines for Mechanical systems published by SMACNA in the selection of the appropriate diameter of threaded rod for the associated load at each attachment point. Use the next largest size of rod if any doubt exists.

.2 Wherever possible keep piping, ducting and equipment within 300 mm of the structure (i.e. top of pipe/duct or equipment to the attachment point at underside of structure). Intermediate points may exceed this 300 mm rule but a consecutive 300 mm attachment must occur with 9 m for ducting and 12 m for piping. No further seismic restraint is required if these parameters are met and all threaded rods at restraint points exceed 6.3 mm diameter.

.3 Piping/ducting may be attached to walls and require no further restraint as long as it is attached within 300 mm of that wall.

.4 Use pipe riser clamps wherever possible on piping without thermal expansion, instead of clevis hangers.

.5 Trapeze parallel runs of piping/ducting except those pipes where thermal expansion is expected. Attach pipes to trapeze with "U" bolts. Where pipes are of different diameter, set the bottom of all pipes on the same horizontal plane, to accommodate attachment to the trapeze.

.6 Anchor ducts to trapezes at flange locations.

.7 Anchor pipes without thermal expansion penetrating structural walls to the wall at the point of penetration.

.8 Anchor ducts penetrating walls to the wall at the point of penetration.

.9 Place piping closer to the structural ceiling than ductwork, except where maintenance prone valves or other devices are installed in the piping.

.10 Set the minimum distance from drill holes to the edge of the concrete or adjacent drill holes as recommended by the manufacturer of the drill inserts.

.11 Place seismic bracing or cables for ductwork within 600 mm, in both directions from every turn on jog, then:

.1 space the transverse bracing at 9 m intervals;

.2 space the longitudinal bracing at 18 m intervals.

.12 Place seismic bracing or cables for pipes within 600 mm, in both directions from every turn or jog, then:

.1 space the transverse bracing at 12 m intervals;

.2 space the longitudinal bracing at 24 m intervals.

.13 Include anchored wall penetrations when calculating the 9/18 and 12/24 bracing spacings to determine the number of transverse and axial restraints required.

.14 Install the required restraints equidistantly between corner and penetration anchor points.

3.6 ANCHORING RIGIDITY

.1 Maximum air gap between anchor bolt and restraint housing anchor hole shall not exceed 3 mm.

.2 If the air gap exceeded 3 mm, the clearance must be reduced by hemi-grommets (where the bolt is concentric with the hole) or epoxy putty.

.3 Follow manufacturer's instructions to hand knead the 0.5 fast epoxy putty and fill the entire gap between the bolt hole and the anchor bolt.

3.7 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.

.2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:

.1 After delivery and storage of Products.

.2 After preparatory work is complete but before installation commences.

.3 Twice during the installation, at 25% and 60%completion stages.

.4 Upon completion of installation.

.3 Submit manufacturer's reports to Departmental Representative within 3 days of manufacturer representative's review.

.4 Make adjustments and corrections in accordance with written report.

.2 Inspection and Certification:

.1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.2 Provide Departmental Represenative with notice 24 h in advance of commencement of tests.

.3 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).

.4 Submit complete report of test results including sound curves.

3.8 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

.2 This section applies to all related work under Division 22 and Division 23.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3-92, Identification of Piping Systems.

1.3 SUBMITTALS

.1 Product Data:

.1 Submittals: in accordance with Section 01 01 50 – General Instructions.

.2 Product data to include paint colour chips, other products specified in this section.

.2 Samples:

.1 Submit samples in accordance with Section 01 01 50 – General Instructions.

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.4 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 01 50 – General Instructions.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Dispose of unused paint coating material at official hazardous material collections site approved by Departmental Representative.

.3 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size # 5.

.2 Equipment in Mechanical Rooms: use size # 9.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Departmental Representative.

2.4 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Natural gas: to CSA/CGA B149.1 and authority having jurisdiction.

.2 Sprinklers: to NFPA 13.

.3 Standpipe and hose systems: to NFPA 14.

2.5 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:

.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 Other pipes: pressure sensitive plastic-coated cloth vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from Departmental Representative.

.2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	**Background colour marking**	**Legend**
** Add design temperature		
++ Add design temperature and pressure		
City water	Green	CITY WATER
Treated water	Green	TREATED WATER
Condenser water loop supply	Green	COND. WTR. LOOP SUPPLY
Condenser water loop return	Green	COND. WTR. LOOP RETURN
Chilled water supply	Green	CH. WTR. SUPPLY
Chilled water return	Green	CH. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Exhaust coil heating supply	Yellow	EXHAUST COIL SUPPLY
Exhaust coil heating return	Yellow	EXHAUST COIL RETURN
Fluid cooler supply	Green	FC SUPPLY
Fluid cooler return	Green	FC RETURN
Air handling unit supply	Yellow	AHU SUPPLY
Air handling unit return	Yellow	AHU RETURN
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Waste water	Green	WASTE WATER
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Natural gas	to Codes	
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS

2.6 VALVES, CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.7 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.8 LANGUAGE

.1 Identification in English.

.2 Use one nameplate and label.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 TIMING

.1 Provide identification only after painting specified Division 9 - Painting has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and CSA registration plates as required by respective agency.

3.4 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy reduced in size if required in each operating and maintenance manual.

.3 Number valves in each system consecutively.

3.7 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Departmental Representative within 30 days of award of contract.

.2 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1 2016.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-2015.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.

.3 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.4 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.5 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.6 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.7 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Departmental Representative in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

1.9 START OF TAB

.1 Notify Departmental Representative 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, and caulking.

.5 Pressure, leakage, other tests specified elsewhere Division 23.

.6 Provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Liquid systems:

.1 Flushed, filled, vented.
.2 Correct pump rotation.
.3 Strainers in place, baskets clean.
.4 Isolating and balancing valves installed, open.
.5 Calibrated balancing valves installed, at factory settings.
.6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 Air Duct systems: plus or minus 5 %.

1.11 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 2 % of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to Departmental Representative list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

1.13 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

1.15 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

.1 Reported results subject to verification by Departmental Representative.

.2 Provide personnel and instrumentation to verify up to 30 % of reported results.

.3 Number and location of verified results as directed by Departmental Representative.

.4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

1.19 AIR / WATER SYSTEMS

.1 Standard: TAB to most stringent of this section or TAB standards of AABC SMACNA and ASHRAE.

.2 Do TAB of systems, equipment, components, controls including but not limited to the following:

.1 HVAC Systems

.3 Qualifications: personnel performing TAB current member in good standing of AABC qualified to standards of AABC.

.4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC.

.5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop, temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.7 Locations of systems measurements to include as appropriate.

1.20 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air and water systems specified this section.

.2 Quality assurance: as for air and water systems specified this section.

.2 Measurement of noise and vibration from equipment specified in Division 23.

.3 Smoke management

.1 Test for proper operation of all fire dampers, installed as a component port of air system specified in Division 23.

.2 Test for proper operation of duct smoke and fire detectors installed in air handling unit systems.

1.21 POST-OCCUPANCY TAB

.1 Participate twice in system checks during warranty period 3 months after acceptance and within 1 month of termination of warranty period.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 01 01 50 General Instructions

.2 23 31 13.0 Metal Ducts – Low Pressure to 500PA (2”W.G.)

.3 23 33 00 Air Duct Accessories

.4 23 37 20 Louvres, Intakes and Vents

1.2 REFERENCES

.1 Definitions:

.1 For purposes of this section:

.1 "CONCEALED" – insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" – means "not concealed" as previously defined.

.3 Insulation systems – insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:

.1 CRD: Code Round Ductwork,

.2 CRF: Code Rectangular Finish.

1.3 Reference Standards:

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE 90.1-2010 – Latest Edition, Standard 90.1-2010 (I-P Edition) -- Energy Standard for Buildings Except Low-Rise Residential Buildings

.2 ASTM International Inc.

.1 ASTM B209M-10 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

.2 ASTM C335/C335M-10E1 – Standard Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411-11 – Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

.4 ASTM C449-07 (2013) – Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement

.5 ASTM C553-11 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

.6 ASTM C612-10 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation

.7 ASTM C795-08 – Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel

.8 ASTM C921-10 – Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

.9 ASTM D412-06AE2 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension

.10 ASTM D1424-09 – Standard Test Method for Tearing Strength of Fabrics by Falling-Pendulum Type (Elmendorf) Apparatus

.11 ASTM E84-12 – Latest Edition, Test Method for Surface Burning Characteristics of Building Materials

.12 ASTM E96M-12 – Standard Test Methods for Water Vapor Transmission of Materials

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52MA – Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation

.4 Green Seal Environmental Standards (GSES)

.1 Standard GS-36-2011 – Latest Edition – Commercial Adhesives

.5 National Fire Protection Association

.1 NFPA-90A - Latest Edition, Installation of Air Condition and Ventilating Systems

.6 Thermal Insulation Association of Canada (TIAC): National Insulation Standards 2013.

.1 CRD: Code Round Ductwork,

.2 CRF: Code Rectangular Finish.

.7 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S102-10 – Latest Edition, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.2 CAN/ULC-S701-11 – Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 To CAN/ULC S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to ASTM C553.

.5 Rigid Insulation:

.1 Ducting and Fittings: Rigid insulation with vapour barrier to be composed of fibrous glass or mineral wood fibres formed into rigid board having a factory applied vapour barrier, and suitable for application on exposed or concealed rectangular ducts and plenums.

.1 Specification Compliance:

.1 CGSB 51-GP-10a

.2 ASTM C612-70, Class 1

.3 ASTM C411-05 to meet NBC or CUA (NFPA 90A), latest edition.

.2 Vapour Barrier:

.1 Vapour barrier shall be composed of aluminum foil minimum 24 gauge thick (0.7 mil), reinforced with fibreglass yarn mesh and laminated to permanently treated fire resistant kraft paper. Vapour barrier shall meet or exceed the following:

.1 Water Vapour Permeability: 0.3 perms max.

.2 Moisture Absorption: Less than 0.2% by volume.

.2 Fire Hazard Classification: not to exceed:

.1 Flame Spread: 25

.2 Fuel Contributed: 50

.3 Smoke Developed: 50

.3 Specification Compliance:

.1 ASTM-C411-05 to meet NBC or CUA 90A (NFPA-90A), latest edition.

.2 Thickness of rigid insulation with vapour barrier to be as indicated in schedule.

.3 Application: Thicknesses as indicated in insulation schedule.

.1 Fresh air intakes from louvres to mixing box and/or filter sections of air handling units.

.2 All rectangular exhaust air ductwork for a minimum distance of 3000mm from the terminal at the roof or exterior wall or to motorized damper or as noted on the drawings.

.3 All rectangular supply air ducts from air handling units (in mechanical rooms).

.6 Flexible Insulation:

.1 Ducting and Fittings:

.1 Flexible insulation with factory applied vapour barrier to be composed of fibrous glass formed into a flexible blanket and be suitable for application on exterior of round and rectangular ducts. Flexible insulation shall be used on rectangle ducts in concealed locations only.

.2 Specification Compliance:

.1 CGSB 51-GP-11b (Type 1)

.2 Class 6 ASTM C411-05, to meet CUA-90A (NFPA 90A).

.2 Vapour Barrier:

.1 The vapour barrier shall be composed of aluminum foil min 24 gauge (0.7 mil) thick, reinforced with fibreglass yarn mesh and laminated to permanently treated fire resistant kraft paper.

.2 Specification Compliance:

.1 ASTM-C411 to meet NBC 1974 or CUA-90A.

.3 Applications: Thicknesses as indicated in insulation schedule.

.1 Insulate circular exhaust air ducts for a minimum distance of 3000mm from the roof terminal or exterior wall opening, or to motorized dampers or as noted on drawing.

.2 Unheated fresh air ducts.

.3 Supply air ductwork, as noted on drawings.

.4 Finishes:

.5 All concealed ductwork will be left with factory applied vapour barrier facing as specified above, with no further finish required.

.6 Cover all exposed ductwork with a thermocanvas jacket as specified under “Jackets”.

.7 The bottom of duct insulation shall be pinned per TIAC standards.

.8 Insulation shall not be installed until spaces are weather tight and no risk of water.

2.3 JACKETS

.1 Canvas:

.1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

.3 Aluminum:

.1 To ASTM B 209 with moisture barrier as scheduled in PART 3 of this section.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Smooth, Stucco embossed or Corrugated.

.4 Jacket banding and mechanical seals: 12 or 19 mm wide, 0.5 mm thick stainless steel.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.

.4 ULC Listed Canvas Jacket:

.1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.5 Outdoor Vapour Retarder Mastic:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².

.6 Tape: self-adhesive, aluminum, reinforced, 50 or 75 mm wide minimum.

.7 Contact adhesive: quick-setting

.8 Tie wire: 1.5 mm stainless steel.

.9 Banding: 12 or 19 mm wide, 0.5 mm thick stainless steel.

.10 Facing: 25 mm stainless or galvanized steel hexagonal wire mesh stitched on one face or both faces of insulation or one face of insulation with expanded metal lath on other face.

.11 Fasteners: 2 or 4 mm diameter pins with 35 mm diameter or square clips, length to suit thickness of insulation.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PRE-INSTALLATION REQUIREMENTS

.1 Ensure surfaces are clean, dry, free from foreign material.

.2 No insulation shall be installed until the area to be insulated is weather tight and there is no risk of water.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer’s instructions and as indicated.

.3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Ensure hangers, and supports are outside vapour retarder jacket.

.5 Hangers and supports in accordance with Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

	TIAC Code	**Vapour Retarder**	**Thickness (mm)**
Rectangular cold and dual temperature supply air ducts	C-1/C-2	yes	25
Round cold and dual temperature supply air ducts	C-2	yes	25
Rectangular warm air ducts	C-1/C-2	no	25
Round warm air ducts	C-2	no	25
Supply and return ducts exposed in space being served	C-1/ C-2	yes	25
Outside air ducts to mixing plenum	C-1	yes	50
Mixing plenums	C-1	yes	50
Exhaust duct 3000mm back from wall or roof penetration	C-1/C-2	yes	50
Rectangular ducts outside	C-1	special	50
Round ducts outside	C-1	special	50
Acoustically lined ducts	none		50

-Interior ductwork does not require exterior insulation if acoustic insulation is provided.
-Exterior outdoor ductwork requires exterior insulation even if acoustic interior insulation is provided.

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

.1 Use TIAC 2013 code C-1 insulation, scored to suit diameter of duct.

.1 Finishes: conform to following table:

	TIAC Code	
	Rectangular	**Round**
Indoor, concealed	none	none
Indoor, exposed	CRF/1	CRD/1
Outdoor, exposed to precipitation	CRF/3	CRD/3
Outdoor, elsewhere	CRF/4	CRD/5

END OF SECTION

Part 1 General

1.1 REFERENCES:

.1 Section 01 01 50 – General Instructions

.2 Section 01 91 00 – Commissioning

.3 Section 26 05 00 – Common Work

1.2 GENERAL COMMISSIONING CONCEPT AND COMMISSIONING PLAN

.1 Commissioning Agent being hired by Contractor.

.2 The Commissioning as applied to buildings is the process of bringing a building into use concluding all activities directed to that end, and including equipment as well as staffing involved in the subject facility.

.3 Verification, as related to the Mechanical, Electrical and Specialty systems installed in the building, represents the process of proving the performance of the equipment as defined in the technical specifications.

.4 If required, Owner shall retain and pay for Commissioning Authority, which manages and oversees the commissioning process.

.5 The Commissioning Plan:

.1 Identifies the role of each participant in the Commissioning Process and maps out both overall and phase-specific strategies for the project.

.2 Describes the procedures for verification of each system.

.6 The Commissioning Process covers the full life cycle of the project from the initial planning activities through to the point where that facility is in full operation and in full compliance with predefined user, operator, design and contract requirements.

.7 The Commissioning Process includes the following five major components:

.1 Thorough documentation and monitoring of all facets of construction.

.2 Extensive tests of all subsystems, their components and controls.

.3 Testing of whole systems that include a multiple of subsystems.

.4 Specific and detailed training on all major equipment for operational personnel.

.5 Ongoing monitoring and checking during the warranty period.

1.3 OBJECTIVES

.1 Support quality management through monitoring and checking of the installation.

.2 Verify systems performance through inspection and performance testing of the completed installation.

.3 Move the completed facility from the "static completion" state to the optimal "dynamic" operating state.

.4 Optimize operating and maintenance through delivery of comprehensive quality training and instruction to the Owner's operating personnel.

.5 System debugging and optimization.

.6 Completion of training and instruction for the operating and maintenance personnel.

.7 Assure provision of accurate and useful historical records, such as "as-built drawings", test certificates etc. Such records provide important data for operating and maintaining the systems as well as for future system testing, maintenance or renovations.

.8 Completion of testing and verification through seasonal review.

.9 Specifically, the Commissioning Process shall deliver to the owner:

.1 A complete set of documentation on the design intent and maintenance requirements of each system involved in the commissioning process.

.2 A system that functions in accordance with the design intent.

.3 Operators who fully understand the design intent and the operation and maintenance requirements of the equipment.

1.4 CONTRACTOR'S RESPONSIBILITIES

.1 Start-up Phase

.1 Ensures that start-up program is implemented in accordance with the facility start-up requirements within the contract documents.

.2 Following start-up, which may be observed by the Owner/Departmental Representative/Commissioning Authority, and must therefore be pre-scheduled, begins Performance Testing under conditions which simulate varying load and all operating modes, including emergency modes of operation.

.3 Following contractor's thorough testing, schedules, and performs verification-related tasks in the presence of the Commissioning Authority.

.2 Post-Construction Phase

.1 Post construction commissioning is the continued adjustment, optimization and modification of the systems to meet specified requirements. It includes updating documentation to reflect minor set point adjustments, system maintenance and calibration, major system modifications and provision of ongoing training of operation and maintenance personnel.

.2 The objective of post construction phase commissioning is to maintain the performance of the systems throughout the useful life of the facility in accordance with the current design intent.

.3 Complete all commissioning procedures, activities, and performance verification, which were delayed or not executed during the construction phase.

.4 Executes system checks with the Owner/Departmental Representative/Commissioning Authority:

.1 Once during the first month of building operation.

.2 Once during the third month of building operation.

.3 Once between the fourth and tenth months in a season opposite to the first or third month visit.

.5 Completes rectification of all deficiencies revealed by the above checks.

.6 Revises all as-builts and operating and maintenance documents to reflect all changes, modifications, revisions and adjustments upon completion of commissioning.

1.5 STANDARD OF ACCEPTANCE

.1 Commissioning Agent services shall be performed by a separate independent company.

.2 Standard of acceptance:

.1 K.D. Engineering.

.2 Western Mechanical.

.3 Design Intent

Part 2 Products

2.1 COMMISSIONING INVOLVEMENT

.1 The Commissioning Authority (if on-board) shall direct, witness and verify equipment performance testing. Accordingly, the Contractor and/or his suppliers and/or his Independent Third Party Commissioning Agents shall perform the following:

.1 Check and ensure the installation of the systems and equipment to ensure that the installation is complete, is in a proper and safe state, has been pre-tested to ensure all complete and proper operation, and is ready for verification.

.2 Run and test the systems and equipment through their design parameters to verify their capabilities in performance, sequencing, safety protection and alarms annunciation.

2.2 SYSTEMS TO BE COMMISSIONED

.1 Mechanical systems shall include, but are not limited to, the following (Refer to Division 1 – General Commissioning (Cx) requirements):

.1 Air distribution systems.

.2 Control systems.

2.3 TESTING EQUIPMENT

.1 The Contractor shall provide all instrumentation and test equipment necessary to conduct the tests specified during the commissioning process.

2.4 DOCUMENTATION

.1 Contractor shall record all test results and procedures on approved record forms, and submit the forms together with copies of test certificates to Departmental Representative and Commissioning Authority for review and approval.

.2 When the results are verified, the Commissioning Agent shall incorporate those records in his Systems Operations Manual. He shall also make entry of those test results into appropriate sections of the Operating and Maintenance Manual for reference.

Part 3 Execution

3.1 COMMISSIONING PROCESS

.1 Perform and complete all works as specified in the Mechanical specifications. In general, it shall include complete activation of all systems; calibration; testing; verification of performance of all components, equipment and systems; verification of performance of all

systems through all specified modes of control and sequences of operation, recording of test results for submission; demonstration, instruction and training of Owner's operating and maintenance personnel; and follow-up during the first year of operation for fine tuning and monitoring purposes.

.2 Advise the Owner/Departmental Representative and/or Commissioning Authority at least 3 days in advance of any test.

.3 Complete the testing form for each test, and submit copies to the Departmental Representative and/or Commissioning Authority.

3.2 COMMISSIONING MEETINGS AND REPORTING

.1 The Contractor shall include all responsibilities noted in the commissioning specifications, including all tests, within his construction schedule.

.2 The commissioning meetings, as required by the Commissioning Authority, shall follow the regular construction meetings. The testing schedules and results of all tests shall be reviewed.

.3 All testing forms and reports associated with the mechanical systems shall be directed to the Commissioning Authority with copies to the Departmental Representative.

.4 The forms and reports to be issued shall include:

.1 Reviewed shop drawings

.2 Equipment verification/data forms

.3 Testing forms

.4 Reports resulting from tests

.5 Testing schedule

3.3 OPERATING AND MAINTENANCE MANUAL

.1 The Contractor shall prepare and submit the Operating and Maintenance Manual as detailed in the specification Section 01 01 50 – General Instructions.

.2 The Contractor shall re-submit the manual should the Departmental Representative find deficiencies. Training shall not begin until the manual has been accepted by the Departmental Representative.

.3 One (1) copy of the manual shall be forwarded to the Commissioning Authority in good quality, vinyl covered binders at the time of submission to the Departmental Representative. Four (4) final hard copies and 3 digital final copies of the manuals (after incorporating the Departmental Representative/Commissioning Authority comments) shall be submitted to the Commissioning Authority in 75mm (3") D-ring white vinyl covered binders with transparent sleeve.

.4 Each mechanical manual shall be organized as follows, but not limited to the following:

.1 Project Directory

.2 Plumbing

.3 Fire Protection

.4 Heating and cooling

.5 Ventilation

.6 Energy Monitoring and Controls System

.5 The project directory shall contain the names, addresses, fax numbers and telephone numbers of Contractors, Sub-Contractors, Manufacturers and Manufacturers representatives.

.6 Sections 3.3.4.2 to 3.3.4.6 noted above shall be divided into the following sub-sections.

.1 Shop drawings (reduced to 8½" x 11")

.2 As-built drawings (reduced to 8½" x 11")

.3 As-built riser diagrams (reduced to 8½" x 11")

.4 Systems description

.5 Operating procedures

.6 Maintenance procedures

.7 Trouble shooting guide;

.8 Valve chart (where applicable)

.9 Filter size chart (where applicable)

.10 Equipment lists

.11 Testing and verification forms

.12 Certification forms

.7 Systems description shall be a detailed description of each major component, describing the intent, function, operational modes, and any information that may be pertinent to day-to-day operation.

.8 The operating procedures, maintenance procedures, spare parts list, and troubleshooting guide shall be as recommended by the Manufacturer.

.9 The equipment list shall include make, model, serial number, electrical characteristics, RPM, pump impeller sizes, fan belt and sheave sizes.

3.4 OWNER DEMONSTRATION AND OPERATOR TRAINING

.1 Systems' demonstration shall be conducted by the Contractor. The demonstration shall cover all operation and maintenance requirements and a physical demonstration of equipment installation and operation.

.2 Owner demonstration shall include a walk-through of the building by the Contractor. During the walk-through, the Contractor shall:

.1 Identify equipment

.2 Identify starters associated with equipment

.3 Identify valves and balancing dampers

.4 Identify access doors

.5 Review general maintenance of equipment

.6 Review drain points in pipe work systems

.7 Identify maintenance items

.3 The Contractor and equipment Manufacturer shall provide operator training for each mechanical system and item of equipment.

.4 Training and instruction shall be provided by qualified Technicians and shall be conducted in a classroom setting and at the equipment or system.

.5 Training and instruction will begin after the Operating and Maintenance manual has been approved and delivered to the Departmental Representative.

.6 Each session shall be structural to cover.

.1 The operating and maintenance manual

.2 System description

.3 Operating procedures

.4 Maintenance procedures

.5 Trouble shooting procedures

.6 The Manufacturer's or Service Representative's name, address and telephone number

.7 Provide course documentation for up to six (6) people.

.8 Training and instruction shall be provided for the following systems wherever applicable:

.1 Life Safety & Fire Protection Systems

.2 Heating and Cooling Systems

.3 Building Automation & Controls Systems.

.4 Mechanical Systems

.5 Ventilation Systems

.9 Time Allocation

.1 The time allocation for various Owner training sessions is not predetermined. The agenda for training sessions will be outlined and agreed upon with the mechanical contractor and commissioning authority through the commissioning program to ensure the Owner receives adequate training.

3.5 TESTING FORMS

.1 The Contractor and Manufacturer shall provide testing and commissioning forms for review and acceptance.

.2 Mechanical testing and verification forms shall include, but are not limited to, the following:

.1 Equipment test form

.2 Test identification form

.3 Fan data sheet

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 This section is complimentary to and supplements the requirements of Division 1. Refer to and coordinate with Division 1 requirements.

.1 23 05 00 Common Work Results for HVAC.

.2 23 05 29 Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM A480 / A480M-12 – Latest Edition, General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip

.2 ASTM A635/A635M-09b – Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements

.3 ASTM A653/A653M-11 – Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process

.3 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS)

.5 National Fire Protection Association (NFPA)

.1 NFPA-90A – Latest Edition, Installation of Air Condition and Ventilating Systems

.2 NFPA 90B – Latest Edition, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems

.3 NFPA-96 - Latest Edition, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

.6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards – Metal and Flexible, 2005, 3rd Edition

.2 SMACNA HVAC Air Duct Leakage Test Manual, 2012, 2nd Edition

.3 IAQ Guideline for Occupied Buildings Under Construction 2007, 2nd Edition

.7 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Use SMACNA Seal Class “C” for all ductwork up to 500 Pa (2” w.g.) maximum operating pressure.

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant, tape or combination thereof.

.3 Class C: transverse joints and connections made air tight with gaskets, sealant, tape or combination thereof. Longitudinal seams unsealed.

2.2 SEALANT

.1 Sealant: water-based, polymer type flame resistant duct sealant. Temperature range of minus 5 degrees C to plus 93 degrees C (minus 23 degrees F to plus 200 degrees F).

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows.

.1 Rectangular: standard radius or short radius with single thickness turning vanes.

.2 Round: five piece. Centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400 mm: with single thickness turning vanes.

.2 Over 400 mm: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with radius on branch 1.5 times width of duct or 45 degrees entry on branch.

.2 Round main and branch: enter main duct at 45 degrees with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.5 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.6 Offsets:

.1 Use radiused elbows unless indicated otherwise.

.7 Obstruction deflectors: maintain full cross-sectional area.

.1 Maximum included angles: as for transitions.

2.5 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to ASHRAE or SMACNA.

.3 Joints: to ASHRAE or SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

2.6 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 00 Common Work Results for HVAC.

.1 Strap hangers: of same material as duct but one sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500 mm wide.

.2 Hanger configuration: to ASHRAE or SMACNA Standards.

.3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE or SMACNA Standards.

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
Up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.
.2 For steel joist: manufactured joist clamp.
.3 For steel beams: manufactured beam clamps.

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with NFPA 90A, NFPA 90B, ASHRAE and SMACNA Standards.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.3 Insulate strap hangers 100 mm beyond insulated duct.

.4 Support risers in accordance with ASHRAE or SMACNA Standards.

.5 Install breakaway joints in ductwork on sides of fire separation.

.6 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.7 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining where applicable.

.8 Coordinate ductwork installation with all other trades involved on this project. Optimize ceiling space in suspended ceilings and maintain maximum headroom under exposed ducts.

.9 Seal all joints in low pressure and high pressure. Apply sealant to outside of joint to manufacturer's recommendations. Bed tape into sealant and recoat with a coat of sealant. This applies to all supply, return, outdoor air and exhaust ductwork.

.10 Limit length of flex duct to 1500mm.

.11 Test all supply air and exhaust air ducts as recommended by SMACNA.

3.2 WATERTIGHT DUCTWORK

.1 Provide watertight ductwork for the following:

.1 Outdoor air intake ducts.

.2 Outside installed ducts

.3 Exhaust ducts from shower areas

.2 Form bottom surfaces of horizontal ducts without longitudinal seams. Use welded joints for bottom and sides, and seal other joints with duct sealer.

.3 Slope horizontal ductwork for drainage.

.4 Provide 6” (150 mm) deep drain pocket at base of vertical duct(s), with 1¼” (32 mm) drain connection with deep seal trap discharging to sanitary drainage system.

3.3 DUCTWORK EXPOSED TO WEATHER ELEMENTS AND BURIED DUCTWORK

.1 Apply specified waterproofing membrane over properly prepared surfaces in accordance with manufacturer’s recommendations.

3.4 HANGERS

.1 Strap hangers: install in accordance with SMACNA Standards.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with ASHRAE or SMACNA Standards.

Duct Size (mm)	Spacing (mm)
To 1500	3000
1501 and over	2500

3.5 SEALING AND TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 This section is complimentary to and supplements the requirements of Division 1. Refer to and coordinate with Division 1 requirements.

.1 23 05 00 Common Work Results for HVAC

.2 23 05 93 Testing, Adjusting and Balancing for HVAC.

.3 23 31 13.01 Metal Ducts-Low Pressure to 500 Pa.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS)

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA – HVAC Duct Construction Standards – Metal and Flexible, 95.

1.3 SUBMITTALS

.1 Submittals in accordance Section 01 01 50 – General Instructions.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 1.0 mm thick with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m².

2.3 ACCESS DOORS IN DUCTS

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene.

.4 Hardware:

.1 Up to 300 x 300 mm: two sash locks complete with safety chain.

.2 301 to 450 mm: four sash locks complete with safety chain.

.3 451 to 1000 mm: piano hinge and minimum two sash locks.

.4 Doors over 1000 mm: piano hinge and two handles operable from both sides.

.5 Hold open devices.

2.4 TURNING VANES

.1 Factory or shop fabricated single thickness and/or double thickness without trailing edge, to recommendations of SMACNA and/or as indicated.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Flexible Connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Length of connection: 100mm.

.3 Minimum distance between metal parts when system in operation: 75 mm.

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access Doors and Viewing Panels:

.1 Size:

.1 600 x 600 mm for person size entry.
.2 450 x 750 mm for servicing entry.
.3 300 x 300 mm for viewing.
.4 As indicated.

.2 Locations:

.1 Fire and smoke dampers.
.2 Control dampers.
.3 Devices requiring maintenance.
.4 Required by code.
.5 Reheat coils.
.6 Heat pumps
.7 Elsewhere as indicated.

.3 Turning vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 WORK FOR OTHER SECTIONS

.1 Install all motorized dampers, fire stats, thermostats, limit switches, sail switches, safety controls, and instrument wells required for control and alarm systems. Coordinate this work with Controls Coordinator.

.2 Smoke detectors are to be installed inside ductwork where required by National Building Code that serve more than one level of the building, and other systems that are required to be shut down by the fire alarm system. The smoke detectors will be supplied and installed by Electrical Contractor, with the assistance of Mechanical Contractor regarding exact locations, access doors, etc. Smoke detectors will be generally positioned in the duct on the discharge side of the supply air fan, and for systems on 15,000 cfm capacity and above, a second detector will be installed in the return air duct or plenum at each floor level. The smoke detectors are to be located where air flow is representative and stable, i.e. in straight lengths of ducts away from bends and fittings, and away from corners at the top or sides of the duct. Detectors may be mounted inside the ductwork, or mounted outside with sampling tubes penetrating the side of the duct, installed in accordance with manufacturer's recommendations.

.3 Provide pitot tube closures for TAB work. TAB contractor to locate closures to be installed by sheet metal contractor. Also install closures adjacent to all BMS duct mounted sensors.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 This section is complimentary to and supplements the requirements of Division 1. Refer to and coordinate with Division 1 requirements.

.1 23 05 00 Common Work Results for HVAC.

.2 23 05 93 Testing, Adjusting and Balancing for HVAC.

.3 23 31 13.01 Metal Ducts-Low Pressure to 500 Pa.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA):

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-1985.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 1 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Indicate the following:

.1 Frame and blade material.

.2 Bearings.

.3 Adjustment quadrant.

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

.1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside bronze end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

2.3 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

.3 Maximum blade height: 150 mm.

.4 Bearings: pin in bronze bushings.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

.7 Maximum leakage: 21 L/s/m^2 at 1000 Pa.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems, as required.

.4 Where integral dampers are specified for registers and grilles, also provide a separate balancing damper on the branch ducts.

.5 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.6 Dampers: vibration free.

.7 Ensure damper operators are observable and accessible.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 This section is complimentary to and supplements the requirements of Division 1. Refer to and coordinate with Division 1 requirements.

.1	23 05 00	Common Work Results for HVAC.
.2	23 05 93	Testing, Adjusting and Balancing HVAC.
.3	23 31 13.01	Metal Ducts-Low Pressure to 500 Pa.
.4	23 33 00	Air Duct Accessories.
.5	25 30 02	EMCS Field Control Devices.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM):

.1 ASTM A635/A635M-09b – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 1 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Indicate the following:

.1 Performance data.

.2 Leakage test data pressure drop at listed airflow.

Part 2 Products

2.1 MULTI-LEAF DAMPERS

.1 Opposed and/or parallel blade type as indicated.

.2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Performance:

.1 Leakage: in closed position less than 3cfm/ft^2 of rated air flow at 250 Pa differential across damper.

.6 Aluminum dampers:

.1 Provide for outside air and exhaust air systems.

.2 Blades and Frames: constructed from aluminum extrusions with internal hollows.

.7 Actuators by EMCS Contractor.

.8 Insulated blades for outside air dampers.

2.2 BACK DRAFT DAMPERS

.1 Automatic gravity operated, multi and single leaf, aluminum construction with nylon bearings, centre pivoted, spring assisted or counterweighted, as indicated.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.5 Ensure dampers are observable and accessible.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 This section is complimentary to and supplements the requirements of Division 1. Refer to and coordinate with Division 1 requirements.

.1	23 05 00	Common Work Results for HVAC.
.2	23 31 13.01	Metal Ducts-Low Pressure to 500 Pa.
.3	23 33 00	Air Duct Accessories.

1.2 REFERENCES

.1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA):

.1 ANSI/NFPA 90A-Latest Edition, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Material Safety Data Sheets (MSDS).

.3 Underwriters Laboratories of Canada (ULC):

.1 CAN/ULC-S112-10, Standard Method of Fire Test of Fire Damper Assemblies

.2 CAN/ULC-S112.2-07, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies

.3 ULC-S505-1974, (Latest Edition) Fusible Links for Fire Protection Service

Part 2 Products

2.1 FIRE DAMPERS

.1 Fire dampers: arrangement Type B, C, shall be listed and bear label of ULC, meet requirements of provincial fire authority and ANSI/NFPA 90A authorities having jurisdiction. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.1 Fire rating to suit the rating of the wall.

.2 Automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.

.3 Top hinged: offset single damper, round or square; multi-blade hinged or interlocking type; roll door type; guillotine type; sized to maintain full duct cross section as indicated.

.4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.

.7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.

.8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.

.9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition of floor slab depth or thickness.

.10 Unless otherwise indicated, the installation details given in SMACNA Install Fire Dampers HVAC and in manufacturer's instructions for fire dampers shall be followed.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.

.2 Maintain integrity of fire separation.

.3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.5 Co-ordinate with installer of fire stopping.

.6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.7 Install break-away joints of approved design on each side of fire separation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 This section is complimentary to and supplements the requirements of Division 1. Refer to and coordinate with Division 1 requirements.

.1 23 05 93 Testing , Adjusting and Balancing.

.2 23 33 00 Air Duct Accessories.

1.2 REFERENCES

.1 Air Conditioning and Mechanical Contractors (AMCA):

.1 AMCA Publication 99-2016, Standards Handbook

.2 AMCA 300-2008, Reverberant Room Method for Sound Testing of Fans

.3 AMCA 301-2014, Methods for Calculating Fan Sound Ratings from Laboratory Test Data

.2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME):

.1 ANSI/AMCA 210-2016, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Material Safety Data Sheets (MSDS).

.4 Underwriters Laboratories

.1 UL 793-2008, Standard for Automatically Operated Roof Vents for Smoke and Heat

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.2 Capacity: flow rate, total or static pressure, bhp or W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.

.4 Sound ratings: comply with AMCA 301, tested to AMCA 300. Supply unit with AMCA certified sound rating seal.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210. Supply unit with AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

Part 2 Products

2.1 FANS GENERAL

.1 Motors:

.1 In accordance with Section 22 05 13 - Motors Requirements for HVAC Equipment supplemented as specified herein.

.2 For use with variable speed controllers.

.3 . Sizes as indicated or specified.

.2 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet and or outlet safety screens as indicated and as specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

.3 Factory primed before assembly in colour standard to manufacturer.

.4 Scroll casing drains: as indicated.

.5 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.6 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

.7 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

2.2 CENTRIFUGAL FANS

.1 Fan wheels:

.1 Welded steel or aluminum construction as indicated.

.2 Maximum operating speed of centrifugal fans not more than 40% of first critical speed.

.3 Air foil, forward curved or backward inclined blades, as indicated.

.2 Bearings: heavy duty, split pillow-block, or flange mounted grease lubricated ball or roller self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 200,000 hours.

.3 Housings:

.1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, cast iron, steel, or aluminum, for smaller wheels, braced, and with welded supports.

.2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.

.3 Provide bolted or latched airtight access doors with handles.

.4 Mounted by fan manufacturer.

2.3 CABINET FANS - GENERAL PURPOSE

.1 See Section 23 73 11 - Air Handling Units.

.2 Fan characteristics and construction: as centrifugal fans.

.3 Casing: floor mounted or cabinet hung single or multiple wheel with DWDI centrifugal fans in factory fabricated casing complete with vibration isolators and seismic control measures, motor, variable speed where indicated, V-belt drive and guard inside or outside casing where indicated.

.4 Fabricate casing of zinc coated or phosphate treated steel of thickness as indicated reinforced and braced for rigidity. Provide removable panels for access to interior. Paint uncoated, steel parts with corrosion resistant paint. Finish inside and out, over prime coat, with rust resistant enamel. Internally line cabinet with 50 mm thick rigid acoustic insulation, pinned and cemented, provide perforated metal liner, complete with metal nosings on exposed edges where indicated.

2.4 UTILITY SETS

.1 Characteristics and construction: for centrifugal fans.

.2 Preassemble single width centrifugal fan with removable weatherproof protective hood with vents, and automatic spring loaded back draft dampers and 12 mm mesh birdscreens.

.3 Provide belt driven sets with adjustable motor bed plate and variable pitch driver sheave.

2.5 IN-LINE CENTRIFUGAL FANS

.1 Characteristics and construction: as for centrifugal fan wheels, with axial flow construction and direct or belt drive.

.2 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.

.2 Provide sheaves and belts required for final air balance.

.3 Bearings and extension tubes to be easily accessible.

.4 Access doors and access panels to be easily accessible.

3.3 ANCHOR BOLTS AND TEMPLATES

.1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified in section 23 05 48 – Vibration and Seismic Controls for Ductwork, Piping and Equipment.

3.4 CLEANING

.1 Proceed in accordance with section 01 01 50 General Instructions.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 01 50 – General Instructions.

.2 Clearly show size weight, internal and external wiring connections, and applicable certifications noted within the specification.

1.2 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 01 50 – General Instructions.

Part 2 Products

2.1 GENERAL

.1 Furnish complete variable frequency drives (VFD, VSD) utilizing pulse width modulated (PWM) design as specified herein for the motors for pumps P-3A and P-3B. All features shall be included within the VFD enclosure, unless otherwise specified. VFD enclosure shall be NEMA.1. The VFD shall be rated 600 volt ±10% and shall operate continuously without failure when connected to a three phase supply line. The VFD shall be highly reliable and rated for 250,000 hours mean time before failure (MTBF).

.2 The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL-508 certified for the building and assembly of option panels. Assembly of the option panels by a third-party panel shop is not acceptable. The appropriate UL stickers shall be applied in both the VFD and option panel, in the case where these are not contained in one panel. When these VFD's are to be located in Canada, CSA or C-UL certifications shall apply.

2.2 BASIC DESIGN

.1 The adjustable frequency drive shall produce adjustable frequency output. Drives utilizing six step technology are not acceptable. To eliminate the need for isolation transformers and/or line suppression equipment, input line reactors will be an integral part of the input section of the drive. If isolation transformers or other external suppression equipment is needed to meet this specification, the supply and additional electrical installation, shall be included as part of this work. The VFD shall have an internally mounted 5% line reactor/15% impedance reactor as a minimum to reduce input current harmonic content and provide isolation from power line transients such as utility power factor correction capacitor switching transients and to reduce RFI emissions. All associated costs for installation and wiring shall be assumed by the manufacturer for externally mounted line reactors.

.2 Line noise shall be no greater than 3% harmonic distortion and no more than a 16,400 volt-microsecond commutation notch area, in accordance with IEEE Standard 519-1992 for special applications.

.3 Manufacturer shall submit a computerized harmonics analysis of the facility electrical system based on the most recent single line diagram. Analysis shall illustrate the effect of VFD's on system harmonics. Provide input line reactors and /or line filters required to reduce the total harmonic distortion (THD) to 5% at the point of common coupling or 3% at each VFD input where the analysis has shown that the incremental effect of the addition of the VFD's would cause the THD to exceed these values as per IEEE 519-1992. Submit shop drawings.

.4 The VFD shall be capable of starting into a rotating load (forward or reverse) and accelerating to setpoint without tripping or damaging components.

.5 The VFD shall have five programmable critical frequency lockout ranges to prevent the VFD from operating at an unstable speed.

.6 The VFD shall have an intelligent motor overload feature to protect the motor at different operating speeds and loads. The VFD shall provide electronic motor overload protection qualified per UL508C.

.7 The VFD shall protect against a stalled motor. The stall frequency/time shall be programmable.

.8 Where the unit and internal components are to be installed within a dusty environment or air plenum, the unit shall be enclosed within a NEMA 12 enclosure.

.9 The output current rating of the VFD shall match or exceed the motor nameplate full load current rating.

2.3 LOCAL/HAND CONTROL PANEL

.1 Each VFD shall be equipped with a front mounted plug-in control panel consisting of 4 lines by 20 characters back lit alphanumeric display and a key pad. The control panel shall include the following:

.1 Hand/Off/Auto switch

.2 Local/Remote switch

.3 Manual speed control

.4 Meter function selector

.2 The control panel shall include a back lit LCD meter that will display % speed, % load, or output voltage. The desired display is selected by a pushbutton. The following drive status indicator displays shall be included on the control panel. Faults shall be displayed in plain English.

.1 Power ON

.2 Ready

.3 Run

.4 Running at commanded speed

.5 Reverse

.6 Fault

.7 Overload

.8 Phase loss

.9 Overtemperature

.10 Overcurrent

.11 Undervoltage

.12 Overvoltage

.13 Ground fault

.14 External fault

2.4 INTERNAL ADJUSTMENTS

.1 All adjustments noted below should be programmable only. Potentiometers and DIP switches are not acceptable.

.1 Minimum speed adjustment

.2 Maximum speed adjustment

.3 Gain and offset adjustments for signal follower

.4 Overload

.5 Current limit

.2 In addition, the drive shall be programmable to control the following functions from the local/hand control panel.

.1 Acceleration time - programmable from approximately 3 to 280 seconds.

.2 Deceleration time - programmable form approximately 3 to 280 seconds.

.3 Fault counter reset - to limit fault reset attempts to 7, the fault counter reset is turned on.

.4 Variable overload - to protect motor form excess current at low speeds.

.5 Individually selectable resetable fault control - automatic functioning of the fault counter reset can be allowed or denied for ground fault, overvoltage fault, undervoltage fault, overcurrent fault, and phase-loss fault.

.6 Follower selection.

.7 Deceleration control or coast-to-rest.

.8 Reverse rotation.

.9 Output frequency - 50 to 60 Hz.

.10 Output voltages.

.11 Provide at least storage for 4 parameter sets.

.12 Speed Control functions include:

.1 Adjustment min/max speed.

.2 Three preset speeds.

.3 At least two sets of critical speed lockouts.

.4 At least 1 PID control loop.

.5 Three analog inputs.

.13 Output control functions:

.1 Flux optimization or automatic voltage optimization to limit audible motor noise.

.2 Current and torque limit.

.3 Torque regulated operating mode.

2.5 INTERNAL INDICATORS

.1 The key pad is to be used for troubleshooting.

2.6 SERVICE CONDITIONS

.1 Elevation to 3,300 ft. without derating.

.2 Ambient temperature 14 to 104°F.

.3 Humidity to 95% non-condensing.

2.7 FEATURES

.1 Control interface inputs/outputs. Supply as standard all independently programmable:

.1 Three analog inputs, one 0-10v and two 4-20ma.

.2 Six discrete inputs.

.3 Two analog outputs.

.4 Relay contact outputs as required.

.2 In addition to the start/stop and variable speed features in the drive, the following protective functions shall be supplied as standard:

.1 A minimum of 5 most recent fault messages shall be stored in the drives fault history.

.2 The VFD shall include MOV's for phase to phase to ground line voltage transient protection.

.3 Output short circuit and ground fault protection rated for 65,000 amps per UL508C without relying on fuses.

.4 Electronic motor overload protection per UL508C.

.5 AC line or DC bus over voltage and under voltage.

.6 Power loss ride through.

.7 Stall protection shall be programmable.

.8 Underload protection shall be programmable.

.9 VFD overtemperature protection.

.10 Input terminals for motor thermistor (PTC type).

.11 Input disconnect switch.

2.8 SPECIAL FEATURES

.1 The following special features shall be included in the VFD enclosure. The unit shall maintain its UL Listing.

.2 Provide a manual 3-contactor bypass consisting of a door interlocked main fused disconnect padlockable in the off position, a built-in motor starter and a four position DRIVE/OFF/BYPASS/TEST switch controlling three contactors. In the DRIVE position, the motor is operated at an adjustable speed from the VFD. In the OFF position, the motor and VFD are disconnected. In the BYPASS position, the motor is operated at full speed from the AC power line and power is disconnected from the VFD so that service can be performed. In the TEST position, the motor is operated at full speed from the AC line power while power is applied to the input of the VFD. This allows the VFD to be given an operational test while continuing to run the motor at full speed in the bypass. In case of an external safety fault, a customer supplied normally closed dry contact shall be able to stop the motor whether in the DRIVE or BYPASS mode. The bypass circuitry shall be mounted in a separate section of the VFD enclosure. Motor overload protection shall be provided in both drive and bypass modes.

.3 The design shall provide for short circuit and locked rotor protection for the motor in both the line and drive position.

.4 Provide interlock feature to a thermistor installed in the motor.

.5 Long motor leads can produce high peak voltages at the motor contributing to motor stress. This should be avoided. If it is not possible to avoid long motor leads, a motor which meets NEMA MG-1, part 31, and an LC filters should be used. In addition, if the motor lead length is longer than 500' and LC filter shall be used. For multiple motor installations, the length of all the motor leads must be added. The LC filter is necessary to reduce the capacitive earth leakage currents as well as the peak voltage as the motor.

2.9 BAS INTERFACE

.1 Provide the following BAS interface capability:

.1 System ON/OFF.

.2 System Status.

.3 4 - 20 mA input for speed signal.

.2 All diagnostic warning and fault information shall be transmitted over the communications bus and be available for alarm reporting at the operator’s workstation.

Part 3 Execution

3.1 INSTALLATION

.1 Mount drive so that operating controls/display are at about 1500mm" above floor, unless otherwise approved by the Departmental Representative.

3.2 START-UP SERVICE

.1 The manufacturer shall provide start-up commissioning of the variable frequency drive and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. The commissioning personnel shall be the same personnel that will provide the factory service and warranty repairs at the customer's site. Sales personnel and other agents who are not factory certified technicians for drive field repair shall not be acceptable as commissioning agents.

.2 Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system. Included in this service shall be (as a minimum):

.3 Verification of contractor wire terminations to the VFD and its operational circuitry.

.4 Installation verification for proper operation and reliability of the VFD, the motor being driven, and the building automation system.

.5 Up to eight hours of customer operator training on operation and service diagnostics at the time of the equipment commissioning. This is a requirement for substantial completion.

.1 Motor voltage and frequency. Verification of proper motor operation.

.2 Control input for proper building automation system interface and control calibration.

.3 Calibration check for the following setpoints (and adjustment as necessary) (1) minimum speed, (2) maximum speed, (3) acceleration and deceleration rates.

3.3 WARRANTY

.1 The VFD shall be warranted by the manufacturer for a period of 36 months from date of shipment. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service.

.2 The motor(s) which are directly connected to the VFD shall be warranted by the VFD manufacturer against insulation breakdown which is directly attributed to the VFD for the same 36 month period. The motor should be rated inverter duty as per NEMA MG1 part 31.

3.4 EXAMINATION

.1 Contractor to verify that job site conditions for installation meet factory recommended and code required conditions for VFD installation prior to start-up. These shall include as a minimum:

.1 Clearance spacing.

.2 Temperature, contamination, dust, and moisture of the environment.

.3 Separate conduit installation of the motor wiring, power wiring, and control wiring.

.4 Installation per the manufacturer's recommendations.

.2 The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.

3.5 COMMISSIONING

.1 Submit the start-up report to the Commissioning Agent. Assist the Commissioning Agent in performing verification testing. Include all time required in the tendered price to assist the commissioning agent.

.2 In accordance with section 01 91 00 – Commissioning and section 23 08 00 – Mechanical Commissioning.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 This section is complimentary to and supplements the requirements of Division 1. Refer to and coordinate with Division 1 requirements.

.1	23 05 00	Common Work Results HVAC
.2	23 05 93	TAB for HVAC
.3	23 31 13.01	Metal Ducts - Low Pressure to 500 Pa.

Part 2 Products

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Frames:

- .1 Full perimeter gaskets.
- .2 Plaster frames where set into plaster or gypsum board and as specified.
- .3 Concealed fasteners.

.3 Colour: as indicated.

2.2 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.3 SUPPLY GRILLES AND REGISTERS

.1 Refer to Grilles and Diffuser schedule on drawings.

2.4 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 Refer to Grilles and Diffuser schedule on drawings.

2.5 DIFFUSERS

.1 General: flow straightening devices, blank-off quadrants and gaskets as indicated.

.2 Refer to Grilles and Diffusers schedule on drawings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install with flat head screws in countersunk holes where fastenings are visible.

.3 Fit frames tightly to prevent leakage and smudging, and to completely cover openings.

.4 Furnish mounting frames to suit construction finish schedule, with concealed fastenings.

.5 Install grilles plumb with building lines, in alignment where several grilles occur in line, and centrally in ceiling tiles unless otherwise indicated.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 This section is complimentary to and supplements the requirements of Division 1. Refer to and coordinate with Division 1 requirements.

.1 23 05 00 Common Work Results for HVAC.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM E90-09 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

.2 ASTM E331-00 (R2009) – Latest Edition, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtains Walls by Uniform Static Air Pressure Difference

.3 ASTM E547-00 (R2009) – Latest Edition, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtains Walls by Cyclic Static Air Pressure Difference

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 National Fire Protection Association (SNFPA)

.1 NFPA-96 - Latest Edition, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

PART 2 Products

2.1 GRAVITY ROOF OUTSIDE AIR INTAKE AND RELIEF VENTS

.1 Factory manufactured galvanized steel.

.1 Complete with integral bird screen 2.7 mm diameter SS wire.

.2 Vertical backdraft damper on four tow faces.

2.2 FIXED LOUVERS - ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Color: As specified by Departmental Representative.

.3 Material: extruded aluminum alloy 6063 T5.

.4 Blade: drainable pattern and maximum blade length of 1500 mm.

.5 Frame, head, sill and jamb: 150 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.

.6 Mullions: at 1500 mm maximum centres.

.7 Fastenings: stainless steel SAE 194 8F with SAE 194 SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.8 Screen: 12 mm exhaust 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U frame.

.9 Finish: anodized.

2.3 ROOF CURBS

.1 Factory made insulated roof curbs to be provided by manufacturer of equipment they are intended to support, where indicated. Refer to HVAC, Fan, etc. specifications for details.

PART 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 In accordance with manufacturer's and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

3.3 ROOF CURBS

.1 Place and centre the roof curb over the opening.

.2 Secure curb to roof using a minimum of three lag screws, anchor bolts, or suitable fasteners per side, and two in each corner.

.3 Flashing to extend at least 4” (100 mm) beyond the flanges on the roof curb, and extend over the top frame.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 22 05 01 – Common Work Results for Plumbing & HVAC.

1.2 FILTRATION MEDIA REQUIREMENTS

.1 Air filter MERV (minimum efficiency reporting value) ratings shall be determined by ASHRAE 52.2-1999.

.2 HVAC systems operated during construction must use minimum MERV-8 rating

.3 After all construction and final cleaning work is complete, install new MERV-13 filters in all HVAC systems prior to building flush-out, IAQ testing or occupancy.

.4 Submit all filter cut sheets to Engineer for review prior to installing in building or turning on any HVAC system using the new filter.

1.3 ENERGY EFFICIENCY

.1 Minimum energy efficiency requirements are required. Additional requirements may be included in this specification or elsewhere in the documents. The more stringent energy efficiency requirement noted in this section or elsewhere governs.

.1 Fan design brake horsepower: indicate in shop drawings and comply with ASHRAE 90.1-2012.

1.4 REFERENCES

.1 Air Movement and Control Association

.1 AMCA 210-07 – Laboratory Methods of Testing Fans for Aerodynamic Performance

.2 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)

.1 ANSI/ARI 430-2009 - Central-Station Air-Handling Units

.3 American Society of Heating, Refrigeration and Air Condition Engineers (ASHRAE)

.1 ASHRAE 90.1-2010 – Latest Edition, Standard 90.1-2010 (I-P Edition) -- Energy Standard for Buildings Except Low-Rise Residential Buildings

.2 ASHRAE 52.2-2012 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI Approved)

.4 American Standard for Testing and Materials

.1 ASTM D-570-98 (2010) – Standard Test Method for Water Absorption of Plastics

.2 ASTM D-638-10 – Standard Test Method for Tensile Properties of Plastics

.3 ASTM D-751-06 (2011) – Standard Test Methods for Coated Fabrics

.4 ASTM D-1004-13 – Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting

.5 ASTM D-2565-99 (2008) – Standard Practice for Xenon-Arc Exposure of Plastics for Outdoor Applications

.6 ASTM D-2135-01 (2012) – Standard Specification for Molded Drain, Waste, and Vent (DWV) Short-Pattern Plastic Fittings

.7 ASTM D-1204 – Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting for Film at Elevated Temperature

.8 ASTM E-108-11 – Standard Methods for Fire Tests of Roof Coverings

.5 Canadian Standards Association

.1 CSA B52-05 (R2009) – Mechanical Refrigeration Code

PART 2 Products

2.1 HEAT RECOVERY UNIT (HRV-1)

.1 General

.1 One piece, Factory assembled components to form units supplying air at designed conditions, as indicated.

.2 Horizontal type, as indicated, having air tight modular components, consisting of casing, supply and return / exhaust fan section with motor and drive, Variable Frequency Drives and filter sections, dampers, heat recovery heat exchanger, mixing box, electric fired heating section, discharge air plenum.

.3 All equipment shall be factory assembled, pre-wired, and factory certified by an approved testing agency such as cETL, prior to shipment.

.4 Pre-wired air handling units shall bear an approved label with all the necessary identification marks, electrical data, and any necessary cautions as required by the Canadian Electrical Code.

.5 All electrical circuits shall undergo a dielectric strength test, and shall be factory tested and checked as to proper function.

.6 The air handling units and major components shall be products of manufacturers regularly engaged in the production of such equipment and with a minimum of fifteen continuous years of proven production experience.

.2 Unit Construction

.1 Unit casing shall be of minimum 1.3mm (18ga.) satin coat galvanized sheet metal. Surfaces shall be cleaned with a degreasing solvent to remove oil and metal oxides and primed with a two-part acid based etching primer. Finish coat shall be an electrostatically applied enamel, to all exposed surfaces. All unprotected metal and welds shall be factory coated.

.2 All walls, roofs and floors shall be of formed construction, with at least two breaks at each joint. Joints shall be secured by sheet metal screws or pop rivets. Wall and floor joints shall be broken in and on all outdoor units roof joints broken out (exposed) for rigidity. All joints shall be caulked with a water resistant sealant.

.3 The components shall be provided with a 0.85mm (22ga.) metal liner inside the whole unit. The liner shall be solid except for the fan section, return air section, and discharge air sections which will be perforated 0.61mm (24ga.)

.4 Units shall be provided with insulated hinged access doors with welded steel frames to the following components: fans and motors, filters, dampers and operators, access plenums, discharge air plenums, electrical control panels, burner and compressor compartments. Access doors shall be large enough for easy access. Removal of screwed wall panels will not be acceptable

.5 Internally insulate with 50mm thick 48 kg./cu.m. density acoustic insulation.

.6 Insulation shall be secured to metal panels with a fire retardant adhesive and welded steel pins at 400mm o/c secured with steel angles. All longitudinal insulation joints and butt ends shall be covered by a sheet metal break to prevent erosion of exposed edges. Drain pans and all floor areas shall be insulated on the underside.

.7 Units shall be provided with hinged access doors, with e-profile gasket, fully lined, and a minimum of two lever handles, operable from both sides for all units.

.8 In air-to-air heat reclaim units, the exhaust section drain pans shall be an integral part of the floor paneling, a minimum of 2" (51 mm) deep, with welded corners. Drain pans shall extend over the full exhaust fan plenum and be connected with a 1 ½"(38 mm) M.P.T. drain connection.

.3 Fans

.1 Centrifugal fans shall be rated in accordance with AMCA Standard Test Code, Bulletin 210. Fan manufacturer shall be a member of AMCA. All fans and fan assemblies shall be dynamically balanced during factory test run. Fan shafts shall be selected for stable operation at least 20% below the first critical RPM. Fan shafts shall be provided with a rust inhibiting coating.

.1 Fan standard of acceptance: Twin City

.2 Airfoil or B1 fan assemblies shall be equipped with greaseable roller type pillow block bearings, supported on a rigid structural steel frame.

.3 Airfoil or B1 supply fan shall be equipped with greaseable, self-aligning ball or roller type pillow block bearings.

.4 All drives shall be provided with a rust inhibiting coating. The air balancer shall provide for drive changes (if required) during the air balance procedure.

.5 Motor, fan bearings and drive assembly shall be located inside the fan plenum to minimize bearing wear and to allow for internal vibration isolation of the fan-motor assembly, where required. Motor mounting shall be adjustable to allow for variations in belt tension.

.6 Provide belt guards.

.7 Fan-motor assemblies shall be provided with standard rated vibration isolators. Fans shall incorporate vertical spring type isolators with leveling bolts, bridge bearing waffled pads with minimum 25mm static deflection designed to achieve high isolation efficiency. Fans shall be attached to the discharge panel by a polyvinyl chloride coated polyester woven fabric, with a sealed double locking fabric to metal connection.

.8 Fan motors shall be Baldor Super-E high efficiency.

.9 The supply and return/exhaust fan motors will be complete with factory mounted and wired VFD. Refer to spec section 23 34 34.

.10 Provide single extended grease line from far side to access side bearing.

.4 Electrical Heating Coils(10kw) with SCR Control

.5 Lights

.1 Provide 120 volt marine lights, 100 watt complete with metal cages, glass seals, wire guards, switch and indicator light in all sections including:

- fan section
- filter sections
- mixed air section
- coil sections
- control panel
- discharge air plenum

.2 All wiring shall be in EMT conduit terminated at a junction box complete with disconnect switch. A separate 120 volt feed shall be provided.

.6 Filters

.1 General

.1 Provide filter media, frames, seals, gaskets per NFPA and ULC codes, and controls per CSA where applicable.

.2 Use incombustible materials in fabrication of filter assembly.

.3 Provide additional filters.

.2 All Filters

.1 Where filters are subject to moisture laden air, or in systems operating on 100% outdoor air, provide filters entirely suited to the saturation condition as a normal operating condition.

.2 Refer to schedules for allowable pressure drops and filter media areas. Indicate the clean filter media pressure drop at the specified air flow quantity, together with the filter media area on shop drawings.

.3 Filter Efficiency

.1 ASHRAE Standard 52, Atmospheric dust spot efficiency. "Absolute filter" efficiency shall be tested with 0.3 micrometre dioctyl phthalate (DOP) smoke.

.2 Dust holding capacity: Air Filter Institute (AFI) Test.

.4 Prefilters

.1 Replace prefilter media used during "temporary heating" with new media at Substantial Performance.

.2 Install the new set of prefilter media at building turnover.

.3 Minimum Requirements:

- MERV 8 rating
- 50 mm thick disposable pleated cotton media, fully supported, complete with disposable frame, U.L. Class 2.

.5 Filter Retaining Frames

.1 Provide frames to suit the design of the filter manufacturer. Use corrosion resistant frames, gasketted with continuous foam seals between frames and filters and including filter retaining clips.

.2 Bolt frames together to form a filter bank. Seal air-tight with specified duct and plenum sealers.

.3 Provide necessary reinforcing for filter banks over three frames high. Brace with vertical steel stiffeners, min. 1.8 mm thick, screwed or bolted to frames, and attached to top and bottom of plenum. When bolting frames together, provide spaces between holding frames as necessary to centre filters on coils.

.4 Scope of Built-Up Frames:

.5 separate frames for each bank of filters

.6 combined frames for a final filter combination

.7 Slide-In Frames:

.8 Supply slide-in channels where noted, for filters mounted in ductwork. Provide hinged and gasketted access doors.

.9 Filter Standard of Acceptance: Farr, AAF, Cambridge.

.6 Filter bank / return air / outside air intake

.1 Filter sections shall be provided with adequately sized access doors to allow easy removal of filters. Filter removal shall be from one side as noted on the drawings.

.2 50mm filters shall slide into a formed metal track, sealing against metal spacers at each end of the track.

.3 50mm Pleated Panel Disposable Filters: An optimum blend of natural and synthetic fiber media with a rust resistant support grid and high-wet strength beverage board enclosing frame with diagonal support members bonded to the air entering and air exiting side of each pleat. Permanent re-usable metal enclosing frame. The filter media shall have a minimum efficiency of 30-35% on ASHRAE Standard 52.1-92, and a minimum of MERV 8 for prefilters and MERV 13 for final filters per ASHRAE 52.2. Rated U.L. Class 2.

.4 Filter media shall meet UL Class 2 standards.

.7 Filters

.1 Filter sections shall be provided with adequately sized access doors to allow easy removal of filters. Filter removal shall be from one side as noted on the drawings.

.2 For units with filter banks up to 72" (1825mm) high, the filter modules shall be designed to slide out of the unit. Side removal 1" (25mm) or 2" (50mm) filters shall slide into a formed metal track, sealing against metal spacers at each end of the track.

.3 For units with filter banks 73" (1854mm) high and larger, the filters shall be lift out from an access plenum upstream of the filters. Lift out 2" (50mm) filters shall fit into a horizontal track from which they are lifted up and out.

.4 2"(50mm) Pleated Panel Disposable Filters: An optimum blend of natural and synthetic fiber media with a rust resistant support grid and high-wet strength beverage board enclosing frame with diagonal support members bonded to the air entering and air exiting side of each pleat. Permanent re-usable metal enclosing frame.

.7 Air-to-Air Plate Heat Exchanger

.1 General

.1 The Air-to-Air Plate Heat Exchanger shall be the sole responsibility of the packaged Heat Recovery unit manufacturer. The manufacturer shall guarantee the performance of the heat exchanger as to its total heat transfer capacity, and its operation. Alternate reclaim devices shall meet or exceed the performance noted in the schedules, without exceeding the fan power requirements specified.

.2 Heat Transfer Media

.1 Air-to-air heat exchanger shall be an stationary aluminum flat plate type. Heat transfer surface shall be formed aluminum plates 0.008" thick with enhanced surface corrugation for increased performance. Exchanger frame profiles shall be all aluminum with coated sheet metal end plates. Unit shall be capable of operating in temperatures up to 212 °F. The entire cell shall be capable of being visibly inspected and cleaned as required.

.3 Frost Prevention

.1 Bypass openings shall be provided with integral face and bypass dampers complete with controller to keep the heat exchanger exhaust air temperature above 32°F (0°C). The dampers, controller, and damper operator are to be factory installed and tested by the manufacturer / supplier.

.8 Temperature Control

.1 An adjustable setpoint on the face of the W-Trac shall allow a selection of 52°F (11°C) to 74°F(23°C) discharge air temperature. In the heating mode, as the discharge air temperature nears the setpoint, the speed of rotation of the wheel is slowed to maintain setpoint. When the minimum speed is reached, and there is a cooling demand, the wheel will stop completely. The wheel will remain off until the outdoor air temperature exceeds the exhaust air temperature, at which time the wheel will resume operation at full RPM.

.1 The setpoint range can be reset by BMS 0-10VDC signal. With the setpoint fixed at 66°F(18.9oC), the Supply air leaving temperature will increase from 30 °F (-1.1°C) to 66°F(18.9°C) as the BMS signal increases from 0-10VDC.

.9 Variable Frequency Drives - Motor Speed Controllers (VFD)

.1 Provide VFD's in compliance with Section 23 34 34.

.10 Dampers

.1 Extrude aluminum, low leak, thermally broken, insulated blade Tamco Series 9000

.2 Mixing dampers shall be parallel blade type. Exhaust air and outside air shall be opposed blade type.

.3 Provide Belimo fully modulating damper motors for all dampers. Terminalized for control by DDC.

.11 General

.1 Submit shop drawings showing data, details, sound levels, controls, wiring.

.2 Refer to drawings for details, accessories.

.3 Unit shall be manufactured to dimensions and weights shown on the drawing.

.4 Provide start-up services, commissioning, and operator instruction.

.5 Unit Standard of Acceptance: Engineered Air.

PART 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions and datasheet.

3.2 INSTALLATION

.1 Install as per manufacturers' instructions on concrete housekeeping pads.

.2 Manufacturer to certify installation, supervise start-up, provide training and commission units.

.3 Run drain line from cooling coil condensate drain pan to drain line.

3.1 TRAINING, DEMONSTRATION, COMMISSIONING

.1 Refer to sections 01 91 00, 01 91 13 and 23 08 00.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements for building Energy Monitoring and Control System (EMCS) that are common to NMS EMCS Sections.

.2 Related Sections:

.1 Section 01 01 50 – General Instructions.

.2 All sections of Division 23

.3 The existing facility is equipped with a BACnet-based Delta Controls (By ESC Automation) DDC system. All newly added software, graphics and hardware required for proper operation of existing and new equipment shall be fully compatible with the existing system. Responsibility for any subsequent failures of the existing system being modified by this contractor will rest solely with this contractor for the duration of the contract.

.4 All new DDC controllers shall be BACnet, controlled and programmable from the existing Delta frontend. Provide software and graphics upgrade complete with full documentation for software and equipment.

.5 Provide, install, calibrate, program and commission the DDC control system to achieve the performance specified in the following clauses. Refer to Section 01 01 50-General Instructions for requirements including scheduling and phasing responsibilities by the contractors including sub-contractors.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).

.1 ANSI/ISA 5.5- 1985, Graphic Symbols for Process Displays.

.2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).

.1 ANSI/IEEE 260.1- 1993, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

.3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.1 ASHRAE STD 135- R2001, BACNET - Data Communication Protocol for Building Automation and Control Network.

.4 Canadian Standards Association (CSA International).

.1 CAN/CSA-Z234.1- 89(R1995), Canadian Metric Practice Guide.

.5 Consumer Electronics Association (CEA).

.1 CEA-709.1- B-2002, Control Network Protocol Specification.

.6 Department of Justice Canada (Jus).

.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.7 Electrical and Electronic Manufacturers Association (EEMAC).

.1 EEMAC 2Y-1- 1958 , Light Gray Colour for Indoor Switch Gear.

.8 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.9 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 ACRONYMS AND ABBREVIATIONS

.1 Acronyms used in EMCS:

.1 AEL - Average Effectiveness Level.

.2 AI - Analog Input.

.3 AIT - Agreement on International Trade.

.4 AO - Analog Output.

.5 BACnet - Building Automation and Control Network.

.6 BC(s) - Building Controller(s).

.7 BECC - Building Environmental Control Center.

.8 CAD - Computer Aided Design.

.9 CDL - Control Description Logic.

.10 CDS - Control Design Schematic.

.11 COSV - Change of State or Value.

.12 CPU - Central Processing Unit.

.13 DI - Digital Input.

.14 DO - Digital Output.

.15 DP - Differential Pressure.

.16 ECU - Equipment Control Unit.

.17 EMCS - Energy Monitoring and Control System.

.18 HVAC - Heating, Ventilation, Air Conditioning.

.19 IDE - Interface Device Equipment.

.20 I/O - Input/Output.

.21 ISA - Industry Standard Architecture.

.22 LAN - Local Area Network.

.23 LCU - Local Control Unit.

.24 MCU - Master Control Unit.

.25 NAFTA - North American Free Trade Agreement.

.26 NC - Normally Closed.

.27 NO - Normally Open.

.28 OS - Operating System.

.29 O&M - Operation and Maintenance.

.30 OWS - Operator Work Station.

.31 PC - Personal Computer.

.32 PCI - Peripheral Control Interface.

.33 PCMCIA - Personal Computer Micro-Card Interface Adapter.

.34 PID - Proportional, Integral and Derivative.

.35 RAM - Random Access Memory.

.36 SP - Static Pressure.

.37 ROM - Read Only Memory.

.38 TCU - Terminal Control Unit.

.39 USB - Universal Serial Bus.

.40 UPS - Uninterruptible Power Supply.

.41 VAV - Variable Air Volume.

1.4 DEFINITIONS

.1 Point: may be logical or physical.

.1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.

.2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and valve or damper actuators.

.2 Point Object Type: points fall into following object types:

.1 AI (analog input).

.2 AO (analog output).

.3 DI (digital input).

.4 DO (digital output).

.3 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.

.1 Printouts: to ANSI/IEEE 260.1.

1.5 SYSTEM DESCRIPTION

.1 Refer to existing control system documents.

.2 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:

.1 Building Controllers.

.2 Control devices as listed in I/O point summary tables.

.3 Data communications equipment necessary to effect EMCS data transmission system.

.4 Field control devices.

.5 Software/Hardware complete with full documentation.

.6 Complete operating and maintenance manuals.

.7 Training of personnel.

.8 Acceptance tests, technical support during commissioning, full documentation.

.9 Wiring interface co-ordination of equipment supplied by others.

.10 Miscellaneous work as specified in these sections and as indicated.

.11 Removal of existing pneumatic controls components and tubing which are being replaced / upgraded to DDC and no longer be required for service.

.12 Retain an electrical sub-contractor to provide electrical work as covered in Division 26 as an integral part of the Division 25 sub-contract. Refer to Division 26 documents and coordinate scope with Division 26 sub-contractor.

.13 Line voltage power required for controls from dedicated circuits determined on site by Controls Contractor.

.14 Reinstate all existing fire alarm / smoke detectors interlocks with air handling equipment.

.15 Balancing work as required to setup the DDC systems and to match existing operating conditions.

.16 Firestopping for new penetrations through existing fire rated assemblies. Refer to Section 07 84 00 – Fire Stopping.

.3 Design Requirements:

.1 Design and provide conduit and wiring linking elements of system.

.2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by Departmental Representative prior to installation.

.3 Location of controllers as reviewed by Departmental Representative prior to installation.

.4 Provide utility power to EMCS as required.

.5 Metric references: in accordance with CAN/CSA Z234.1.

.4 Language Operating Requirements:

.1 Provide English operator selectable access codes.

.2 Use non-linguistic symbols for displays on graphic terminals.

.3 Operating system executive: provide primary hardware-to-software interface specified as part of hardware purchase with associated documentation to be in English.

.4 System manager software: include in English system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.

.5 Include, in English:

.1 Input and output commands and messages from operator-initiated functions and field related changes and alarms as defined in CDL's or assigned limits (i.e. commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-definements).

.2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points. To be in English at specified OWS and to be able to operate one terminal in English and second in French. Point name expansions in both languages.

.3 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.

1.6 SUBMITTALS

.1 Make submittals in accordance with Section 01 01 50 – General Instructions.and 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

.2 Quality Control:

.1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.

.2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.

.3 Submit proof of compliance to specified standards with shop drawings and product data. Label or listing of specified organization is acceptable evidence.

.4 In lieu of such evidence, submit certificate from testing organization, approved by Departmental Representative, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.

.5 For materials whose compliance with organizational standards/codes/specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.

.6 Permits and fees: in accordance with general conditions of contract.

.7 Submit certificate of acceptance from authority having jurisdiction to Departmental Representative.

.8 Existing devices intended for re-use: submit test report.

1.7 QUALITY ASSURANCE

.1 Have local office nearest to the project staffed by trained personnel capable of providing instruction, routine maintenance and emergency service on systems,

.2 Provide record of successful previous installations submitting tender showing experience with similar installations utilizing computer-based systems.

.3 Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.

.4 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.

.5 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.8 IDENTIFICATION, CALIBRATION AND PROGRAMMING

.1 Provide a written sequence of operation for each piece of equipment or system being controlled. Provide a print out of the complete data base, including program listings, inputs, outputs, controllers, virtual points, trend logs, alarm points, etc. Provide in an organized manner, separated for each panel.

.1 Procedures for daily operation of the system.

.2 Theory of operation of the equipment.

.3 Theory of operation of the control program.

.2 Mount an input/output layout sheet within each controller. This sheet shall include the name of the points connected to each controller channel.

.3 Identify all controllers and associated devices with symbols relating directly to the control diagram. Provide plastic labels for each input and output point with the following information:

.1 Point descriptor.

.2 Point type and channel number.

.3 Corresponding controller number.

.4 Program each controller immediately following installation. Setup and tune all control loops during the initial start-up of the systems. Submit a well-documented print out of the controller program for review.

.5 At the time of the Owner's Demonstration and Instruction Period:

.1 Demonstrate and confirm that all systems are programmed and operating correctly. Submit trend logs, 1 week in duration, that confirm systems are operating as designed and follow the internal building loads in an energy efficient manner.

.2 Submit CD's (including back-up diskettes) containing up to date copies of the programs in each controller.

.3 Submit (4) CD's with printed PDF copies of the final programs that include all point definitions, weekly and annual schedule settings, controller setpoints and tuning parameters, and documented general control language programs. (As Built control shop drawings)

.4 Provide the original software diskettes and the users' manuals for all software programs provided as part of this contract. Provide one set of original disks for each notebook, laptop, and desktop computer the software has been installed on.

.5 The controls contractor shall be responsible for registering all software with the manufacturer in the owner's name. Provide copies of the registration of all software to the Departmental Representative as part of the final inspection.

.6 Check sensor calibration and control system operation twice during the first year of operation including the first heating season and prior to the first cooling season. Include all parts and labour in service. Following each visit submit:

.1 A report indicating all work performed.

.2 Printed graphs of trend logs one week in duration with hourly samples for all analog inputs connected to each controller.

.3 Update printed and diskette copies of any changes made to programs for any controller.

.7 Provide one day of on-site instruction to the Owner's operating personnel during the first year of operation, scheduled as requested by the Owner.

Part 2 Products

2.1 EQUIPMENT

.1 Control Network Protocol and Data Communication Protocol: to ASHRAE STD 135.

.2 Complete list of equipment and materials to be used on project and forming part of tender documents by adding manufacturer's name, model number and details of materials, and submit for approval.

2.2 ADAPTORS

.1 Provide adaptors between metric and imperial components.

Part 3 Execution

3.1 MANUFACTURER'S RECOMMENDATIONS

.1 Installation: to manufacturer's recommendations.

3.2 I/O WIRING

.1 All input/output device wiring will use #18-2 solid core cable with individually jacked conductors and jacketed sheath over the pair.

.2 Use plenum rated cable where required.

.3 All I/O wiring passing near or within the enclosure of a VFD will be shielded, with the shield terminated at the device end.

.4 All I/O wiring will be identified using Panduit adhesive wire-marker at the controller and end device ends. Description of point to include point mnemonic, point type and network location.

.5 All I/O wiring within controller enclosure shall be neat and tidy and suitably bundled and strapped or contained in plastic wire duct or equivalent.

3.3 POWER WIRING

.1 Where required, provide power wiring and transformers and grounding to each controller and transducer as per the manufacturer’s specification.

.2 Each building controller will have its own dedicated power supply. No other controller or input/output device will be powered from this supply.

.3 Power wiring as per manufacturer’s specification.

3.4 ENCLOSURE AND CONDUIT

.1 Relays, transformers, and I/O devices and peripherals shall be installed in separate enclosures and not in the enclosures containing the controllers.

.2 All wires penetrating the enclosure that are not required to be in conduit must be neatly bundled and strapped in place.

.3 All Building Controllers will be installed in CSA rated enclosures that are complete with hinged and key-locked doors. The door will be painted and labeled suitably bearing the manufacturer's system name/logos, the controller address, and the installing contractor's contact information. This enclosure will be mounted at a height that provides easy access without the need of a ladder.

.4 A hard points list shall be affixed on the inside of the door/cover of the enclosure.

.5 The inside bottom of the enclosure shall be clean of dirt, metal shavings, and debris.

.6 Provide tamperproof screws to new and relocated equipment, controls enclosures and devices which are located in inmate accessible areas. Tamperproof screws shall be stainless TORX with pin.

.7 Wiring is to be in EMT conduit with set screw metal fittings in all wall spaces and exposed locations as well as in pipe chases, service spaces, attics, and crawl spaces which are entered for service access. Wiring in suspended ceiling spaces does not require conduit but shall be neatly installed parallel to building lines using bridle rings. All conduits shall be piped smoothly and neatly following building lines. Wiring above existing ceilings and wall cavities may be run free-air.

.8 Exposed conduits located in areas where inmates have access shall comply with the following security measures:

.1 Use two-hole straps.

.2 Install straps within 100mm of device boxes.

.3 Install straps within 100mm of both sides of fittings.

.4 Install straps at a maximum spacing of 500mm.

.5 All fittings steel.

.6 Keep conduit close to the wall and avoid spaces behind the conduit

.7 Route conduit along top of walls where possible.

.9 Liquid-tight flexible conduit to be used for roof mounted equipment wiring c/w liquid-tight fittings. Provide spun aluminum roof jack where control wiring penetrates roof unless penetration is within waterproof roof equipment curb.

.10 All junction boxes will have covers properly and firmly affixed after installation completion.

.11 Control panels located in occupied areas for relays or other similar field devices shall be accessible and located above corridor ceilings. For areas accessible by inmates, provide security type access panels.

3.5 CONTROL SYSTEM COMMISSIONING

.1 Upon completion of the installation of the controls system and the calibration of all sensors, this Subcontractor shall carry out all required testing, debugging, and revision of operations to suit the intent of the Sequence of Operation and to the review of the Departmental Representative.

.2 The contractor is to supply digital point and non-digital checkout data sheets for all controlled components installed in this contract, including components supplied by others. The data sheets shall indicate each components physical installation is complete, End to End, identification, tagged, the result of the functional test, calibration deviation recorded, setpoints and set-up of each device, digital and non-digital.

.3 Each digital input or control device shall be checked by physical operation of the monitored device in the field with the result noted. Each digital output or controlled device shall be commanded or tested On/Off, Open/Close as required and the corresponding field device checked for correct operation with the result and comments noted.

.4 Each analog input or control device shall have its field values measured with a calibrated test instrument, with the deviation recorded and adjusted, if necessary, at the AI set up. The field measurement and analog point deviation must be reported. A hard copy of the set up for each digital and non-digital controller with adjustments is required. Field set up and setpoints of other devices shall be reported.

.5 Each analog output, control or controlled device shall be field tested. The physical test data sheet is to indicate each controlled device function through its range 0, 25, 50, 75, 100% and 1 to 100% as required with no leakage or bypass of the controlled medium.

.6 Submit copies of all test data sheets intended to be used to the Departmental Representative and Commissioning Agent prior to the contractor's verification at least one months before the scheduled substantial completion of the project.

.7 The controls contractor shall provide sequence of operation check sheets, to the Departmental Representative and Commissioning Agent in standard letter size for each DDC and non DDC system sequence. Each sequence to be verified with each item/page signed off with comments noted.

.8 The Commissioning Agent is not to commence controls checks until the above documentation is received. The Control System Supplier and Installer shall loan a current copy of all control software/devices needed for full access to the control system, at no charge to the Commissioning Agent The software/devices shall be returned to the Control Supplier in good working order at the completion of the commissioning process, or the Commissioning Agent must reimburse the Control System Supplier for the purchase price of the material.

.9 All documentation, tagging, identification, as-builts, software, instruction manuals, special control connection to access all devices and panels must be in place before the granting of substantial performance.

.10 The Controls Contractor shall loan a current copy of all control software/devices needed for full access to the control system, at no charge to the Commissioning Agent. The software/devices shall be returned to the Controls Contractor in good working order at the completion of the commissioning process, or the Commissioning Agent must reimburse the Controls Contractor for the purchase price of the material. The Control System Supplier shall cooperate fully with the Commissioning Agent to work together to obtain a fully operating system, providing additional technicians and trades people to assist the designated commissioning person as required. Refer to Section 01 91 00 - Commissioning and Section 23 08 00 - Commissioning of Mechanical Systems.

.11 The controls contractor is to provide the technicians for field checks, calibration, checkouts, and commissioning necessary for a complete and fully operational system. Provide two 2-way portable radios for the commissioning period.

3.6 THIRD PARTY BACNET INTEGRATION

.1 Where third party systems are installed with a BACnet compatible control panel, it is the responsibility of this contractor to integrate the system into the DDC control system.

.2 The contractor shall map over BACnet points that made available in the third party panels and provide control for all BACnet points permitted by the third party panels.

.3 Integrate the third party system into the DDC sequence of operation. This includes scheduling, outdoor conditions (temperature and ambient lighting levels), alarms, and any other information required to operate, diagnose, and maintain the equipment.

.4 Provide a detailed graphical display(s) depicting the third party equipment. The graphical display(s) shall contain ALL points that were mapped over from the third party system.

3.7 PAINTING

.1 Painting: in accordance with Division 9 - Painting, supplemented and as follows:

.1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.

.2 Restore to new condition, finished surfaces too extensively damaged to be primed and touched up to make good.

.3 Clean and prime exposed hangers, racks, fastenings, and other support components.

.4 Paint unfinished equipment installed indoors.

3.8 CLEANING

.1 Proceed in accordance with Section 01 01 50 - General Instructions.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Methods and procedures for shop drawings submittals, preliminary and detailed review process including review meetings, for building Energy Monitoring and

.2 Control System (EMCS).

1.2 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 23 05 00 – Common Work Results - Mechanical.

.3 Section 26 05 00 – Common Work Results for Electrical.

.4 Section 25 05 01 - EMCS: General Requirements.

1.3 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.4 DESIGN REQUIREMENTS

.1 Preliminary Design Review: to contain following contractor and systems information.

.1 Location of local office.

.2 Description and location of installing and servicing technical staff.

.3 Location and qualifications of programming design and programming support staff.

.4 Location of spare parts stock.

.5 Names of sub-contractors and site-specific key personnel.

.6 Sketch of site-specific system architecture.

.7 Specification sheets for each item including memory provided, programming language, speed, type of data transmission.

.8 Descriptive brochures.

.9 Sample CDL and graphics (systems schematics).

.10 Response time for each type of command and report.

.11 Item-by-item statement of compliance.

1.5 PRELIMINARY SHOP DRAWING REVIEW

.1 Submit preliminary shop to include following:

.1 Specification sheets for each item. To include manufacturer's descriptive literature, manufacturer's installation recommendations, specifications, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data to establish compliance.

.2 Detailed system architecture showing all points associated with each controller.

.3 Spare point capacity of each controller by number and type.

.4 Controller locations.

.5 Auxiliary control cabinet locations.

.6 Single line diagrams showing cable routings, conduit sizes, spare conduit capacity between control centre, field controllers and systems being controlled.

.7 Valves: complete schedule listing including following information: designation, service, manufacturer, model, point ID, design flow rate, design pressure drop, required Cv, Valve size, actual Cv, spring range, pilot range, required torque, actual torque and close off pressure (required and actual).

.8 Dampers: sketches showing module assembly, interconnecting hardware, operator locations, operator spring range, pilot range, required torque, actual torque.

.9 Flow measuring stations: complete schedule listing designation, service, point ID, manufacturer, model, size, velocity at design flow rate, manufacturer, model and range of velocity transmitter.

1.6 DETAILED SHOP DRAWING REVIEW

.1 Submit detailed shop drawings after award of contract and before start of installation and include following:

.1 Corrected and updated versions (hard copy only) of submissions made during preliminary review.

.2 Wiring diagrams.

.3 Piping diagrams and hook-ups.

.4 Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others.

.5 Shop drawings for each input/output point, sensors, transmitters, showing information associated with each particular point including:

.1 Sensing element type and location.

.2 Transmitter type and range.

.3 Associated field wiring schematics, schedules and terminations.

.4 Complete Point Name Lists.

.5 Setpoints, curves or graphs and alarm limits (high and low, 3 types critical, cautionary and maintenance), signal range.

.6 Software and programming details associated with each point.

.7 Manufacturer's recommended installation instructions and procedures.

.6 Control schematics, narrative description, CDL's fully showing and describing automatic and manual procedure required to achieve proper operation of project, including under complete failure of EMCS.

.7 Graphic system schematic displays of air and water systems with point identifiers and textual description of system, and typical floor plans as specified.

.8 Complete system CDL's including companion English language explanations on same sheet but with different font and italics. CDL's to contain specified energy optimization programs.

.9 Listing and example of specified reports.

.10 Listing of time of day schedules.

.11 Mark up to-scale construction drawing to detail control room showing location of equipment and operator work space.

.12 Type and size of memory with statement of spare memory capacity.

.13 Full description of software programs provided.

.14 Sample of "Operating Instructions Manual" to be used for training purposes.

.15 Outline of proposed start-up and verification procedures.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Requirements and procedures for final control diagrams and operation and maintenance (O&M) manual, for building Energy Monitoring and Control System (EMCS) Work.

1.2 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 23 05 00 – Common Work Results - Mechanical.

.3 Section 25 05 01 - EMCS: General Requirements.

.4 Section 26 05 00 – Common Work Results for Electrical.

.5 Section 25 05 02 – EMCS: Submittals and Review Process.

1.3 DEFINITIONS

.1 BECC - Building Environmental Control Centre.

.2 OWS - Operator Work Station.

.3 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 01 50 – General Instructions, supplemented and modified by requirements of this Section.

.2 Submit Record Documents As-built drawings Operation and Maintenance Manual in English.

.3 Provide soft copies and 6 sets of hard copies in hard-back, 50 mm 3 ring, D-ring binders.

.1 Binders to be 2/3 maximum full.

.2 Provide index to full volume in each binder.

.3 Identify contents of each manual on cover and spine.

.4 Provide Table of Contents in each manual.

.5 Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

1.5 AS-BUILTS

.1 Provide 1 copy of detailed shop drawings and manuals generated in Section 25 05 02 - EMCS: Submittals and Review Process and System Architecture and include:

.1 Changes to contract documents as well as addenda and contract extras.

.2 Changes to interface wiring.

.3 Routing of conduit, wiring and control air lines associated with EMCS installation.

.4 Locations of obscure devices to be indicated on drawings.

.5 Listing of alarm messages.

.6 Panel/circuit breaker number for sources of normal/emergency power.

.7 Names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.

.8 Test procedures and reports: provide records of start-up procedures, test procedures, checkout tests and final commissioning reports.

.9 Basic system design and full documentation on system configuration.

.10 Print out of graphics.

.11 Print outs of as-built programs

.12 All commissioning documentation including sign-offs

.13 Record of training

.14 Custom design O&M Manuals (both hard and soft copy) to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.

.15 Provide 2 complete sets of hard and soft copies prior to system or equipment tests and 4 complete sets at completion of the project plus one electronic copy.

.16 Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.

.17 Functional description to include:

.1 Functional description of theory of operation.

.2 Design philosophy.

.3 Specific functions of design philosophy and system.

.4 Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.

.5 Explicit description of hardware and software functions, interfaces and requirements for components in functions and operating modes.

.6 Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented or planned for implementation in automatic mode.

.18 System operation to include:

.1 Complete step-by-step procedures for operation of system including required actions at each OWS.

.2 Operation of computer peripherals, input and output formats.

.3 Emergency, alarm and failure recovery.

.4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.

.19 Software to include:

.1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.

.2 Detailed descriptions of program requirements and capabilities.

.3 Data necessary to permit modification, relocation, reprogramming and to permit software modules to respond to changing system functional requirements without disrupting normal operation.

.4 Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device

.5 Complete program cross reference plus linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.

.6 Software for each Controller and single section referencing Controller common parameters and functions.

.20 Maintenance: document maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, controller and interface firmware's, plus diagnostics and repair/replacement of system hardware.

.21 System configuration document:

.1 Provisions and procedures for planning, implementing and recording hardware and software modifications required during operating lifetime of system.

.2 Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.

.22 Programmer control panel documentation: provide where panels are independently interfaced with BECC, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

.2 Submit for final review by Departmental Representative.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for building automation controllers including:

.1 Master Control Unit (MCU).
.2 Local Control Unit (LCU).
.3 Equipment Control Unit (ECU).
.4 Terminal Control Unit (TCU).

.2 Related sections:

.1 Section 25 05 01 - EMCS: General Requirements.

.2 Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

.3 Section 25 05 03 - EMCS: Project Record Documents.

.4 Section 25 30 02 - EMCS: Field Control Devices.

.5 Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc. (ASHRAE).

.1 ASHRAE (2015), Applications Handbook, SI Edition.

.2 Canadian Standards Association (CSA International).

.1 C22.2 No.205, Signal Equipment.

.3 Institute of Electrical and Electronics Engineers (IEEE).

.1 IEEE C37.90.1, Surge Withstand Capabilities (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus.

.4 Public Works and Government Services Canada (PWGSC)/Real Property Branch/Architectural and Engineering Services.

.1 MD13800, Energy Management and Control Systems (EMCS) Design Manual. English: ftp://ftp.pwgsc.gc.ca/rps/docentre/mechanical/me214-e.pdf

1.3 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.4 SYSTEM DESCRIPTION

.1 General: Network of controllers comprising of MCU('s), LCU('s), ECU('s) or TCU('s) to be provided as indicated in System Architecture Diagram to support building systems and associated sequence(s) of operations as detailed in these specifications.

.1 Provide sufficient controllers to meet intents and requirements of this section.

.2 Controller quantity, and point contents to be approved by Departmental Representative at time of preliminary design review.

.2 Controllers: stand-alone intelligent Control Units.

.1 Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.

.2 Incorporate communication interface ports for communication to LANs to exchange information with other Controllers.

.3 Capable of interfacing with operator interface device.

.4 Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need to interact with other controller. Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

.1 Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

1.5 DESIGN REQUIREMENTS

.1 To include:

.1 Scanning of AI and DI connected inputs for detection of change of value and processing detection of alarm conditions.

.2 Perform On-Off digital control of connected points, including resulting required states generated through programmable logic output.

.3 Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.

.4 Control of systems as described in sequence of operations.

.5 Execution of optimization routines as listed in this section.

.2 Field Termination and Interface Devices:

.1 To: CSA C22.2 No.205.

.2 Electronically interface sensors and control devices to processor unit.

.3 Include, but not be limited to, following:

.1 Programmed firmware or logic circuits to meet functional and technical requirements.

.2 Power supplies for operation of logics devices and associated field equipment.

.3 Lockable wall cabinet.

.4 Required communications equipment and wiring (if remote units).

.5 Leave controlled system in "fail-safe" mode in event of loss of communication with, or failure of, processor unit.

.6 Input Output interface to accept as minimum AI, AO, DI, DO functions as specified.

.7 Wiring terminations: use conveniently located screw type or spade lug Terminals.

.4 AI interface equipment to:

.1 Convert analog signals to digital format with 10 bit analog-to-digital resolution.

.2 Provide for following input signal types and ranges:

.1 4 - 20 mA;

.2 0 - 10 V DC;

.3 100/10,000 ohm RTD input;

.3 Meet IEEE C37.90.1 surge withstand capability.

.4 Have common mode signal rejection greater than 60 dB to 60 Hz.

.5 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.

.5 AO interface equipment:

.1 Convert digital data from controller processor to acceptable analog output signals using 8 bit digital-to-analog resolution.

.2 Provide for following output signal types and ranges:

.1 4 - 20 mA.

.2 0 - 10 V DC.

.3 Meet IEEE C37.90.1 surge withstand capability.

.6 DI interface equipment:

.1 Able to reliably detect contact change of sensed field contact and transmit condition to controller.

.2 Meet IEEE C37.90.1 surge withstand capability.

.3 Accept pulsed inputs up to 2 kHz.

.7 DO interface equipment:

.1 Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5 amps at 24 V AC.

.2 Switch up to 5 amps at 220 V AC using optional interface relay.

.3 Controllers and associated hardware and software: operate in conditions of 0 degrees C to 44 degrees C and 20 % to 90 % non-condensing RH.

.4 Controllers (MCU, LCU): mount in wall mounted cabinet with hinged, keyed-alike locked door.

.1 Provide for conduit entrance from top, bottom or sides of panel.

.2 ECUs and TCUs to be mounted in equipment enclosures or separate enclosures.

.3 Mounting details as approved by Departmental Representative for ceiling mounting.

.5 Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.

.6 Provide surge and low voltage protection for interconnecting wiring connections.

1.6 SUBMITTALS

.1 Make submittals in accordance with Section 01 01 50 – General Instructions and Section 25 05 02 - EMCS: Submittals and Review Process.

.1 Submit product data sheets for each product item proposed for this project.

1.7 MAINTENANCE PROCEDURES

.1 Provide manufacturers recommended maintenance procedures for insertion in Section 25 05 03 - EMCS: Project Record Documents.

Part 2 Products

2.1 MASTER CONTROL UNIT (MCU)

.1 General: primary function of MCU is to provide co-ordination and supervision of subordinate devices in execution of optimization routines such as demand limiting or enthalpy control.

.2 Include high speed communication LAN Port for Peer to Peer communications with OWS(s) and other MCU level devices.

.1 MCU must support existing Proprietary Protocol.

.3 MCU local I/O capacity as follows:

.1 MCU I/O points as allocated in I/O Summary Table referenced in MD13800.

.2 LCUs may be added to support system functions.

.4 Central Processing Unit (CPU).

.1 Processor to consist of minimum 16 bit microprocessor capable of supporting software to meet specified requirements.

.2 CPU idle time to be more than 30% when system configured to maximum input and output with worst case program use.

.3 Minimum addressable memory to be at manufacturer's discretion but to support at least performance and technical specifications to include but not limited to:

.1 Non-volatile EEPROM to contain operating system, executive, application, sub-routine, other configurations definition software. Tape media not acceptable.

.2 Battery backed (72 hour minimum capacity) RAM (to reduce the need to reload operating data in event of power failure) to contain CDLs, application parameters, operating data or software that is required to be modifiable from operational standpoint such as schedules, setpoints, alarm limits, PID constants and CDL and hence modifiable on-line through operator panel or remote operator's interface. RAM to be downline loadable from OWS.

.4 Include uninterruptible clock accurate to plus or minus 5 secs/month, capable of deriving year/month/day/hour/minute/second, with rechargeable batteries for minimum 72 hour operation in event of power failure.

2.2 LOCAL CONTROL UNIT (LCU)

.1 Provide multiple control functions for typical built-up and package HVAC systems, hydronic systems and electrical systems.

.2 Minimum of 16 I/O points of which minimum be 4 AOs, 4 AIs, 4 DIs, 4 DOs.

.3 Points integral to one Building System to be resident on only one controller.

.4 Microprocessor capable of supporting necessary software and hardware to meet specified requirements as listed in previous MCU article with following additions:

.1 Include minimum 2 interface ports for connection of local computer terminal.

.2 Design so that shorts, opens or grounds on input or output will not interfere with other input or output signals.

.3 Physically separate line voltage (70V and over) circuits from DC logic circuits to permit maintenance on either circuit with minimum hazards to technician and equipment.

.4 Include power supplies for operation of LCU and associated field equipment.

.5 In event of loss of communications with, or failure of, MCU, LCU to continue to perform control. Controllers that use defaults or fail to open or close positions not acceptable.

.6 Provide conveniently located screw type or spade lug terminals for field wiring.

2.3 TERMINAL/EQUIPMENT CONTROL UNIT (TCU/ECU)

.1 Microprocessor capable of supporting necessary software and hardware to meet TCU/ECU functional specifications.

.1 TCU/ECU definition to be consistent with those defined in ASHRAE HVAC Applications Handbook section 45.

.2 Controller to communicate directly with EMCS through EMCS LAN and provide access from EMCS OWS for setting occupied and unoccupied space temperature setpoints, flow setpoints, and associated alarm values, permit reading of sensor values, field control values (% open) and transmit alarm conditions to EMCS OWS.

2.4 SOFTWARE

.1 General.

.1 Include as minimum: operating system executive, communications, application programs, operator interface, and systems sequence of operation - CDL's.

.2 Include "firmware" or instructions which are programmed into ROM, EPROM, EEPROM or other non-volatile memory.

.3 Update existing initial programming of Controllers, as required for the work under this contract. Refer to Section 25 05 01 – General Requirements and 25 90 11 – Sequence of Operation.

.2 Control Description Logic (CDL):

.1 Capable of generating on-line project-specific CDLs which are software based, programmed into RAM or EEPROM and backed up to OWS. Owner must have access to these algorithms for modification or to be able to create new ones and to integrate these into CDLs on BC(s) from OWS.

.2 Write CDL in high level language that allows algorithms and interlocking programs to be written simply and clearly. Use parameters entered into system (e.g. setpoints) to determine operation of algorithm. Operator to be able to alter operating parameters on-line from OWS and BC(s) to tune control loops.

.3 Perform changes to CDL on-line.

.4 Control logic to have access to values or status of points available to controller including global or common values, allowing cascading or inter-locking control.

.5 Energy optimization routines including enthalpy control, supply temperature reset, to be LCU or MCU resident functions and form part of CDL.

.6 MCU to be able to perform following pre-tested control algorithms:

.1 Two position control.

.2 Proportional Integral and Derivative (PID) control.

.7 Control software to provide ability to define time between successive starts for each piece of equipment to reduce cycling of motors.

.8 Provide protection against excessive electrical-demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

.3 Event and Alarm management: use management by exception concept for Alarm Reporting. This is system wide requirement. This approach will insure that only principal alarms are reported to OWS. Events which occur as direct result of primary event to be suppressed by system and only events which fail to occur to be reported. Such event sequence to be identified in I/O Summary and sequence of operation. Examples of above are, operational temperature alarms limits which are exceeded when main air handler is stopped, or General Fire condition shuts air handlers down, only Fire alarm status shall be reported. Exception is, when air handler which is supposed to stop or start fails to do so under event condition.

2.5 LEVELS OF ADDRESS

.1 Upon operator's request, EMCS to present status of any single 'point', 'system' or point group, entire 'area', or entire network on printer or OWS as selected by operator.

.1 Display analog values digitally to 1 place of decimals with negative sign as required.

.2 Update displayed analog values and status when new values received.

.3 Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm.

.4 Updates to be change-of-value (COV)-driven or if polled not exceeding 2 second intervals.

2.6 POINT NAME SUPPORT

.1 Maintain existing point naming convention.

Part 3 Execution

3.1 LOCATION

.1 Location of Controllers to be approved by Departmental Representative.

3.2 INSTALLATION

.1 Install Controllers in secure locking enclosures as directed by Departmental Representative.

.2 Provide necessary power from local 120V branch circuit panel for equipment. Refer to electrical drawings and coordinate with electrical contractor.

.3 Install tamper locks on breakers of circuit breaker panel.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Control devices integral to the Building Energy Monitoring and Control System EMCS: transmitters, sensors, controls, meters, switches, transducers, dampers, damper operators, valves, valve actuators, and low voltage current transformers.

Related Sections:

.1 Section 01 01 50 – General Instructions

.2 Section 25 05 01 - EMCS: General Requirements.

.3 Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

.4 Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation.

.5 Section 26 05 00 - Common Work Results - Electrical.

.6 Section 26 27 26 - Wiring Devices.

1.2 REFERENCES

.1 American National Standards Institute (ANSI).

.1 ANSI C12.7, Requirements for Watthour Meter Sockets.

.2 ANSI/IEEE C57.13, Standard Requirements for Instrument Transformers.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM B148, Standard Specification for Aluminum-Bronze Sand Castings.

.3 National Electrical Manufacturer's Association (NEMA).

.1 NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

.4 Canadian Standards Association (CSA International).

.1 CSA-C22.1, Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 Acronyms and Definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.4 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02 - EMCS: Submittals and Review Process and Section 01 01 50 – General Instructions.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions for specified equipment and devices.

1.5 EXISTING CONDITIONS

.1 Repair surfaces damaged during execution of Work to match the existing.

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer, and be compatible with the existing system.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight assembly.

.3 Operating conditions: 0 - 32 degrees C with 10 - 90% RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.

.8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

.9 Range: including temperature, humidity, pressure, as indicated in Section 25 90 01 - EMCS: Site Requirements, Applications and System Sequences of Operation.

2.2 TEMPERATURE SENSORS

.1 General: to be resistance or thermocouple type to following requirements:

.1 Thermocouples: limit to temperature range of 200 degrees C and over.

.2 RTD's: 100 or 1000 ohm at 0 degrees C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.

.3 Sensing element: hermetically sealed.

.4 Stem and tip construction: copper or type 304 stainless steel.

.5 Time constant response: less than 3 seconds to temperature change of 10 degrees C.

.6 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length 100 150mm as indicated.

.2 Room temperature sensors and display wall modules.

.1 Temperature sensing and display wall module.

.1 LCD display to show space temperature ed and temperature setpoint.

.2 Buttons for occupant selection of temperature setpoint and occupied/unoccupied mode.

.3 Jack connection for plugging in laptop personal computer for access to zone bus.

.4 Integral thermistor sensing element 10,000 ohm at 24 degrees.

.5 Accuracy 0.2 degrees C over range of 0 to 70 degrees C.

.6 Stability 0.02 degrees C drift per year.

.7 Separate mounting base for ease of installation.

.2 Room temperature sensors.

.1 Wall mounting, in slotted type covers having brushed stainless steel finish, with guard.

.2 Element 10-50mm long RTD with ceramic tube or equivalent protection or thermistor, 10,000 ohm, accuracy of plus or minus 0.2 degrees C.

.3 Outdoor air temperature sensors:

.1 Outside air type: complete with probe length 100 - 150mm long, non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13mm conduit, weatherproof construction in NEMA 4 enclosure.

2.3 TEMPERATURE TRANSMITTERS

.1 Requirements:

.1 Input circuit: to accept 3-lead, 100 or 1000 ohm at 0 degrees C, platinum resistance detector type sensors.

.2 Power supply: 24 V DC into load of 575 ohms. Power supply effect less than 0.01 degrees C per volt change.

.3 Output signal: 4 – 20 mA into 500 ohm maximum load.

.4 Input and output short circuit and open circuit protection.

.5 Output variation: less than 0.2% of full scale for supply voltage variation of plus or minus 10%.

.6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5% of full scale output.

.7 Maximum current to 100 or 1000 ohm RTD sensor: not to exceed 25 mA.

.8 Integral zero and span adjustments.

.9 Temperature effects: not to exceed plus or minus 1.0% of full scale/ 50 degrees C.

.10 Long term output drift: not to exceed 0.25% of full scale/ 6 months.

.11 Transmitter ranges: select narrowest range to suit application.

2.4 METHANE (CH4) SENSOR/TRANSMITTER

.1 Requirements:

.1 Range: 0 – 50.0ppm

.2 Electrochemical diffusion type

.3 Output: 4 -20mA or 0 – 10 VDC

.4 Explosion proof

.5 Wall or ceiling mounted

.6 Locate methane sensors on or near the ceiling.

.7 Methane sensor shall be capable of operating within relative humidity ranges of 5-90% and temperature ranges of 32°F to 100°F (O°C to 40°C). Sensor must also have optional capacity of operating within a -40°F to 140°F (-40°C to 50°C) temperature rang.

.8 Standard of Acceptance:

.1 XCD- VULCAIN explosion proof catalytic sensor OR EQUAL with audible alarm for methane.

2.5 PRESSURE TRANSDUCERS

.1 Requirements:

.1 Combined sensor and transmitter measuring pressure.

.1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.

.2 Output signal: 4 - 20 mA onto 500 ohm maximum load.

.3 Input and output short circuit and open circuit protection.

.4 Output variations: not to exceed 0.2 % of full scale output for supply voltage variations of plus or minus 10 %.

.5 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5 % of full scale output over entire range.

.6 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 degrees C.

.7 Over-pressure input protection to at least twice rated input pressure.

.8 Output short circuit and open circuit protection.

.9 Accuracy: plus or minus 1 % of Full Scale.

2.6 DIFFERENTIAL PRESSURE TRANSMITTERS

.1 Requirements:

.1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.

.2 Output signal: 4 - 20 mA into 500 ohm maximum load.

.3 Output variations: less than 0.2 % full scale for supply voltage variations of plus or minus 10 %.

.4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5 % of full scale output over entire range.

.5 Integral zero and span adjustment.

.6 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 degrees C.

.7 Over-pressure input protection to at least twice rated input pressure.

.8 Output short circuit and open circuit protection.

.9 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.

2.7 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

.1 Requirements:

.1 Internal materials: suitable for continuous contact with compressed air, water, steam, etc., as applicable.

.2 Adjustable setpoint and differential.

.3 Switch: snap action type, rated at 120V, 15 amps AC or 24 V DC as required.

.4 Switch assembly: to operate automatically and reset automatically when conditions return to normal. Over-pressure input protection to at least twice rated input pressure.

.5 Accuracy: within 2% repetitive switching.

.6 Provide switches with isolation valve and snubber, where code allows, between sensor and pressure source.

.7 Switches on steam and high temperature hot water service: provide pigtail syphon.

2.8 TEMPERATURE SWITCHES

.1 Requirements:

.1 Operate automatically. Reset automatically, except as follows:

.1 Low temperature detection: manual reset.

.2 High temperature detection: manual reset .

.2 Adjustable setpoint and differential.

.3 Accuracy: plus or minus 1 degrees C.

.4 Snap action rating: 120V, 15 amps or 24V DC as required. Switch to be DPST for hardwire and EMCS connections.

.5 Type as follows:

.1 Room: for wall mounting on standard electrical box with or without protective guard as indicated.

.2 Duct, general purpose: insertion length = half way in the air stream.

.3 Thermowell: stainless steel, with compression fitting for NPS 3/4 thermowell. Immersion length: 100 mm.

.4 Low temperature detection: continuous element with 6000 mm insertion length, duct mounting, to detect coldest temperature in any 30 mm length.

.5 Strap-on: with helical screw stainless steel clamp.

2.9 ELECTROMECHANICAL RELAYS

.1 Requirements:

.1 Double voltage, DPDT, plug-in type with termination base.

.2 Coils: rated for 120V AC or 24V DC. Other voltage: provide transformer.

.3 Contacts: rated at 5 amps at 120 V AC.

.4 Relay to have visual status indication

2.10 SOLID STATE RELAYS

.1 General:

.1 Relays to be socket or rail mounted.

.2 Relays to have LED Indicator

.3 Input and output Barrier Strips to accept 14 to 28 AWG wire.

.4 Operating temperature range to be -20 degrees C to 70 degrees C.

.5 Relays to be CSA Certified.

.6 Input/output Isolation Voltage to be 4000 VAC at 25 degrees C for 1 second maximum duration.

.7 Operational frequency range, 45 to 65 HZ.

.2 Input:

.1 Control voltage, 3 to 32 VDC.

.2 Drop out voltage, 1.2 VDC.

.3 Maximum input current to match AO (Analog Output) board.

.3 Output.

.1 AC or DC Output Model to suit application.

2.11 CURRENT TRANSDUCERS

.1 Requirements:

.2 Purpose: combined sensor/transducer, to measure line current and produce proportional signal in one of following ranges:

.1 4-20 mA DC.

.2 0-1 volt DC.

.3 0-10 volts DC.

.4 0-20 volts DC.

.3 Frequency insensitive from 10 - 80 hz.

.4 Accuracy to 0.5% full scale.

.5 Zero and span adjustments. Field adjustable range to suit motor applications.

.6 Adjustable mounting bracket to allow for secure/safe mounting inside MCC.

2.12 PANELS

.1 Wall mounted enamelled steel cabinets with hinged and key-locked front door.

.2 Multiple panels as required to handle requirements with additional space to accommodate 25% additional capacity without adding additional cabinets.

.3 Panels to be lockable with same key.

2.13 WIRING

.1 In accordance with Division 26.

.2 For wiring in concealed ceiling spaces and under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.

.3 For exposed wiring, run in EMT conduit.

.4 Wiring must be continuous without joints.

.5 Sizes:

.1 Field wiring to digital device: #18AWG.

.2 Analog input and output: shielded #18 minimum solid copper stranded twisted pair.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.

.4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.5 Fire stopping: provide space for fire stopping. Maintain fire rating integrity.

.6 Electrical:

.1 Complete installation in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.

.3 Refer to electrical control schematics included as part of control design schematics in Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation. Trace existing control wiring installation and provide updated wiring schematics including additions, deletions to control circuits for review by Departmental Representative before beginning Work.

.4 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

.5 Install communication wiring in conduit.

.1 Provide complete conduit system to link Building Controllers, field panels and OWS(s).

.2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.

.3 Maximum conduit fill not to exceed 40%.

.4 Design drawings do not show conduit layout.

.6 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Departmental Representative to review before starting Work. Wiring in mechanical rooms, wiring in service rooms and exposed wiring must be in conduit.

3.2 TEMPERATURE SENSORS

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.

.3 Outdoor installation:

.1 Protect from solar radiation and wind effects by non-corroding shields.

.2 Install in NEMA 4 enclosures.

.4 Thermowells: install for piping installations.

.1 Locate well in elbow where pipe diameter is less than well insertion length.

.2 Thermowell to restrict flow by less than 30%.

.3 Use thermal conducting paste inside wells.

3.3 PANELS

.1 Arrange for conduit and tubing entry from top, bottom or either side.

.2 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.3 Identify wiring and conduit clearly.

3.4 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES AND SENSORS

.1 Install isolation valve and snubber on sensors between sensor and pressure source where code allows.

.1 Protect sensing elements on steam and high temperature hot water service with pigtail syphon between valve and sensor.

3.5 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance in accordance with Section 01 01 50 – General Instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 25 05 01 – EMCS: General Requirements

1.2 SUMMARY

.1 Section Includes:

.1 At minimum detailed narrative description of Sequence of Operation of each system including ramping periods and reset schedules.

.1 Control Description Logic (CDL) for each system.

.2 Input/Output Point Summary Tables for each system.

.2 Allow for sequence of operation modification during commissioning.

.3 All set points shall be adjustable.

.4 General

.1 All other existing sequence of operation governing other equipment not specified in this section will remain unchanged.

.2 Control contractor shall submit within the shop drawings submittal one whole sequence of operation covering the new & existing systems.

.3 Current DDC system used in the facility is Delta Controls by ESC. Retain the same contractor for this work.

1.3 REFERENCES

.1 MD13800-September 2000, Energy Management and Control Systems (EMCS) Design Manual. English: ftp://ftp.pwgsc.gc.ca/rps/docentre/mechanical/me214-e.pdf

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 SEQUENCE OF OPERATIONS

.1 Present sequencing of operations for systems, in accordance with MD13800 - Energy Management and Control Systems (EMCS) Design Manual.

.2 Sequencing of operations for systems as follows:

3.2 ENERGY RECOVERY UNIT (HRV-1)

.1 General:

.1 The HRV-1 is a factory type which provides ventilation, heating and heat recovery to the tunnel and sump station it serves.

.2 The system consists of:

.1 Supply and exhaust fans;

.2 Normally closed outdoor air damper;

.3 Normally closed exhaust air damper;

.4 Filter sections;

.5 Electric heater

.6 Plate type air-to-air heat reclaim.

.2 Operation Description:

.1 The systems are to run according to an occupancy schedule (set to 24 hours) to provide ventilation and exhaust air from sump station.

.2 Deactivation of supply fan will stop return fan and will close outdoor air and exhaust dampers.

.3 Monitor outdoor, space, return, exhaust and supply temperatures.

.4 Monitor status of outdoor airflow monitoring systems.

.5 Monitor status of supply and exhaust fans through current sensors.

.6 Generate alarm on BAS by a low limit duct thermostat set at 4 °C. Provide auto bypass freeze stat to prevent nuisance alarms.

.7 Provide damper motors for all air dampers.

.3 Startup:

.1 Start the HRV-1 fans through the BAS system based upon a programmed occupancy schedule (24/7).

.2 Prove supply and return fan flow.

.3 Outdoor and exhaust air dampers shall start first, fans after.

.4 On Mode:

.1 Normal operation: HRV-1 shall run at minimum flow (190 l/s, 400 CFM).

.2 Upon activation on Methane gas detection system, HRV-1 shall ramp up to 100% speed (284 l/s, 600 CFM).

.3 Modulate electric heating coil through duct temperature sensor down stream of coil to maintain air temperature at 20°C (68°F)

.4 Units can be enabled/ disabled by the DDC system according to an occupancy schedule.

3.3 GAS DETECTION AND MONITORING

.1 Refer to Section 25 30 02 for Methane sensors to be provided.

.2 Refer to drawings for locations of sensors. Locate Methane sensors on or near the ceiling.

.1 The BAS shall be able to override the gas detection system thereby starting and ramping the fans to 100% speed, as required.

.2 Sequence of operation:

.1 At any time during occupied or un-occupied time schedule, upon a low level alarm of 10% LEL for CH4 respectively from a gas detector, or malfunction (fault) of gas detection system, first stage of local and BAS audible and visual alarms will be activated, outdoor and exhaust air dampers of HRV-1 shall open to 100%, and the supply and return fans shall ramp up to 100% speed until the gas levels are below alarm levels.

.2 Upon a reading of 20% LEL for CH4, second stage local and BAS audible and visual alarms will be latched activated, the red beacon installed in Tunnel above the entrance to the sump room shall the be activated for no entrance, and anybody in the sump room shall leave immediately.

.3 Upon return on gas level to below 10% LEL, the latched audible and visual alarm should be reset manually, and HRV-1 shall run at the minimum speed set point.

3.4 TRANSFER FANS SF-S3, SF-S4, SF-N5, SF-N6

.1 These fans provide ventilation to 4 wings of the tunnel. Existing fans are replaced by the same type and or the same capacity.

.2 Retain the existing sequence of operation for these fans, however, the following sequences should be available as a minimum:

.1 Units can be enabled/ disabled by the DDC system according to an occupancy schedule

.2 Monitor status of fans through current sensors.

.3 Generate alarm on BAS in case of fan failure.

3.5 DDC POINT LIST

.1 The following points list is for guidance only and shall not limit the requirements of the system or its operation. Refer to Systems Sequence Of Operations to determine the full extent of the points required.

.2 All motor driven or electrically operated mechanical equipment that are fitted with electrical current sensors shall be hard wired back to the DDC control system to provide a direct positive indication of the operating status of the equipment.

.3 All motor driven or electrically operated mechanical equipment that are not called up to be fitted with electrical current sensors shall be monitored by the DDC control system to provide indication of the equipment operating status that has been directed by the controls system.

.4 For all other functions marked by an "X" symbol in the status column, the DDC control system shall provide actual status of the operation, temperature, pressure, etc.

.5 The control points list shall be read in conjunction with this Section- Sequence of Operation. This list might not be covering all required control points

Description	DI-Points	DO-Points	AI-Points	A0-Points	Alarms & Indication			
					Hi	Lo	Fail	Stat
TRANSFER FANS SF-S3, S4, N5, N6								
Fan Start/Stop		X						X
Fan Status			X				X	X

Description	DI Points	DO Points	AI Points	AO Points	Alarms & Indication			
					Hi	Lo	Fail	Stat
HEAT RECOVERY VENTILATION UNITS HRV-1								
HRV Occupancy Enable/Disable	X							X
Supply Fan VFD	BACnet Interface to DDC							
Exhaust Fan VFD	BACnet Interface to DDC							
O/Air Intake Damper w/ End Switch	X	X					X	X
By-pass Damper		X					X	X
E/Air Intake Damper w/ End Switch	X	X					X	X
Supply Air Temperature			X		X	X		X
Electric Coil				X				X
Air Flow switch	X						X	X
Freeze stat	X					X		X

Description	DI-Points	DO-Points	AI-Points	A0-Points	Alarms & Indication			
					Hi	Lo	Fail	Stat
Gas Detection System								
First Stage Detection	X							X
HRV Exh Fan Override			X				X	X
HRV Supply Fan Override			X				X	X
Second Stage Detection	X							X

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS & SUMMARY

.1 The General Conditions, Supplements and Amendments shall govern this Section (read in conjunction with Instructions to Tenderers / Bidders). This section covers items common to all Electrical sections and is intended only to supplement the requirements of Section 01 01 50.

.2 Reference to “Electrical Divisions” shall mean all related Electrical Sections and components including Division 26 and 28 in the Master Format Specifications.

.3 Reference to “Mechanical Divisions” shall mean all related Mechanical Sections and components including Divisions 23 and 25 in the Master Format Specifications.

.4 The word "Provide" shall mean "Supply, Install and Connect" the products and services specified. "As Indicated" means that the item(s) specified are shown on the drawings.

.5 Provide materials, equipment and plant, of specified design, performance and quality; and, current models with published certified ratings for which replacement parts are readily available. Provide project management and on-site supervision to undertake administration, meet schedules, ensure timely performance, and ensure coordination, establishing orderly completion and the delivery of a fully commissioned installation.

.6 The most stringent requirements of this and other electrical sections shall govern.

.7 All work shall be in accordance with the CONTRACT Drawings and Specifications and their intents, complete with all necessary components, including those not normally shown or specified, but required for a complete installation.

.8 Provide seismic restraints for all required equipment, piping and ductwork.

.9 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Departmental Representative. Uncrate equipment, move in place and install complete; start-up and test. Include all field assembly of loosely/separately packaged accessories.

1.2 REFERENCES

.1 Install in accordance with CSA C22.1-2018 except where specified otherwise.

.2 Comply with CSA Certified Standards, and Local Authorities having jurisdiction and Electrical Bulletins in force at time of tender submission.

.3 Comply with other applicable standards.

.4 Perform work in accordance with CSA Z462- Workplace Electrical Safety and Worksafe BC.

1.3 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.4 DESIGN REQUIREMENTS

.1 Operating voltages to CAN3-C235-83.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 SCOPE OF WORK

.1 Contractor shall supply, install, commission and provide warranty for a complete and fully documented electrical system as per contract drawings and specified herein. The Work includes all hardware, and services necessary to provide fully functional, coordinated electrical system. Refer to Section 01 01 50 for hours of work.

.2 Coordinate with Mechanical Div. 25 for all the demolition and installation work. Ensure safety.

.3 Perform work to add new mechanical equipment and provide power connection from existing electrical panel.

.4 Coordinate the exact location of the mechanical equipment with mechanical drawing package.

.5 Make sure no disturbance/hazard to existing equipment. Provide a cover to protect the communication panel while working on the MCC.

.6 Coordinate the outage in fire alarm systems with the facility during construction. Provide a verification of the duct smoke detector with the integrated system once it is commissioned with the new duct works.

.7 All drawings to be read in conjunction with existing reference drawings provided with the package and other disciplines drawings.

.8 Provide Quality Management (QM) services for the following:

.1 Project construction schedule

.2 Onsite testing and inspections of new and existing equipment

.3 Re-CSA certification of existing modified equipment

.4 Quality Management plan

.9 Component subsystems of the electrical system will include, but are not limited to the following:

.1 Connect exterior mechanical equipment via a system of interior surface mounted conduit. Equipment shall be connected to an existing distribution system.

.2 Connect interior mechanical equipment via surface mounted conduit. Equipment shall be connected to an existing electrical distribution system.

.3 Provide all required motor starters, associated control wiring and local disconnect switches.

.10 Provide grounding/bonding equipment as per CEC or as indicated in the contract drawings and specifications.

.11 Provide fire stopping as required.

.12 Perform commissioning in accordance with Section 01 01 50.

.13 Provide As-built drawings and maintenance manuals.

.14 Provide seismic restraint for all electrical equipment and installations.

1.6 SUBMITTALS

.1 Submittals to be in accordance with Section 01 01 50.

.2 Submit shop drawings, product data and samples in accordance with Section 01 01 50. The submission shall be reviewed, signed and processed as described in Section 01 01 50.

.3 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.4 Where applicable, include wiring, line and schematic diagrams. Include wiring drawings or diagrams showing interconnection with work of other Sections.

.5 Content

.1 Shop drawings submitted in accordance with Section 01 01 50.

.2 Data shall be specific and technical.

.3 Identify each piece of equipment.

.4 Identify the electrical rating for each equipment.

.5 Information shall include all scheduled data.

.6 Indicate the exact proposed model number for certain equipment.

.7 Advertising literature will be rejected.

.8 The project and equipment designations shall be identified on each document.

.9 Information shall be given in S.I. units

.10 The shop drawings/product data shall include:

.1 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with all equipment weight and mounting point loads.

.2 Mounting arrangements.

.3 Detailed drawings of bases supports and anchor bolts.

.4 Control explanation and internal wiring diagrams for packaged equipment.

.5 A written description of control sequences relating to the schematic diagrams.

.6 Format

.1 Electronic copy (PDF format).

.2 Bill of Quantities for related components, identified by model number, listed on the front cover with item identification numbers.

.7 Coordination

.1 Where electrical equipment requires support or backing by other trades or mechanical connections, the shop drawings shall also be circulated through the other "services" contractor(s) prior to submission to the Departmental Representative.

.8 Keep one copy of shop drawings and product data, on site, available for reference.

.9 Quality Control: in accordance with Section 01 01 50

.1 Provide CSA certified equipment and material. Where CSA certified equipment and/or material is not available, submit such equipment and/or material to the authority having jurisdiction for special approval before delivery to site.

.2 Submit test results of installed electrical systems and instrumentation.

.3 Submit, upon completion of Work, the electrical “load balance” report.

.10 Permits and Fees:

.1 Submit to Electrical Inspection Department, Local Fire Authorities and Supply Authority the necessary number of drawings and specifications for examination and approval prior to commencement of work. Obtain all required permits and pay all fees.

.2 Arrange for inspection of all Work by the authorities having jurisdiction. On completion of the Work, furnish final unconditional certificates of approval by the inspecting authorities.

1.7 QUALITY ASSURANCE

.1 Quality Assurance in accordance with Section 01 01 50.

.2 Qualifications: Electrical Work to be carried out by qualified, licensed electricians in accordance with authorities having jurisdiction.

.1 Employees registered in apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: Determined based on training level attained and demonstration of ability to perform specific duties.

.3 Site Meetings in accordance with Section 01 01 50.

.4 Health and Safety Requirements in accordance with Section 01 01 50.

1.8 DELIVERY , STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative with schedule within 4 weeks after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and/or recycling in accordance with Section 01 01 50.

1.9 SYSTEM START-UP

.1 Refer to Section 01 01 50.

.2 Instruct the Departmental Representative and operating personnel in the operation, care and maintenance of equipment.

.3 Arrange and pay for services of manufacturer's factory service Engineer to supervise start-up of installation, check, adjust, balance and calibrate components.

.4 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

1.10 OPERATING INSTRUCTIONS

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.12 DRAWINGS AND MEASUREMENTS

.1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work and are not detailed installation drawings. Do not scale the drawings. Obtain accurate dimensions from the Structural drawings.

.2 Consult the mechanical drawings and details for exact locations of fixtures and equipment. Obtain this information from the Departmental Representative where definite locations are not indicated.

.3 Take field measurements, where equipment and material dimensions are dependent upon building dimensions.

1.13 PROJECT COORDINATION

.1 Check drawings of all trades to verify space and headroom limitations for work to be installed. Coordinate work with all trades and make changes to facilitate a satisfactory installation. Make no deviations to the design intent involving extra cost without the Departmental Representative's written approval.

.2 The drawings indicate the general location and route to be followed by the electrical services. Where details are not shown on the drawings or only shown diagrammatically, the services shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel to building lines. All services in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All electrical services shall be coordinated in elevation to ensure that they are concealed in the ceiling or structural space provided unless detailed otherwise on drawings.

.3 Work out jointly all interference problems on the site and coordinate all work before fabricating, or installing any material or equipment. Where necessary, produce interference/coordination drawings showing exact locations of electrical systems or equipment within service areas, shafts and the ceiling space. Distribute copies of the final interference/coordination drawings to the Departmental Representative and all affected parties.

.4 Contractor to read the drawings in conjunction with existing reference drawings and specifications to understand the intent of the work. Notify Departmental Representative if there is any discrepancies. No extra cost will be considered for any misunderstanding of work to be done.

.5 Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Departmental Representative of space problems before installing any material or equipment. Demonstrate to the Departmental Representative on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required.

1.14 SPRINKLER PROOF REQUIREMENTS

.1 In sprinklered rooms where electrical equipment is installed surface mounted, electrical equipment contained in these rooms to be protected by non-combustible driphoods, shields, and gasketed doors as applicable to inhibit water ingress into electrical equipment. Exposed conduits connected to equipment to utilize watertight connectors.

1.15 EQUIPMENT RESTRAINT

.1 It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

1.16 WARRANTY

.1 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the Division 01 01 50.

.2 Take note of any extended warranties specified.

.3 Furnish a written warranty stating that all work executed under this Division will be free from defects of material and workmanship for a period of one year from the date of substantial performance.

.4 Promptly investigate any electrical or control malfunction, and repair or replace all such defective work and all other damages thereby which becomes defective during the time of the warranty.

1.17 EXAMINATION

.1 A site visit before the close of tender to be communicated with the Departmental Representative. No extra cost will be considered for any misunderstanding of work to be done.

.2 Examine the documents for details of work included. Obtain a written clarification in the event of conflict within the specification, between the specifications and the drawings, or in the drawings. Obtain written clarification from the Departmental Representative if work affecting the installation is not clear. Where this is not done in advance, allow in the tender sum for providing the more costly alternative.

1.18 RESPONSIBILITIES

.1 Ensure that equipment does not transmit noise and/or vibration to other parts of the building, as a result of poor installation practice.

.2 The Drawings and Specifications complement each other and what is called for by one is binding as if called for by both. If there is any doubt as to the meaning or true intent due to a discrepancy between the Drawings and Specifications, obtain a ruling from the Departmental Representative **prior** to Tender closing. Failing this, the most expensive alternative is to be allowed for.

.3 The Contractor shall advise the Departmental Representative during the Tender period of any specified material or equipment which is either no longer available from manufacturers or whose delivery is likely to exceed the requirements of the anticipated Construction Schedule. Failure of the Contractor to perform the above shall cause the Contractor to supply, at his own expense, alternate material or equipment as selected by the Departmental Representative at a later date. Alternatively, the Contractor shall procure the specified material or equipment at his own additional expense by means of air freight or other special means of transportation.

.4 Advise the Departmental Representative of any specified equipment, material, or installation of same which appears inadequate or unsuitable or which is in violation of laws, ordinances, rules, or regulations of authorities having jurisdiction. Provide all labour and materials which are obviously necessary or reasonably implied to be necessary to complete the work as if the work was shown on the Drawings and/or described in the Specifications.

.5 Check Drawings of all trades and coordinate the installation of all material and equipment to ensure adequate space and free access and to maintain headroom limitations for all new and indicated future work. Work out jointly, with all Subcontractors on the site, solutions to interference problems. Coordinate all work before fabricating or installing any material or equipment. It is incumbent on all Subcontractors on the site to ensure that all materials and equipment fit into the allocated spaces and that all equipment can be properly inspected, serviced and replaced if and when required. Advise the Departmental Representative of space problems before fabricating or installing any material or equipment. Demonstrate to the Departmental Representative on completion of his work that all equipment and material installed by him can be properly and safely serviced and replaced. Make no deviations from the intent of the design, or any involving additional cost, without the Departmental Representative’s written direction.

.6 Where electrical work and materials are noted as being provided by the Departmental Representative/CBSA or under other Divisions of these Specifications, the responsibility for integrating, to the extent required, such work and materials into the complete installation, shall remain within Division 26.

.7 Protect equipment and material from the weather, moisture, dust and physical damage.

.8 Cover equipment openings and open ends of conduit, piping and pullboxes as work progresses. Failure to do so will result in the Trade being required to adequately clean or replace materials and equipment at no extra cost to the Departmental Representative/CBSA.

.9 Protect all existing services encountered. Obtain instructions from the Departmental Representative when existing services require relocation or modification.

.10 Refinish damaged or marred factory finish to factory finish.

.11 The specifications and drawings form an integral part of the Contract Documents. Neither the drawings nor the specifications shall be used alone. Work omitted from the drawings but mentioned or reasonably implied in the specifications, vice versa, shall be considered as properly and sufficiently specified and shall be provided. Misinterpretation of any requirement of either plans or specifications shall not relieve this Contractor of the responsibility of properly completing his trade to the approval of the Departmental Representative.

1.19 EQUIPMENT LIST

.1 Submit a completed Equipment List, showing the make of equipment and material included in the Tender, including the names of the subtrades, 10 days after the award of the Contract.

.2 The equipment list shall be a full list of materials or systems intended for installation.

1.20 PROGRESS CLAIM AND CHANGE ORDER BREAKDOWNS

.1 Ten days after the award of contract, submit detailed progress claim breakdown for each division. Items to be included but shall not be necessarily limited to the following:

.1 Site services

.2 Distribution

.3 Feeders

.4 Branch circuit wiring, conduit and boxes

.5 Wiring devices

.6 Mechanical equipment and wiring

.7 Low tension

.8 Testing and commissioning

.9 As-built drawings and maintenance manuals

.10 Mobilization; not to exceed 2% of the contract value

.2 Change order breakdowns shall include but not be necessarily limited to the following:

.1 Labour hours per unit of material or equipment to be added, deleted or altered

.2 Units of material or equipment to be added or deleted.

.3 Per unit cost of material, equipment and labour broken down by category of labour and type of material or equipment

.4 Extensions of the above to arrive at total costs

.5 Miscellaneous and identifiable charges such as re-stocking, overhead, profit, etc

1.21 PROJECT CLOSE-OUT REQUIREMENTS

.1 Refer to Section 01 01 50.

.2 Refer to detailed specifications in each section for detailed requirements. Provide the following list of required substantial completion submissions.

.1 Final electrical inspector certificate.

.2 Drafted as-built drawings.

.3 Operating and maintenance manual.

.4 Contractors letter of guarantee.

.5 Complete Demonstration of systems to Departmental Representative.

.3 Record drawings to be submitted to the Departmental Representative and all life safety systems must be operational, verified and tested and demonstrated to Departmental Representative prior to issuance of Schedule C.

1.22 SUBSTANTIAL PERFORMANCE REQUIREMENTS

.1 Before the Departmental Representative is requested to make an inspection for substantial performance of the work:

.1 Commission all systems and prove out all components, interlocks and safety devices.

.2 Submit a letter certifying that all work is complete for the intended use, operational, clean and all required submissions have been completed.

.3 A complete list of incomplete or deficient items shall be provided by the Contractor. If, in the opinion of the Departmental Representative, this list indicates the project is excessively incomplete, a substantial completion inspection will not be performed.

.2 The work will not be considered to be ready for use or substantially complete until the following requirements have been met:

.1 All reported deficiencies have been corrected.

.2 Operating and Maintenance Manuals completed.

.3 "As Built" Record Drawing ready for review.

.4 Systems Commissioning has been completed and has been verified by Departmental Representative.

.5 All demonstrations to the user have been completed.

.6 All documents required have been submitted.

.3 Letters of Assurance will not be issued until the following requirements have been met:

.1 All items listed in 1.22 above have been completed or addressed.

.2 Certificate of penetrations through separations have been sealed and labelled with certified fire stopping material.

.3 Provincial Electrical Inspection - Certificate of inspection.

.4 final inspection report.

.5 Certificate of Substantial Performance.

1.23 POWER INTERRUPTIONS

.1 Contractor shall work closely with Departmental Representative to arrange all interruptions of any portion of the existing electrical distribution systems.

.2 All interruptions to existing electrical distribution systems and shutdown of existing Panel boards in the contract shall be carried out outside normal working hours, or on weekends. Normal working hours of the Institution are considered to be 0730 to 1600 hours, Monday through Friday, except holidays.

.3 Contractor shall submit request for any power shutdown 7 working days prior to such power shutdown. Request shall indicate start time of interruption and duration of interruption. Indicate in request exactly what buildings and/or systems will be affected by the requested power shutdown.

.4 No interruptions to power shall be carried out without the approval of the Departmental Representative.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Section 01 01 50.

.2 Do verification requirements in accordance with Section 01 01 50.

2.2 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 01 01 50 and as follows.

.2 Material and equipment to be CSA certified. Where CSA certified material or equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval.

.3 Where equipment or materials are specified by technical description only, they are to be of the best commercial quality available for the intended purpose.

.4 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Provide all power and electrical system related control wiring, conduit, wire, fittings, disconnect switches, motor starters, for all mechanical equipment unless otherwise specified.

.2 Ground all motors to conduit system with separate grounding conductor in flexible conduit or bonding conductor in the flexible conduit.

.3 Connections shall be made with watertight flexible conduit with watertight connectors.

.4 Control wiring and conduit standards are specified in the Electrical Divisions. Refer to Mechanical Divisions for scope of work and particular details.

2.4 WARNING SIGNS

.1 Provide warning signs, as specified or to meet requirements of Inspection Department and Departmental Representative.

.2 Use decal signs, minimum 175 x 250 mm size.

2.5 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for copper conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify all electrical equipment including but not limited to starters, disconnects, remote ballasts and controls with nameplates and labels as follows:

.2 Nameplates:

.1 Electrical Equipment:

COMPONENT	*LABEL TYPE*	*INFORMATION*
Main distribution centre	A	Year installed and name of facility
		Name of Electrical Engineer and Electrical Contractor
Main Breaker	A	Voltage, phase, amps
Sub-distribution panel	A	Name of panels it is feeding (i.e. Panel A, Panel B)
Panelboards	B	Panel designation (i.e. Panel A, Panel B)
Terminal Cabinet	B	System and Voltage
Disconnect switches	B	Indicate equipment controlled and voltage
Starters/contactors	B	Indicate equipment controlled and voltage
Motor control centre	B	Indicate equipment controlled and voltage
Transformer	B	Transformer designation
		Circuit and Panel designation
Junction boxes, pull boxes	D	Circuit and panel designation
On/Off switches	C	If it is not obvious, then indicate area being served

COMPONENT	*LABEL TYPE*	*INFORMATION*
Fire Alarm Devices (i.e. pull stations, bell, smoke detector, end-of –line)	C	Zone number and device number in that zone (i.e. Zone 1-#3, Zone 10-#7)
Receptacles	C	Circuit/panel designation
Special receptacles	C	Circuit/panel designation and voltage, phase, amps

.2 Label Type:

	LETTER HEIGHT	*TYPE*	*COLOUR*
Label Type A	9.5 mm	Lamacoid	White lettering/black background
Label Type B	6.0 mm	Lamacoid	White lettering/black background
Label Type C	3.0 mm	Lamacoid	White lettering/black background
	LETTER HEIGHT	*TYPE*	*COLOUR*
Label Type D	3.0 mm	Adhesive label	As specified

.3 Adhesive Labels:

.1 Good quality vinyl, self-laminating label as T & B E-Z Code WSL, Dymo Letratag or Brother P-Touch equivalent printable markers. Embossed Dymo or any labels with edges and corners that are prone to lift will be rejected.

.4 Provide plastic covered typewritten panel directory with circuits and areas served and mounted on inside of door. Directory shall conform to Record Drawings.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code to CSA C22.1-18.

.4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT, CABLE AND PULLBOX IDENTIFICATION

.1 All junction boxes, pull boxes and their covers shall be painted according to the colour coding schedule.

.2 Code with 25 mm plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor and at 15 m intervals.

.3 Colour coding to be as follows unless otherwise specified:

COMPONENT	*RACEWAY AND JUNCTION BOXES*	*RECEPTACLES AND OTHER*
Normal 120/208, 240 volt	Gray	White
Normal 347/600 volt	Sand	White
Emergency 120/208, 240 volt	Green with red bands	Red
Emergency 347/600 volt	Sand with red bands	n/a
Fire Alarm	Red	Strobe (red)
Low voltage		
-switching/controls	Black	
-emergency/exit lighting	Black with red bands	
-security	Black with blue bands	Strobe (blue)
-mechanical alarms	Black with yellow bands	Strobe (amber)

2.9 FINISHES

.1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside and at least two coats of finish enamel.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original finish.

.3 Clean and prime paint exposed hangers, racks, fastenings to prevent rusting. Finish painting shall be provided by Division 09.

2.10 WIRING & CABLES – GENERAL

.1 Conductors: stranded for 12 AWG and larger. Minimum size #12 AWG.

.2 Insulation to be 1000 volt RW90XLPE (X link) for the general building wiring in conduit, unless otherwise specified.

.3 Main feeders to be conduit and insulated copper wiring unless otherwise noted on drawings. Provide ground wiring for all conduits in or below slabs. Increase conduit size as required.

.4 Conductors within cable trays shall have ‘plenum’ rated (FT6 type) outer jacket to comply with all applicable regulations and bylaws.

.5 Conductors to be colour-coded. Conductors No.10 gauge and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size No.8 gauge and larger may be colour-coded with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible. Where colour-coding tape is utilized, it shall be applied for a minimum of 50 mm at terminations, junctions and pullboxes and condulet fittings. Conductors shall not be painted.

2.11 FASTENING TO BUILDING STRUCTURE

.1 General:

.1 Do not use inserts in base material with a compressive strength less than 13.79 MPa (2000 psi).

.2 All inserts supporting conduit racks shall have a factor of safety of 5. All other inserts shall have a factor of safety of 4.

.2 Types:

.1 Cast-in-place type:

.1 Channel type - Burndy, Canadian Strut, Unistrut, Cantruss or Hilti Channel.

.2 Wedge type galvanized steel concrete insert, Grinnell Fig. 281 for up to 200 mm (8") pipe size.

.3 Universal type malleable iron body insert, Grinnell Fig. 282 for up to 200 mm (8") pipe size.

.2 Drilled, mechanical expansion type:

.1 Hilti HSL or UCAN LHL heavy duty anchor for use in concrete with compressive strength not less than 19.6 MPa (2840 psi).

.2 Hilti Kwik-Bolt or UCAN WED stud anchor for concrete. (Do not use in seismic restraint applications).

.3 Hilti HDI or UCAN IPA drop-in anchor for concrete.

.4 Hilti or UCAN Sleeve Anchor (medium and light duty) for concrete and masonry.

.5 Hilti ZBP or UCAN Zamac pin bolt (light duty) for concrete and masonry.

.3 Drilled, adhesive type:

.1 Hilti HVA or UCAN Adhesive Anchor consisting of anchor rod assembly with a capsule containing a two-component adhesive, resin and hardener.

.2 Hilti HY150 consisting of anchor rod with a 2 part adhesive system.

.3 For use in concrete housekeeping bases (in vertical downward position) where the distance to the edge of the concrete base could cause weakness if a mechanical expansion type anchor were used.

.4 Rod assemblies shall extend a minimum of 50 mm (2") into the concrete slab below the housekeeping bases.

.3 Note:

.1 All drilling for inserts shall be performed using the appropriate tool specifically designed for the particular insert. The diameter and depth of each drilled hole shall be to the exact dimensions as specified by the insert manufacturer.

.2 Refer to manufacturer's recommendations for tightening torques to be applied to inserts.

.3 Where specifically called for, drills shall include a dust vacuum system, Hilti SAV Dust Vacuum System.

.4 One hole steel straps to secure surface conduits 27 mm and smaller. Use two hole steel straps to conduits larger than 27 mm.

2.12 EQUIPMENT SUPPORTS

.1 Provide stands and supports for equipment and materials supplied.

.2 Lay out concrete bases and curbs required under Electrical Divisions. Coordinate with Concrete Divisions.

.3 Concrete bases shall be a minimum of 100 mm thick, or as noted and shall project at least 150 mm outside the equipment base, unless otherwise directed. Bases and curbs shall be keyed to the floor and incorporate reinforcing bars and/or steel mesh. Chamfer edges of bases at 45 degrees.

.4 Equipment with bedplates shall have metal wedges placed under the edges of the bedplates to raise them 25mm above the base after levelling. The wedges shall be left permanently in place. Fill the space between the bedplate and the base with non-shrink grout - Embeco or In-Pakt.

.5 Construct equipment supports of structural steel. Securely brace. Employ only welded construction. Bolt mounting plates to the structure.

.6 Support ceiling hung equipment with rod hangers and/or structural steel.

2.13 MISCELLANEOUS METAL

.1 Be responsible for all miscellaneous steel work relative to Electrical Divisions of the Specifications, including but not limited to:

.1 Support of equipment.

.2 Hanging, support, anchoring, guiding and relative work as it applies to wiring raceways and electrical equipment.

.3 Earthquake restraint devices - refer also to “Seismic Restraint” sections

.4 Bridle rings - secure to structure or steel supports.

.2 All steel work shall be primed and undercoat painted ready for finish under the related Division.

2.14 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into maintenance manual specified in Section 01 01 50 and as follows.

.2 Include in operations and maintenance data:

.1 Details of design elements, construction features, component function and maintenance requirements, to permit effective operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

.2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.

.3 Wiring and schematic diagrams.

.4 Names and addresses of local suppliers for items included in maintenance manuals.

.3 Include in the manual the following major sections:

.1 Title page (in plastic cover).

.2 Comprehensive description of the operation of the systems, including the function of each item of equipment within the system.

.3 Detailed instructions for the normal maintenance of all systems and equipment installed including procedures and frequency of operational checks and service and trouble shooting instructions.

.4 Local source of supply for each item of equipment.

.5 Wiring and control diagrams.

.6 Spare parts list.

.7 Copies of guarantees and certificates.

.8 Manufacturer's maintenance brochures and shop drawings.

.9 Test and inspection reports.

.4 Submit a draft copy to the Departmental Representative for approval thirty days prior to start up of the systems and equipment.

2.15 PROJECT RECORD DRAWINGS

.1 Refer to Section 01 01 50.

.2 During the construction period, maintain on Site a clean set of drawings and specifications marked up clearly and indelibly in red, indicating "As-Built" conditions where such conditions deviate from the original directions of the Contract Documents and indicating final installation of feeders and branch circuits.

.3 “As-Built” drawing markings shall include but shall not be limited to the following:

.1 All changes in circuiting.

.2 Size and routing of all conduits for all branch circuits including power, lighting and systems. Note that branch circuit wiring is generally not shown on Drawings. Accurately record “As-Built” drawings the size and routing of all installed raceways and cables.

.3 Number and size of conductors (#10 AWG and larger) in raceways and cables.

.4 Location of all junction boxes and pullboxes.

.5 Location of all conduits or duct stubs, installed equipment, devices and fixtures.

.6 All changes to electrical installation resulting from Addenda, Change Orders and Field Instructions.

.7 Exact location of all services left for future work.

.8 Location by accurate horizontal and vertical dimensions of the routes and terminations of all raceways and cables installed underground beyond the building.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 2018 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

.3 Comply with CSA Electrical Bulletins and Local Authorities having jurisdiction.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturers nameplates and CSA labels are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit and protruding 50 mm.

.2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.3 Install roof jacks where conduit and cables penetrate roofs. Apply sealant after installation.

.4 All cables and conduits shall be concealed in finished areas.

3.4 LOCATION OF OUTLETS

.1 Coordinate outlet locations with Architectural Drawings.

.2 Do not install outlets back-to-back or in the same stud space in wall; allow minimum 400mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm and information is given before installation.

.4 Locate disconnect devices in mechanical and elevator machine rooms on latch side of doors.

3.5 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not indicated verify before proceeding with installation. Confirm the height of devices in handicapped facilities before installation.

.3 Refer to detail on architectural drawings.

.4 In the absence of a drawing detail or drawing note, use the following:

Device	*Height*		*Comment*
Local switches	1200	48”	
Wall receptacles/data	400	12”	General
Wall receptacles/data	175	7”	Above top of counters or counter splash backs – coordinate with Architectural detail
Wall receptacles/data	1400	56”	In mechanical rooms
Panelboards			Panelboards: as required by Code or as indicated.
Fire alarm stations	1200	48”	As required by ULC S524.
Device	*Height*		*Comment*
Fire alarm bells/audio/visual	2300	90”	ULC S524 requires not less than 1800mm. In any event not closer than 50mm to the ceiling
End of line resistors	1800	72”	
Emergency Lighting (wall mounted)			150mm below ceiling or 2300mm max.

.5 Confirm mounting height with Departmental Representative prior to rough-in.

3.6 DELIVERY AND STORAGE

.1 Store all electrical equipment and devices other than conduits, fittings, boxes, and ducts in a heated and ventilated space, and protect from construction damage. Include in the tender price all costs related to such storage.

.2 Conduits, fittings, boxes, and ducts may be stored outside if properly protected against the weather.

.3 Ship and store floor mounted equipment in upright position.

.4 Ship equipment in adequate containers to assure it arrives undamaged at the site.

.5 Keep equipment doors locked. Protect equipment from damage and dust.

.6 Block moving parts when necessary to prevent damage during movement and shipment of equipment.

.7 Remove from the site, and replace with new, all materials showing evidence of damage or rust.

3.7 COORDINATION OF PROTECTIVE DEVICES

.1 Coordinate and pay for all tests specified herein including further tests as required by authorities having jurisdiction.

.2 All testing shall be performed after each system installation has been completed. Prior to commissioning, all motors, MCCs, transformers and switchgear shall be meggered for insulation integrity and the results recorded prior to the systems being put into operation.

.3 Perform the testing, adjusting, and balancing only when conditions are commensurate with actual operating conditions for the given system.

.4 Advise the Departmental Representative 48 hours in advance of each test. Carry out tests in the presence of Departmental Representative.

.5 Submit detailed printed, dated and signed test reports in duplicate to the Departmental Representative within 7 days after the completion of each test. Include all test reports in the Maintenance Manuals. Each test shall clearly indicated, in a line-by-line format, that the components (not as a group) have been tested, test results, and whether test results are within acceptable limits. Each test report shall be accompanied by a front cover sheet briefly outlining what the test report is for and clearly summarizing all items that have failed the tests. The cover sheet shall indicate names of individuals who conducted the tests and their signatures.

3.8 FIELD QUALITY CONTROL

.1 Load and Balance:

.1 Measure voltage and phase & neutral currents to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Conduct and pay for the following tests:

.1 Motors, and associated control equipment including sequenced operation of systems where applicable.

.3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.4 Reports:

.1 Provide written reports in a timely manner upon completion of the testing and load balance. Indicate test hour and date.

3.9 DEMONSTRATION

.1 Demonstrate to and instruct the Departmental Representative on operating and maintenance procedures for all electrical systems using the assistance of specialist sub-trades and manufacturer's representatives for instruction and include all costs in the tender. Systems to be demonstrated shall include, but not be limited to, the following:

.1 Routing and installation of major feeders, duct banks and manholes, grounding and cable trays.

.2 Arrange an acceptable time with the Departmental Representative and submit a program of instruction and demonstration for the Departmental Representative’s approval. Assume that the Departmental Representative is not familiar with any of the special equipment and/or systems installed.

.3 Submit to the Departmental Representative, at the time of Substantial Performance inspection, a complete list of systems stating for each system:

.1 Date of instruction.

.2 Duration of instruction.

.3 Name of persons instructed.

.4 Other parties present (manufacturer's representative, etc.).

.5 Signature of the Departmental Representative stating that they properly understood the system installation, operation, and maintenance requirements and identifying any systems or equipment which were not demonstrated to their satisfaction and which must be re-demonstrated.

3.10 CLEANING

.1 Do final cleaning in accordance with Section 01 01 50.

.2 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.

.3 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.4 Clean and prime paint exposed non-galvanised hangers, racks, fastenings to prevent rusting. Coordinate finish painting with Section 01 01 50.

3.11 WORKMANSHIP

.1 Workmanship shall be in accordance with well established practice and standards accepted and recognized by the Departmental Representative and the Trade.

.2 The Departmental Representative shall have the right to reject any item of work that does not conform to the Contract Documents and accepted standards of performance, quietness of operation, finish and appearance.

.3 Employ only tradesmen holding valid Provincial Trade Qualification Certificates. Tradesmen shall perform only work that their certificate permits. Certificates shall be available for inspection by the Departmental Representative.

3.12 PROTECTION OF WORK

.1 Protect equipment and materials, stored or in place, from the weather, moisture, dust and physical damage.

.2 Mask machined surfaces. Secure covers over equipment openings and open ends of equipment and conduit, as the installation work progresses.

.3 Equipment having operating parts, bearings or machined surfaces, showing signs of rusting, pitting or physical damage will be rejected.

.4 Refinish damaged or marred factory finish.

3.13 PROTECTION ELECTRICAL EQUIPMENT

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark live parts, e.g. "LIVE 120 VOLTS".

.3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

3.14 CONCEALMENT

.1 Conceal wiring and conduit in partitions, walls, crawlspaces and ceiling spaces, unless otherwise noted.

.2 Do not install wiring and conduit on outside walls or on roofs unless specifically directed.

3.15 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS

.1 Refer to 07 84 00.

.2 All cabling, wiring, conduits, cable trays, etc. passing through rated fire separations shall be smoke and fire stopped to a ULC or cUL tested assembly system, in accordance with CAN4-S115-95, that meets the requirements of the Building code in effect.

.3 The scope includes new services which pass through existing rated separations and also all existing services which pass through a new rated separation or existing separations whose rating has been upgraded.

.4 Fire resistance rating of installed firestopping assembly shall not be less than fire resistance rating of surrounding assembly indicated on Architectural drawings. Where this is not indicated assume a minimum of one hour for walls and two hours for floors.

.5 Install firestopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions. The Applicator shall be approved, licensed and supervised by the manufacturer in the installation of firestopping and are to follow the requirements of a rated system as detailed above.

.6 Contractors are expected to submit system information detailing firestopping product, backing, penetration, penetrated assembly, fire and temperature rating, and ULC or cUL system number.

.7 Provide fire stopping material and system information in the maintenance manuals and via labels at major penetrations that are likely to be re-penetrated.

.8 Allow openings for 100% capacity of raceway.

.9 Provide split systems where existing cables are involved.

3.16 SERVICE PENETRATIONS IN NON-RATED SEPARATIONS

.1 Provide metal sleeves for all cabling, wiring, conduits, cable trays, etc. passing through non-rated fire separations and non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with caulking or silicon sealant to prevent the passage of smoke and/or transmission of sound.

3.17 EQUIPMENT INSTALLATION

.1 Provide means of access for servicing equipment.

.2 CSA identification and equipment labels to be clearly visible after installation.

3.18 COORDINATION

.1 Coordinates starting of electrical equipment and systems with testing, adjusting and balancing, and demonstration and instruction of:

.1 Electrical equipment and systems specified in Division 26.

.2 Mechanical equipment and systems specified in Division 21, 22, 23 & 25.

.3 Other equipment and systems specified in other Divisions.

.2 Where any equipment or system requires testing, adjusting or balancing prior to starting, ensure that such work has been completed prior to starting of electrical equipment and systems.

3.19 STARTING MOTORS

.1 Prior to starting motors:

.1 Perform Megger test on the motors.

.2 Verify phase rotation at motor control centres.

.3 Confirm motor nameplate data with motor starter heater overloads.

3.20 ENERGIZING EQUIPMENT

.1 Complete all testing and provide testing result to Departmental Representative prior to energizing equipment.

.2 Confirm equipment nameplate data with characteristics of power supply.

3.21 CUTTING, PATCHING, DIGGING, CANNING, CORING & CONCRETE

.1 Lay out all cutting, patching, digging, canning and coring required to accommodate the electrical services. Coordinate with other Divisions. The performance of actual cutting, patching, digging, canning and coring is specified under other Divisions.

.2 Be responsible for correct location and sizing of all openings required under Electrical Divisions, including piped sleeves.

.3 Openings through structural members of the building shall not be made without the approval of the Departmental Representative.

.4 Openings in Concrete:

.1 Be responsible for the layout of all openings in concrete, where openings are not left ready under previous contract.

.2 All openings shall be core drilled or diamond saw cut.

.3 Refer to structural drawings for permissible locations of openings and permissible opening sizes in concrete floors and walls.

.4 Refer to structural drawings for locations of steel reinforcing.

.5 Be responsible for repairing any damage to steel reinforcing.

.5 Openings in building surfaces other than concrete:

.1 Lay out all openings required.

.6 Poured concrete for duct encasements, pole bases, transformer pads and housekeeping pads shall be provided by other Divisions, coordinated and supervised by the Electrical Divisions.

.7 Precast concrete items such as transformer pad bases and light pole bases to be provided and installed by the Electrical Divisions unless otherwise specified.

.8 Excavation and backfilling will be provided by other Divisions. This division to supervise the work and provide all layouts and parameters.

3.22 PAINTING

.1 Clean exposed bare metal surfaces supplied under the Electrical Divisions removing all dirt, dust, grease and mill scale. Apply at least one coat of corrosion resistant primer paint to all supports and equipment fabricated from ferrous metal.

.2 Paint all hangers and exposed sleeves, in exposed areas, with a rust inhibiting primer, as they are installed.

.3 Repaint all marred factory finished equipment supplied under the Electrical Divisions, to match the original factory finish.

.4 Coordinate with Division 09.

.5 Finish painting of all equipment and materials, supplied under the Electrical Divisions, installed in Electrical Rooms of the building or exposed outside the building, is included under Division 09 of the Specification.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work

1.3 REFERENCES

.1 CSA C22.1-18

.2 CSA C22.2

.3 National Electrical Manufacturers Association (NEMA)

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 01 50.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50.

1.6 TERMS OF REFERENCE

.1 Typically use insulated 98% conductivity copper conductor wiring enclosed in EMT (steel) conduit for the general wiring systems unless otherwise indicated.

.2 Armoured cable (BX) may be permitted only for luminaire drops to maximum length of 1500mm. Where flexible connections are required provide wiring in flexible conduits.

.3 Aluminium conductors not permitted.

.4 Teck cable may only be used where specifically indicated on the drawings or in the specifications. Where permitted, Teck wiring up to 750 volts to be PVC jacketed armoured cable, multi-copper conductor type Teck90 having a PVC jacket with FT-6 flame spread rating.

.5 Provide all control wiring except HVAC controls as specified in Mechanical Divisions. Refer to Equipment Schedule(s) for detailed responsibilities.

.6 Non-metallic sheathed wiring not to be used on this project.

Part 2 Products

2.1 WIRING & CABLES – GENERAL

.1 Conductors: stranded for 12 AWG and larger. Minimum size #12 AWG.

.2 Insulation to be 1000 volt RW90XLPE (X link) for the general building wiring in conduit, unless otherwise specified.

.3 Main feeders to be conduit and insulated copper wiring unless otherwise noted on drawings. Provide ground wiring for all conduits in or below slabs. Increase conduit size as required.

.4 Conductors within cable trays shall have 'plenum' rated (FT6 type) outer jacket to comply with all applicable regulations and bylaws.

.5 Conductors to be colour-coded. Conductors No.10 gauge and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size No.8 gauge and larger may be colour-coded with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible. Where colour-coding tape is utilized, it shall be applied for a minimum of 50 mm at terminations, junctions and pullboxes and condulet fittings. Conductors shall not be painted.

2.2 TECK CABLE

.1 Conductors:

.1 Grounding conductor: copper

.2 Circuit conductors: copper, size as indicated.

.2 Insulation: Chemically cross-linked thermosetting polyethylene, type RW90, rated 600 V.

.3 Inner jacket: polyvinyl chloride material.

.4 Armour: interlocking aluminum.

.5 Overall covering: polyvinyl chloride material FT-4/6 flame test rated as specified.

.6 Connectors: Watertight, approved for Teck cable installation.

2.3 LOW VOLTAGE CONTROL CABLES

.1 Type LVT: soft annealed copper conductors, with thermoplastic insulation, outer covering of thermoplastic jacket. Minimum size #18 AWG.

.2 Unless otherwise specified wiring to be multicore individually identified and colour coded with grey sheath enclosed in conduit or (EMT).

2.4 BUILDING WIRE AND CABLE

.1 Unless otherwise directed, building wire and cable shall be copper conductors, sized as indicated.

.2 Except where otherwise directed or required by Code or other applicable regulations, building wire and cable insulation shall be Type RW90, cross-linked polyethylene insulated 600 volts rated for not less then 90°C.

.3 All conductors within cable trays shall have FT6 type outer jacket to comply with all applicable regulations and bylaws.

.4 Use of NMD90 (Loomex) not permitted.

2.5 ARMOURED CABLE

.1 Do not utilize armoured cables (AC90).

2.6 WIRE AND BOX CONNECTORS AND MISCELLANEOUS MATERIALS

.1 Connectors for wire and cable splices and taps: Unless otherwise directed, use 3M Co. 'Scotchlok,' Thomas & Betts PT Series, Buchanan 'B,' IDI Electric 'Super Nut,' or approved equal, for conductors #8 AWG or smaller; Burndy 'Servit' Type KSU or approved equal for conductors #1/0 AWG and smaller; and Burndy 'OKlip' Type KVSU or approved equal for conductors 750 MCM or smaller.

.2 Clamps, glanding connectors, or box connectors for armoured cable, and flexible conduit as required.

.3 Lugs, terminals, screws used for termination of wiring to be suitable for copper conductors.

.4 Plastic electrical insulation tape: Scotch #88 or approved equal.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Unless specifically indicated otherwise, all wiring shall be installed in conduit. Use flexible conduits for final connections to suspend light fixtures and vibrating equipment.

.2 Use no wire smaller than #12 AWG, unless otherwise directed.

.3 Control circuit conductors for motors and mechanical equipment controls shall be not less than #14 AWG except where specifically directed otherwise.

.4 Before pulling wire, ensure conduit is dry and clean. If moisture is present, thoroughly dry out conduits; vacuum if necessary. To facilitate pulling, recognized specially manufactured wire pulling lubricants may be used. Do not use grease. Employ suitable techniques to prevent damage to wire when ambient temperature is below the minimum permitted for each insulation type. Do not pull wires into incomplete conduit runs.

.5 Installation to be free of opens and grounds. Before energization, measure insulation resistance and comply with the Canadian Electrical Code. Submit data sheet with values measured.

.6 The number of splices in any circuit shall be kept to an absolute minimum consistent with available coil length and installation conditions.

.7 Conductors for lighting, receptacle, appliance and equipment branch circuits shall have ampacity not less than the rating of the over-current device protecting the branch circuit and shall be sized for a maximum voltage drop of 2% from panelboard to the last outlet of a circuit. The length of the branch circuit to be used in the determination of the required wire size shall be the combined vertical and horizontal distances from the panelboard to the last device in the circuit. In no case shall the wire sizes as determined above, be less than that indicated in the following table.

120 Volts, 1 Phase

15 Ampere Circuits	20 Ampere Circuits
0-25 m - min. #12 AWG	0-20 m - min. #12 AWG
Over 25 m - min. #10 AWG	0 m-30 m - min. #10 AWG
	Over 30 m - min. #8 AWG

347 Volts, 1 Phase

15 Ampere Circuits	20 Ampere Circuits
0-75 m - min. #12 AWG	0-55 m - min. #12 AWG
Over 75 m - min. #10 AWG	Over 55 m - min. #10 AWG

.8 Make final connections to recessed incandescent or gas-discharge lamp fixtures, and other heat-producing equipment with thermoplastic insulated, lacquered glass-braid-jacketed "equipment wire," except that where higher temperature rating of insulation or larger conductor size than #10 AWG is required, use wire specifically approved for the purpose.

.9 Exercise care in stripping insulation from wire. Do not nick conductors; if nicked replace with new.

3.2 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34.

3.3 (SECTION IS DELETED – NOT USED)

3.4 IDENTIFICATION, CODING AND BALANCING

.1 For branch circuit wiring, follow identification system shown on the drawings and as specified in Section 26 05 00 – Common Work.

.2 Connect single phase equipment to minimize imbalance on feeders. Adjust branch circuiting shown as required for optimum balancing. Record all changes on the records drawings.

.3 Colour code all feeders at all terminations, at all points where taps are made, and at all panelboards, switchboards, motor control centres, etc. Use two wraps of 3M #471 plastic film tape 48 mm wide.

.4 Conductors sized No. 10 and smaller are required to be factory coloured, not taped on site.

3.5 TESTING

.1 All power and control wiring shall be tested for insulation resistance value with a 1000 volt megger. Resistance values shall be as recommended by the cable manufacturer.

.2 All wire test results shall be properly tabulated, signed, dated, and submitted to the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.2 CSA C22.1-18

.3 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.4 Transformer grounding shall comply with CSA C22.2 No.41-M87 (R99).

.5 All grounding conductors to be stranded soft annealed copper unless otherwise noted.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 01 50.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50.

Part 2 Products

2.1 MATERIALS

.1 Grounding equipment to: CSA C22.2 No.41-M87 (R99).

2.2 EQUIPMENT

.1 Clamps for grounding of conductor, size as required.

.2 Copper conductor at least 6m long for each concrete encased electrode, bare, stranded, soft annealed, size as indicated. If not indicated, use 3/0AWG which is the maximum in Table 43 CEC.

.3 Rod electrodes, copper clad steel 20mm dia by 3m long as indicated.

.4 System and circuit, equipment, grounding conductors, bare stranded copper, soft annealed, sized as indicated. Insulation where specified to be green.

.5 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.6 Non-corroding accessories necessary for grounding system, type, size material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Thermit welded type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.

.2 Provide separate, insulated, copper bonding conductor in EVERY conduit used for power, lighting, fire alarm and every low tension system required in the building. Where wire size is not indicates, provide minimum size per applicable CEC tables.

.3 Install connectors in accordance with manufacturer's instructions.

.4 Protect exposed grounding conductors from mechanical injury.

.5 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process or permanent mechanical connectors approved for the use.

.6 Use mechanical connectors for grounding connections to equipment provided with lugs.

.7 Soldered joints not permitted.

.8 Install bonding wire for flexible conduit, connected at both end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit. Provide a ground conductor in all flexible conduit and secure to system grounding lugs at both the equipment and source.

.9 Install separate ground conductor to each outdoor lighting standard.

.10 Connect building structural steel and metal siding to ground by welding copper to steel.

.11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.12 Bond single conductor, metallic armoured cables to cabinet at supply end and provide non-metallic entry plate at load end.

.13 Ground secondary service pedestals in raised computer floors.

.14 Coordinate ground rod installation with local soil conditions to assure proper grounding system.

3.2 GROUNDING ELECTRODES

.1 Provide and install an artificial ground consisting typically of a minimum of four 3000mm x 20mm copperweld ground rods, interconnected by bare stranded copper #1 AWG conductors and terminating to the Main Electrical Room ground bus. Conductors shall be connected to the ground rods with compression type fittings and shall be buried 600 mm below grade. Check and measure the installation to ensure an adequate resistance to ground before covering.

.2 Provide ground test well over one of the rods on the ground grid to allow access to the grid for testing.

3.3 BUILDING SERVICES GROUNDING

.1 WATER - From the main electrical room ground bus, connect #3 AWG insulated ground conductor in 27mm conduit to water main with approved ground clamp ahead of water meter. Install 1#3/0 ground conductor jumper strapped around water meter and associated unions and valves to ground building side of water system.

.2 METALLIC WASTE WATER PIPING - Each metallic waste water piping system to the building to be grounded by bonding it to the interior metallic water supply system by copper bonding jumper of not less than #3 AWG

.3 GAS PIPE GROUNDING - All interior metallic gas piping which may become energized to be made electrically continuous and to be bonded in accordance with requirements of Canadian Electrical Code.

3.4 GROUNDING BUS

.1 Provide ground bus in the main electrical room and main communication room.

.2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size #3 AWG or as indicated.

.3 Copper or bronze lugs required for termination of all copper conductors at ground busses.

3.5 EQUIPMENT GROUNDING AND BONDING

.1 Install bonding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, starters, UPS, control panels, building steel work, raised floor systems, generators, distribution panels and outdoor lighting.

.2 Provide grounding conductor(s) from all major switchgear to solidly ground the secondary system. This includes equipment located in the main electrical room as well as each sub-electrical room. Grounding conductors to be sized to Canadian Electrical Code and switchgear manufacturer's requirements.

3.6 MECHANICAL EQUIPMENT BONDING

.1 Ground wires to be installed in all conduit serving motor feeder circuits and to extend to ground screws on junction and outlet boxes for bonding.

3.7 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions.

.3 Measure ground grid resistance with earth test megohmmeter and install additional ground rods and conductors as required until resistance to ground complies with Code requirements and is less than 5Ω. Submit test results to Department Representative.

.4 Carry out all tests required by the Electrical Inspection Authority and provide all required reports and copied to the Departmental Representative. Include all associated costs.

.5 Ensure test results are satisfactory before energizing the electrical system.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Provide a complete system of splitters boxes and cabinets for the installation of wiring and equipment.

1.2 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work

.3 Section 26 05 25 – Seismic Restraints

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Section 01 01 50.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50.

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION BOXES AND PULL BOXES, INDOOR DRY LOCATIONS

.1 Materials:

.1 Code gauge sheet steel, welded construction, phosphatised and/or galvanized.

.2 Components:

.1 For flush mounting, covers to overlap box by 25 mm minimum all around with flush head cover retaining screws.

.2 Use rolled edges for surface boxes.

.3 Size shall be in accordance with Canadian Electrical Code for the given conduit sizes and arrangement and number of conductors and splices in the boxes.

.4 Surface or flush with trim and hinged door, latch and lock and two keys and keyed to match panelboard keys.

.5 Backboards: 19 mm GIS Fir plywood backboard.

.3 Junction boxes mounted in exterior walls shall be complete with box vapour barriers.

2.3 CABINETS

.1 Materials:

.1 Cabinets: Code gauge sheet steel, welded construction, phosphatised and factory paint finish, suitable for field painting.

.2 Locks: to match panelboards.

.3 Backboards: 19 mm GIS fir plywood, one piece per cabinet, covering entire cabinet interior.

.2 Components:

.1 With hinged door and return flange overlapping sides, with handle, lock and catch for surface mounting, size as indicated or to suit.

.2 Surface or flush with trim and hinged door, latch and lock and two keys, size as indicated or to Canadian Electrical Code for the given conduit sizes and arrangement and number of conductors and splices in the boxes. Keyed to match panelboard keys.

Part 3 Execution

3.1 INSTALLATION

.1 Junction Boxes and Pull Boxes:

.1 Supply all pull boxes and junction boxes shown on the drawings or required for the installation.

.2 Boxes installed in party walls to be offset by a minimum of one stud space.

.3 Install in inconspicuous but accessible locations, above removable ceilings or in electrical rooms, utility rooms or storage areas.

.4 Identify with system name and circuit designation as applicable.

.5 Size in accordance with the Canadian Electrical Code, as a minimum.

.2 Cabinets:

.1 Mount cabinets with top not greater than 1980 mm above finished floor, coordinated with masonry, panelboards, fire hose cabinets and similar items. Securely fasten backboards to cabinet interiors.

.2 Install terminal block where indicated.

.3 Identification

.1 Provide equipment identification in accordance with drawings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work

1.2 REFERENCES

.1 CSA C22.1-18 - Canadian Electrical Codes, Part 1.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 01 50.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1-18.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 OUTLET BOXES FOR METAL CONDUIT

.1 Materials:

.1 Surface or recessed concealed type: Die formed steel, hot dip galvanized, 350 g/m² minimum zinc coating.

.2 Surface mounting exposed: Cast ferrous for threaded conduit, with attached lugs, corrosion resistant two coats finish.

2.3 JUNCTION & PULL BOXES

.1 Electro-galvanized sheet steel type boxes for flush mount in walls with matching extension and plaster rings as required.

.2 Install pull boxes in inconspicuous but accessible locations.

.3 Install pull boxes after cumulative bend total of 270 degrees between boxes.

.4 Install pull boxes so as not to exceed 30m of conduit run between pull boxes.

2.4 CONDUIT BOXES

.1 Cast FS or electro-galvanized sheet steel boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.5 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, and armoured cable connections. Reducing washers are not allowed.

.5 Install all outlets flush and surface mounted as required for the installation.

.6 Surface mount above suspended ceilings, or in unfinished areas.

.7 Adjust position of outlets in finished masonry walls to suit course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes.

.8 Do not distort boxes during installation. If boxes are distorted, replace with new boxes.

.9 Use plaster rings to correct depth. Use 30 mm on concrete block.

.10 Do not use sectional boxes.

.11 Provide boxes sized as required by the Canadian Electrical Code.

.12 Install vapour barrier material to surround and seal all outlet boxes located on exterior walls of building. Maintain wall insulation.

.13 Outlets installed in partition walls to be offset by a minimum of one stud space.

.14 Ceiling outlet boxes shall be provided for every surface mounted fixture or row of fixtures installed on suspended "hard" ceilings.

.15 Primary bushings in termination box for cable connection.

.16 Secondary bushings in termination box for bus duct connection.

.17 For telecom conduit runs:

.1 Achieve the best route with no bend greater than 90 degrees or an aggregate of bends in excess of 180 degrees between pull points or pull boxes.

.2 Contain no continuous section longer than 30.5 meter (100 feet).

.3 Be bonded to ground on one or both ends in accordance with national or local requirements.

.4 Withstand the environment to which they will be exposed.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work

.3 Section 26 05 48.01 – Seismic Restraints

1.2 REFERENCES

.1 CSA C22.1-18.

.2 Canadian Standards Association (CSA) CAN/CSA C22.2.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 01 50.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50.

1.5 SCOPE OF WORK

.1 Drawings do not show all conduits. Those shown are in diagrammatic form only.

.2 Conceal all conduits in finished areas. Conduits may be surface mounted either only where indicated or in service areas accessible only to authorized personnel.

.3 Note particular requirements for routing of conduits where detailed.

.4 Provide polypropylene pull cord in all “empty” conduits.

.5 Conduits and boxes penetrating rated fire walls, ceilings and floors shall be properly firestopped and sealed for fire and smoke travel.

Part 2 Products

2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No.45 Galvanized Steel.

.2 Electrical Metallic Tubing (EMT): to CSA C22.2 No.83.

.3 Flexible conduits: to CSA C22.2 No. 56.

.4 Minimum conduit size in the project to be 21mm (3/4') diameter (for power as well as low tension services).

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 27 mm and smaller. Use two hole steel straps to conduits larger than 27 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits.

.4 10 mm threaded rods to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings manufactured for use with conduits specified. Coating same as conduit.

.2 Provide factory "ells" where 90 degree bends are required for 35 mm and larger conduits.

.3 EMT couplings and connectors shall be steel. Regular die-cast alloy fittings and couplings are not acceptable. Provide plastic bushings (insulated throat) for all connectors unless there is no chance of burrs. Provide water-tight connectors in damp or wet locations and for surface equipment (e.g. Panelboards, MCC's, etc) in rooms that are fire sprinkler protected.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable linear expansion.

.2 Water-tight expansion fittings: with integral bonding jumper, suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel as required.

2.5 RIGID P.V.C. CONDUIT

.1 Conduit: rigid non-metallic conduit of unplasticized polyvinyl chloride as manufactured C.G.E. "Sceptre" Schedule 40.

.2 Fittings: threaded male or female solvent weld connectors and solvent weld couplings, as supplied by conduit manufacturer.

.3 Solvent: as recommended by conduit manufacturer.

2.6 OUTLET AND CONDUIT BOXES IN GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped. Do not use sectional boxes.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

.6 Bushing and connectors with nylon insulated throats.

.7 Knock-out fillers to prevent entry of foreign materials.

.8 Conduit outlet bodies for conduit up to 35 mm. Use pull boxes for larger conduits.

.9 Double locknuts and insulated bushings on sheet metal boxes.

2.7 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. Larger 102 mm square x 54 mm deep outlet boxes (No. 52151 or 52171) to be used when more than one conduit enters one side. Provide extension and plaster rings as required.

.2 For larger boxes use GSB solid type as required.

.3 Boxes for surface mounted switches, receptacles, communications, telephone to be 100mm square No. 52151 or 52171 with Taylor 8300 series covers.

.4 Lighting fixture outlets: 102 mm square outlet boxes (No 52151, 52171 or 72171) or octagonal outlet boxes (No 54151 or 54171).

.5 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster and/or tile walls.

2.8 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi gang type MDB boxes for devices flush mounted in exposed block walls.

2.9 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.10 SURFACE CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

Part 3 Execution

3.1 CONDUIT - GENERAL

.1 Generally use electrical metallic tubing (EMT) in the building interior and in above grade slabs except where subject to mechanical injury or where otherwise indicated.

.2 Install all conduit and wiring concealed, unless otherwise shown on the drawings. Do not recess conduit in columns, except as noted, without permission.

.3 Lay out conduit to avoid interference with other work. Maintain a minimum clearance of 150 mm from steam or hot water piping, vents, etc.

.4 At all recessed panels cap 4 - 27 mm empty conduits from panel into ceiling above for future use.

.5 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass. Set out the work and coordinate with other services prior to installation. Maintain access to junction and pull boxes.

.6 Any conduit shown exposed in finished areas is to be free of unnecessary labels and trade marks.

.7 All conduit ends to be reamed to ensure a smooth interior finish that will not damage the insulation of the wiring.

.8 Ensure grounding continuity in all conduit systems.

.9 Use rigid galvanized steel (RGS) threaded conduit where the installation is subject to mechanical injury. In any event, use RGS conduit for surface installations up to 1.5 m (5') above the finished floor.

.10 Field threads on rigid conduit shall be sufficient length to draw conduits ends together.

.11 Unless otherwise noted and where practical, all conduits to be routed through the ceiling space rather than in, or below, slabs or floor structures to facilitate future changes.

.12 Conduits in walls should typically drop (or loop) vertically from above to better facilitate future renovations. Generally conduits from below and horizontal conduits in walls and concrete structures should be avoided unless indicated.

.13 Generally use Rigid PVC conduits in or below ground level slab unless otherwise noted. Transition to RGS conduit in exposed locations: e.g. where conduits emerge from ground level slab.

.14 Conduits are not permitted in terrazo or concrete toppings.

.15 Cap turned up conduits to prevent the entrance of dirt of moisture during construction.

.16 Locate conduits more than 75 mm parallel to steam or hot water lines with a minimum of 25 mm at crossovers.

.17 Bend conduits cold, so that conduit at any point is not flattened more than 1/10th of its original diameter. Conduits bent more than this or kinked to be replaced.

.18 Provide polypropylene pull cord in empty conduits to facilitate pulling wiring in future.

.19 Where conduits become blocked, the use of corrosive agents is prohibited. Remove and replace blocked section.

.20 Damaged conduits to be repaired or replaced.

.21 Dry conduits out thoroughly before installing wiring. Swab out conduit and thoroughly clean internally before wires and cables are pulled.

.22 Conduits shall not pass through structural members except as indicated.

.23 Conduit sizes indicated on drawings are minimum only. Increase sizes as required to suit alternative wiring types or to comply with Code.

.24 Conduits and ducts crossing building expansion joints shall have approved conduit expansion fittings to suit the type of conduit used.

.25 Seal conduits with approved sealant where conduits are run between heated and unheated areas.

.26 Seal openings with approved sealant where conduits, cables, or cable trays pierce fire separations.

.27 Where conduits pass through walls, they shall be grouped and installed through openings. After all conduits shown on the drawings are installed, wall openings shall be closed with material compatible with the wall construction and/or to meet any fire separation integrity.

.28 Where drawings show conduit designations, these conduits shall be identified at each point of termination with Thomas & Betts "Ty-Rap" No. TY532M labels.

.29 Use "Condulet" fittings for power and telephone type conduit terminations in lieu of standard boxes where box support is not provided.

.30 Provide necessary roof jacks or flashing where conduits pass through roof or watertight membranes. Apply approved sealant to maintain membrane integrity.

.31 Use flexible metal conduit for connection to recessed incandescent fixtures without a prewired outlet box and connection to recessed fluorescent fixtures.

.32 Use liquid tight flexible metal conduit for connection to motors, and other vibrating equipment and transformers.

.33 Use explosion proof flexible connection for connection to explosion proof motors.

.34 Install conduit-sealing fittings in hazardous areas, isolation rooms and clean rooms. Fill with compound.

3.2 SURFACE CONDUITS

.1 Surface conduits are acceptable in mechanical and electrical service rooms and in unfinished areas or where indicated.

.2 Run parallel or perpendicular to building lines.

.3 Locate conduits behind infrared or gas fired heaters with minimum 1.5 m clearance.

.4 Conduits to be run in flanged portion of structural steel.

.5 Group conduits wherever possible on suspended and/or surface channels.

.6 Surface conduits will not be accepted in finished areas unless detailed.

3.3 SPARE CONDUITS

.1 Provide spare conduits as indicated.

.2 Provide 4x27 mm spare conduits up to ceiling space and 4x27 mm spare conduits down to ceiling space below from each flush panel. Terminate the conduits in 150x150x100 mm junction boxes in ceiling spaces or in case of an exposed concrete slab, terminate each conduit in a flush concrete box. Provide coverplates for all junction boxes.

3.4 BOXES INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Ceiling outlet boxes to be provided for each surface mounted fixture or row of fixtures installed in other than T bar ceilings with removable tiles.

.3 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of construction material. Remove upon completion of work.

.4 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.5 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers not to be used.

.6 All outlet boxes to be flush mounted in all areas, excluding mechanical rooms, electrical rooms, and above removable ceilings.

.7 Adjust position of outlets in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes. All cutting of masonry work for installation of electrical fittings to be done using rotary cutting equipment.

.8 No sectional or handy boxes to be installed.

.9 Provide vapour barrier wrap or boots behind outlets mounted in exterior walls. Maintain integrity of the vapour barrier and insulation to prevent condensation through boxes.

.10 Coordinate location and mounting heights of outlets above counters, benches, splash-backs and with respect to heating units and plumbing fixtures. Coordinate with architectural details.

.11 Outlets installed back to back in party stud walls to be off-set by one stud space.

.12 Refer to wiring device and communication specification sections and to architectural layouts for mounting heights of outlet boxes.

.13 Back-boxes for all communications systems equipment to be provided in accordance with specific manufacturer's recommendations and as specified in the communications sections of these specifications.

.14 Separate outlets located immediately alongside one another to be mounted at exactly the same height above finished floor. Similarly, outlets mounted on a wall in the same general location at varying heights to be on the same vertical centre-line unless otherwise noted.

.15 Where outlet boxes penetrate through a fire separation, ensure that the boxes are externally tightly fitted with an approved non-combustible material to prevent passage of smoke or flame in the event of a fire.

END OF SECTION

Part 1 General

1.1 DOCUMENTS

This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 GENERAL

.1 All electrical equipment installed throughout the building shall meet the Seismic requirements for the BCBC, Local By-Laws and as outlined.

.2 Supply all labour, materials and equipment required and necessary to isolate (noise/vibration) and seismically restrain electrical equipment as specified herein and guarantee the function of the materials and equipment supplied.

.3 All electrical connections to vibration isolated equipment shall be made with flexible conduit or other flexible means acceptable to the Departmental Representative so as not to restrict the maximum anticipated movement of the equipment under seismic excitation movement.

.4 Seismic restraining devices shall be provided to restrain all electrical and related equipment.

.5 Use of the manufacturer's isolation package is acceptable providing it meets the requirements of this Specification.

.6 Provide vibration isolation for equipment or parts connected rigidly to the isolated equipment of this section.

.7 In the event that inadequate isolation is provided by the manufacturer's isolation package, the supplier shall be responsible for improving the isolation to an acceptable standard at no additional cost to the contract.

Part 2 Materials

2.1 NEOPRENE ISOLATORS

.1 All neoprene isolators shall be tested to ASTM specifications. The Departmental Representative shall be provided with the following test data to verify the performance of the neoprene isolators.

.1 A data sheet listing all of the ASTM test results.

.2 Load deflection curves for the isolator indicating the deflection to full compression for both laterally restrained and unrestrained isolators.

.2 Neoprene pads or elements shall be selected at the supplier's optimum recommended loading and shall not be loaded beyond the limit specified in the neoprene manufacturer's literature.

2.2 OPEN STEEL SPRING ISOLATORS

.1 All springs shall be "Iso-Stiff" type. Spring coefficient shall be 1.0 to 1.5.

.2 Spring mounts shall be complete with levelling devices, minimum 6 mm (0.25 in.) thick neoprene sound pads.

2.3 SEISMIC RESTRAINTS

.1 The seismic restraints shall restrain the equipment in all directions and shall be sized to meet the appropriate Sp factor defined in Table 4.1.9.D of the current National Building Code and Commentary J of the Supplement to the current Code. Calculations bearing the seal of a qualified Professional Engineer must be submitted with the shop drawings to justify the stated seismic restraint requirements.

.2 All attachment points and fasteners shall be capable of withstanding a load of 3 times the sized capacity of the restraint. The equipment suppliers shall provide proof of conformance with this clause by means of shop drawings certified by a qualified Professional Engineer.

.3 All neoprene isolators shall be bridge bearing rated type.

.4 Test data shall be provided to the Departmental Representative, showing the load deflection curves up to 1.5 times the rated capacity of the restraint, and certifying that neither the neoprene elements nor the restraint body sustained any deformation after release of load.

.5 All restraints shall be adjusted to have clearances between 3mm and 6mm under normal operating conditions of the equipment.

Part 3 Execution

3.1 DISTRIBUTION CENTRES

.1 All distribution centres shall be securely mounted to either room walls or floor. All walls shall have 19mm plywood backing installed behind drywall for mounting screws.

3.2 GENERAL

.1 Cable trays, conduit, buss bars, raceways or other connections shall be either flexibly connected to vibration isolated equipment or vibration isolated per above for a minimum of 9100 mm (30 ft.) from the equipment. If a flexible connection is used, it must accommodate without strain the full range of movement of the isolated equipment.

.2 Perforated pipe hangers shall not be used for any seismic supports.

.3 Explosive type fasteners shall not be used. Rawl plugs and 6.3mm and 9.5mm inserts are acceptable.

.4 Arrange and pay for the Professional Engineer to inspect same on site (note that multiple inspections will be required as the work progresses) and to provide typewritten Inspection, and to provide "Letters of Assurance and Conformance" with the specified Codes, Standards and Bylaws.

Calculations sealed by a Professional Engineer registered in B.C. shall be provided for the seismic restraint design shown on the shop drawings.

.1 Product Data:

.1 Submit catalogue details for metal support assemblies illustrating profiles, dimensions and fabrication, installation recommendations and data that products have been tested and comply with performance requirements.

.1 Recycled Content: Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

.2 Local/Regional Materials:

.1 Indicate location of manufacturing facility; indicate distance between manufacturing facility and project site.

.2 Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

.2 Shop Drawings:

Submit completed Schedule B1, Assurance of Professional Design and Commitment for Field Review, and Schedule B2, Summary of Design and field review Requirements, together with initial shop drawing submission as required.

.1 Submit shop drawings of metal support assemblies for review, prepared under the supervision and bearing the seal and signature of a registered professional Engineer of the province of British Columbia.

.2 Show seismic design of suspension systems, lateral bracing and metal support assemblies supporting items requiring seismic restraints to meet all of the requirements stipulated by the BCBC.

.3 Letter of Assurance:

Registered Professional Engineer who signed and sealed shop drawings shall perform sufficient field reviews in order to allow him to provide a letter of professional assurance after completion of the Work, giving assurance that the work has been installed in general conformance with the sealed shop drawings. Approved form is a BCBC Schedule C-B or Schedule S-C, Assurance of professional Field Review and Compliance. Written inspection reports of field reviews shall be submitted to Departmental Representative promptly as the field reviews are made.

Requirements for seismic restraint outlined in Section 26 05 48.01 shall be minimum accepted.

.5 The following electrical equipment and fixtures require seismic protections:

- Switchboards.
- Panelboards.
- Transformers.

.6 Electrical Contractor to include the requirement for retaining the Seismic Engineer as part of their scope of work and costs.

END OF SECTION

Part 1 General

1.1 DOCUMENTS

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 GENERAL

.1 Supply and install new dry type step down transformers rated 600volt three phase to 120/208 volt three phase four wire, with kVA ratings as called for on the drawings.

1.3 SECTION INCLUDES:

.1 All 600V-120/208V dry type transformers shall be supplied and installed by the Contractor.

.2 The Contractor shall provide matching wiring boxes located at the sides of the transformers for incoming and outgoing cables.

.3 The Contractor shall provide transformer mounting racks, all necessary material and labour for proper installation (including seismic restraints) of the transformers.

1.4 RELATED SECTIONS

.1 Section 20 05 01: Electrical General Requirements

.2 Section 26 05 48.01: Seismic Requirements

1.5 SHOP DRAWINGS

.1 Submit shop drawings for each transformer which shall include:

.1 Dimensioned drawings showing: enclosure, mounting devices, terminals, taps, internal and external component layout.

.2 Technical data:

.1 kVA rating

.2 Primary and secondary voltages

.3 % Impedance

.4 Full and no load efficiency

.5 Regulation at unity power factor

.6 Insulation type

.7 Sound level

.3 Efficiency test reports for each size harmonic mitigation transformer.

1.6 MAINTENANCE INSTRUCTIONS

.1 Provide copies of operation and maintenance data to be included in electrical maintenance manuals. Include full operating and maintenance instructions, tap changing procedures, recommended inspection and maintenance procedures and copies of all shop drawings and test reports.

1.7 WARRANTY

.1 Manufacturer shall provide a comprehensive warranty for the products free from defects in the material and workmanship for a period of 1 year from the date of substantial completion.

Part 2 Materials

2.1 DRY TYPE TRANSFORMERS

.1 All 600V/120/208 Volt dry type transformers supplied shall be general purpose transformers. All transformers shall be tested under Nema Standards TPI-1996 for "Energy Star" compliant and bear ECO-LOGO label and at 50% of full load deliver at least 98% efficiency. Transformer shall be copper wound, 60Hz, 600V primary, delta connected complete with four full capacity 2.5% adjusted taps, 2 below (FCBN) and 2 above (FCAN) the rated voltage, 208/120V secondary, 220 C class insulation 150ºC temperature rise, NEMA 1 enclosure, with a single electrostatic shield for a common mode noise attenuation of 60db minimum, and meet NEMA TP1 and NEMA ST-20. Magnetizing in rush current shall be less than ten times full load RMS current. Neutral bus ampacity shall be 200% of phase current. The above product must be UL and CSA listed and built at an ISO 9000 regulated facility. Transformer enclosure shall be sprinkler proof.

.2 Sound level to be less than 55 dBA.

.3 Division 26 to provide matching wiring boxes located at the sides of the transformers for incoming and outgoing cables. Entry to these boxes shall be side or bottom entry only.

.4 Division 26 to provide transformer mounting supports constructed and installed to the approval of the Departmental Representative, and the seismic engineer retained by the Contractor.

.5 Acceptable manufacturer subject to meeting all requirements of the specifications shall be Square-D, Hammond, Eaton, Seimens, Delta or equivalent.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01.

.2 Label size: 7, with wording as shown on Drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Contractor to provide detailed layout of equipment to be installed as shown located on layouts. The room layout details provided with electrical drawings are meant to be conceptual and are not intended for exact locations of equipment. Confirm exact mounting location of transformers and other equipment prior to installation. Provide a steel trapeze style hanger to hang transformers from the concrete slab above as needed. Ensure the hangers will support the full weight of the transformer as per manufactures specifications.

.2 Receive shipment from the supplier and mount dry type transformers as noted on Drawings.

.3 Ensure adequate clearance around transformer for ventilation.

.4 Install ground sheet metal plates or cementitious ceramic till backerboard on the wall immediately behind and beside all distribution transformers.

.5 Mount transformers using vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution of equipment so as to produce the manufacturers' recommended uniform deflection. Such equipment shall be restrained at each isolator pad using bolts into the floor slab or transformer mounting support with neoprene washers and clearance holes to prevent short circuiting.

.5 Install transformers in level upright position.

.6 Remove shipping supports only after transformer is installed and just before putting into service.

.7 Loosen isolation pad bolts until no compression is visible.

.8 Make primary and secondary connections in accordance with wiring diagram. Install equipment and system grounds.

.9 Make flexible conduit connections on both primary and secondary sides of all transformers.

.10 Test and commission in accordance with Sections 26 05 01 including megger test of windings.

.11 Energize transformers after installation is complete and set taps based on measured supply voltage.

END OF SECTION

Part 1 General

1.1 DOCUMENTS

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 REQUIREMENTS

.1 Supply and install branch circuit panelboards as indicated on the drawings and as hereinafter specified.

.2 Shop drawings of all panelboards shall be reviewed by the departmental representative before construction commences.

Part 2 Materials

2.1 MATERIALS

.1 Panelboards shall be of the molded case circuit breaker type, for surface or flush mounting. Panelboard boxes shall be fabricated from #12 code gauge steel, either satin galvanized finish or painted with rust resistant primer paint and two coats of glossy acrylic enamel. Trims shall be fabricated from code gauge sheet steel painted with rust resisting zinc-chromate primer paint and two coats of glossy acrylic enamel, ASA61E. Panelboards in public spaces to be custom painted to match the walls.

.2 Breakers shall be of the bolted quick-lag type sized as indicated, quick-make, quick-break, thermal magnetic action. Multi-pole breakers shall have a common trip with a single operating handle. Minimum short circuit rating shall be 10,000 amperes rms symmetrical. Panels shall be rated minimum 225A. Double tub panels shall be factory assembled and certified for the application.

.3 Trims shall have doors equipped with flush hinges and double lock. A lock and catch shall be at the top and bottom of the doors. Two keys shall be supplied with each lock. All locks shall be common keyed. Panelboard catches shall be flush with the trim cover. Trims shall be of sufficient gauge to prevent warping. 42-circuit and larger panelboards shall have two locks. Minimum size: 146mm deep 508mm wide.

.4 Breakers shall be identified on a typewritten directory blank form supplied by manufacturer mounted in a suitable frame facing inside each panel door, indicating the circuit being controlled by each breaker. Wording for the directory shall clearly identify the load or area being controlled, and the breaker size, such as the following:

.1 Lights – Amenity Room 121 – 15A

.2 Receptacles – Office 125 -15A

.3 Exhaust fan – Electrical Room 225 – 15A 3P

Provide a copy of the directory in the Maintenance Manual.

.5 Spare breakers shall be identified as “SPARE” on the typewritten directory.

.6 Panels shall have numbered circuits: odd numbers on left and even numbers on the right.

.7 Surface mounted panels shall be sprinklerproof. All conduits penetrating sprinklerproof panels shall be sealed using rain tight connectors, NEMA 2 rated complete with top drip shield.

.8 Panelboard busbar material shall be copper tin plated.

.9 Shop drawings to include an elevation drawing and trim lower detail.

.10 Acceptable manufacturers: Match with existing panel brands on site.

Part 3 Execution

3.1 GENERAL

.1 Panelboards shall be mounted with tops of panelboard at +1800 mm above the finished floor. Coordinate panelboard heights and locations with Architectural trims, etc.

.2 The contractor shall, if so directed, replace circuit breakers from the size specified to other ampere size ratings within the same frame size without extra cost to the contract up to the date of substantial completion.

.3 All panel locks shall be common-keyed.

.4 Each panelboard shall be complete with door, catch, and two keys. Double door locks.

.5 Panelboard voltage and bus capacity shall be shown on the panel schedule.

.6 CSA approved panels must be provided. All panelboards must be bolt-on molded case circuit breaker type, with copper mains, rated for the available interrupting capacity.

.7 All two and three pole breakers must have common trip type with single handle.

.8 A minimum of 20% spare capacity must be provided for all panelboards. Provide 15A 1pole spare breakers in panel.

.9 When multi-section panelboards are installed, panelboard sections shall not be used as wireway for wiring from other section.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work

1.2 REFERENCES

.1 CSA C22.1-18

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 01 50.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50.

Part 2 Products

2.1 SWITCHES

.1 Extra heavy duty specification grade.

.2 20 A, 120 V, single pole, double pole, three-way, four-way switches as indicated.

.3 Manually-operated general purpose ac switches as indicated and with following features:

- .1 Terminal holes approved for No.10 AWG wire.
- .2 Silver alloy contacts.
- .3 Urea or melamine molding for parts subject to carbon tracking.
- .4 Suitable for back and side wiring.
- .5 White toggle (red toggle for emergency power circuits).

.4 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rating capacity of motor loads.

.5 Switches of one manufacturer throughout project.

.6 Acceptable products or approved equal:

- .1 Arrow Hart 1900 series
- .2 Bryant 4900 series
- .3 Hubbell HBL.1221 series
- .4 Leviton 1221-2 series

.5 Pass & Seymour PS20AC1 120V series

2.2 RECEPTACLES – GENERAL

.1 Extra heavy duty specification grade.

.2 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

.1 White nylon molded housing (red for emergency power circuits, blue for surge protection)

.2 Suitable for No.10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and non riveted grounding contacts.

.3 Duplex receptacles with a CSA Configuration of 5-15R and 5-20R installed within the Living Unit shall be tamper-resistant. Receptacles dedicated for microwaves, refrigerators, freezers or kitchen counters are excluded.

.4 Receptacles of one manufacturer throughout project.

.5 Acceptable products or approved equal:

.1 Arrow Hart 6262

.2 Bryant 5262.

.3 Hubbell 5262 series

.4 Leviton 5262 series

.5 Pass & Seymour 5262 series

2.3 RECEPTACLES – 20A

.1 Extra heavy duty specification grade.

.2 Duplex receptacles, CSA type 5-20 RA, 125 V, 15/20 A, U ground, with following features:

.1 White nylon molded housing (red for emergency power circuits)

.2 Suitable for No.10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and non riveted grounding contacts.

2.4 COVER PLATES

.1 Stainless steel: Type 302 or 304, No. 4 finish, 1mm thick, accurately die cut, protective cover for shipping. For general interior flush mounted wiring devices and surface type FS or FD type boxes.

.2 Steel: sheet steel hot dip galvanized with rolled edges for surface mounted utility boxes.

.3 Wall plates to be flush mounting with "positive bow" feature to ensure that all edges of plate are flush with wall or surface box when installed.

.4 All plates to be bevelled type with smooth rolled outer edge and smooth face. Exposed sharp edges are not acceptable.

.5 Cast metal: die cast profile, ribbed for strength, flash removed, primed with grey enamel finish and complete with four mounting screws to box for special purpose wiring devices.

.6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for wiring devices as indicated. Double doors for standard duplex receptacles. Coverplates to fasten to box by four screws.

.7 Gaskets: resilient rubber or close cell foam urethane. All gaskets inside inmate cells shall be air tight type to maintain negative air pressure in the cells.

.8 Cover plates for all wiring devices to be from one manufacturer throughout project.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Mount wiring devices to height specified in Section 26 05 00 or as indicated.

.2 Upper edge of plates located on separate outlets immediately alongside one another to be at exactly the same height above finished floor.

.3 All plates to be installed parallel or perpendicular to building lines.

3.2 INSTALLATION PARTICULAR

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.2 Receptacles:

.1 Install all receptacles in the vertical plane unless otherwise noted.

.2 Generally install the 5-15/20R U ground pin down unless otherwise noted.

.3 Install receptacles vertically in gang type outlet box when more than one receptacle is required in one location.

.4 Where split receptacles has one portion switched, mount vertically and switch the upper portion.

.5 Ground fault interrupter duplex receptacles to be used, adjacent sinks or water sources.

.3 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.4 Use weatherproof cover plates in wet locations and where indicated.

.5 Provide a label on every switch and receptacle cover plate indicating panel and circuit number.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions

.2 Section 26 05 00 - Common Work

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 01 50.

.2 Include time-current characteristic curves for breakers with ampacity and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

Part 2 Products

2.1 BREAKERS - GENERAL

.1 All breakers shall be CSA approved for their application and bear a CSA approval label.

.2 Moulded-case circuit breakers, and ground-fault circuit-interrupters, and accessory high-fault protectors: to CSA C22.2 No. 5.

.3 Breakers shall be of the same manufacturer and have the same interrupting capacity of panel or panelboard into which it is being installed.

.4 Breakers shall be bolt-on style, quick-make, quick-break type, fully rated for the short circuit level on their installed bus. Minimum interrupting capacities shall be 10 kA for 120/208 V.

.5 Bolt-on moulded-case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

.6 Plug-in moulded-case circuit breakers shall not be used.

.7 Common-trip breakers: with single handle for multi-pole applications.

.8 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.9 Circuit breakers with interchangeable trips as indicated.

2.2 THERMAL MAGNETIC BREAKERS

.1 Moulded-case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Mechanical: Divisions 23 and 25

1.2 REQUIREMENTS

.1 Provide a complete system of wiring to motors and mechanical controls as specified herein and as shown on the drawings.

.2 Unless specifically noted otherwise, wire and leave in operation all electrically operated equipment supplied under contracts related to this project or relocated as part of the scope. Examine the drawings and shop drawings of all Divisions for the extent of electrically operated equipment supplied under other divisions.

.3 Unless specifically noted otherwise, supply all disconnects, relays, starters, etc., necessary for the operation of equipment. Check all starters, relay coils and thermal elements to ensure that they provide the necessary protection for motors.

.4 Do not operate motors and controls until approval is obtained from the trade providing equipment.

.5 Examine drawings and shop drawings of other Divisions to obtain exact location of motors and equipment shown on drawings. Where necessary, obtain conduit locations from other trades' drawings and shop drawings.

.6 Assist in placing in operation all mechanical equipment having electrical connections.

.7 Provide three phase starters with fused 120 volt control transformers and overload relays.

.8 Provide all power wiring for all motors.

.9 Provide power wiring for heating ventilating and air conditioning equipment. Provide terminations in starters and MCCs for control wiring so that starter control circuits may be extended. Where 120 volt power is required for mechanical equipment, i.e. roll type filters, refrigerated aftercoolers, control cabinets, etc. wiring to the equipment terminals is the work of this Division.

.10 Refer to Mechanical Equipment Schedule attached.

.11 The motor control work which shall be provided under Division 26 shall include the following:

.1 All conduit and control wiring specifically noted on the drawings and outlined in the different parts of the Specification.

.2 Conduit and control wiring for baseboard heaters, unit heater and force flow heater thermostats.

.3 All control wiring as specified in the Motor Schedule.

.4 Control wiring related to air handling shutdown during fire alarm.

Part 2 Products

2.1 3 PHASE MOTOR DISCONNECT SWITCHES

.1 Industrial Type "A", having quick make, quick break visible blade mechanism, cover interlocks and padlocking switch in the closed or open position. Use NEMA 4X rated disconnect switches outdoors, and NEMA 1 indoors, switches to be heavy duty and rated for relevant HP of equipment.

2.2 120 VOLT, 1 PHASE DISCONNECT SWITCHES

.1 Manual disconnect switch HP rated (starter) without overload relay.

2.3 208 VOLT, 1 PHASE MOTOR DISCONNECT SWITCHES

.1 Manual disconnect switch HP rated (starter) without overload relay – two pole.

Part 3 Execution

3.1 INSTALLATION

.1 Provide disconnect switches adjacent to all motors.

.2 Provide all wiring between all force flow and unit heaters and their thermostats. Install wiring between all mechanical components to provide a functional system.

.3 Do control wiring as indicated on the drawings and the motor control schedules.

END OF SECTION

APPENDIX A

Occupational Exposure Assessment – CSC Kent Institution

Occupational Exposure Assessment – CSC Kent Institution, Agassiz, BC

August 14, 2020

Prepared for:

Public Services and Procurement Canada
Real Property Service Branch
Professional and Technical Services
Mission Site Office

Prepared by:

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Revision: 0

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Executive Summary

Stantec Consulting Ltd. (Stantec) was commissioned by Public Services and Procurement Canada (PSPC) to assess for the presence of various sewer gases that could be introduced to the Sump Pump & Sewage Lift Station Room (SPSLS Room) and adjacent tunnels (subject areas) via sewage treatment activities undertaken in the SPSLS Room. The objectives of the assessment were:

1. To evaluate the potential for Correctional Service of Canada (CSC) guards and other workers spending time in the subject areas, to be exposed to specific airborne chemical agents associated with sewer gas at concentrations exceeding applicable occupational exposure limits (OELs), as set out within the *Canada Labour Code, Part II, Canada Occupational Health and Safety Regulations (COHSR)* and/or *National Joint Council Occupational Health and Safety Directive (NJC OHSD)*.
2. To assess for the presence of flammable gases within the subject areas and conduct interviews with knowledgeable site staff and a non-destructive visual review of the subject areas, with the aim of noting readily-identifiable ignition sources that could present a flammability/explosion risk within the subject areas, in support of planned renovations.

The assessment was conducted at the CSC Kent Institution (subject site) located at 4732 Cemetery Road, Agassiz, British Columbia.

The assessment was conducted by Amanda Bell of Stantec over an approximately 72-hour period spanning July 14 through July 17, 2020. The assessment involved air sampling (continuous air monitoring and the collection of long-term air samples), interviews with the site escort and collection of visual observations relevant to the study scope.

The following tables summarize the air sampling results. A score of  indicates there is no need to take any action at this time based upon the results. A score of  indicates that further action may be required based upon the results.

More detailed results are presented in Section 7 and Appendices A through G.

Table E.1 Summary of Results – Long-Term Sampling

Parameter	Score	Location	Concentration (ppm)	Adjusted 12-hr Regulated TWA OEL (ppm)	Regulated STEL (ppm)	Regulated Ceiling Limit (ppm)	Comment
Nitrogen Dioxide (NO_2)		SPSLS Room	<0.03–<0.05	0.13	-	-	Concentrations of NO_2 were well below the adjusted 12-hr TWA OEL in area samples.
		North Tunnel	<0.03–<0.05	0.13	-	-	Concentrations of NO_2 were well below the adjusted 12-hr OEL in area samples.

NOTES:
"-" – No published limit available
TWA OEL– Time-Weighted Average Occupational Exposure Limit
STEL – 15-minute Short-Term Exposure Limit
ppm – parts of the parameter per million parts of air by volume.

Table E.2 Summary of Results—Continuous Monitoring—Parameters with Published OELs

Parameter	Score	Location	Instantaneous Measurement Range (ppm)	Adjusted 12-hr Regulated TWA OEL (unless otherwise noted) (ppm)	Regulated 15-min STEL (unless otherwise noted) (ppm)	Regulated Ceiling Limit (unless otherwise noted) (ppm)	Comment
Ammonia (NH_3)	✓	SPSLS Room	<1–1	25	35	-	Results from continuous monitoring of NH_3 were below the regulated TWA OEL as adjusted for a 12-hour shift, and the regulated STEL.
	✓	North Tunnel	<1–1				
Carbon Monoxide (CO)	✓	SPSLS Room	<1–1	16.7	-	200 (NIOSH REL)	Results from continuous monitoring of CO were below the applicable regulated TWA OEL, as adjusted for a 12-hour shift, and the guideline NIOSH ceiling limit.
	✓	North Tunnel	<1–1				
Hydrogen Sulfide (H_2S)	✓	SPSLS Room	<0.1	1	5	-	Results from continuous monitoring of H_2S were below the applicable regulated TWA OEL as adjusted for a 12-hour shift, and the regulated STEL.
	✓	North Tunnel	<0.1				
Sulfur Dioxide (SO_2)	✓	SPSLS Room	<0.1	2 (NIOSH REL)	0.25	-	Results from continuous monitoring of SO_2 were below the applicable guideline TWA NIOSH REL, as adjusted for a 12-hour shift, and the regulated STEL.
	✓	North Tunnel	<0.1				

Notes:
"-" – No published limit available
NIOSH REL – US National Institute of Science and Health Recommended Exposure Limit
ppm – parts of the parameter per million parts of air by volume.
STEL – 15-minute Short-Term Exposure Limit
TWA OEL – Time-Weighted Average Occupational Exposure Limit

Table E.3 Summary of Results—Continuous Monitoring—Other Parameters

Parameter	Score	Location	Instantaneous Measurement Range (%)	Regulated Limit (%)	Comment
Lower Explosive Limit (LEL)	✓	SPSLS Room	0–14	<50	Results were within the applicable regulated limit under the COHSR (<50% of the LEL) for areas with no hot work and no ignition sources present.
	✓	North Tunnel	0		
Oxygen	✓	SPSLS Room	20.9	≥18 (≤23 for hot work)	Measured O_2 concentrations were typical (20.9%) and within the applicable regulated limit under the COHSR (>18% O_2) Measured concentrations also did not exceed the regulated limit for hot work (>23% O^2).
	✓	North Tunnel	20.9		

Conclusions and Recommendations

Based on site observations, the results of continuous air monitoring and laboratory analysis of air samples, and statistical analysis of the results, the following conclusions are provided:

- Long-term area air sampling and continuous monitoring results collected in the tunnel and SPSLS Room during the assessment were less than the applicable published occupational exposure limits (OELs) for the measured parameters. This suggests the actual exposures of CSC guards and workers to the measured parameters were likely to have been acceptable over the assessment period.
  - Note that area sample results are indicative of the potential for worker exposures in a given area; they do not directly represent the actual exposure of any worker on the day(s) of sampling. As such, area sampling results cannot be directly compared to occupational exposure limits to determine compliance with occupational exposure limits. Rather, the results are used to assess the potential for workers exposures to exceed the applicable OELs.
- The concentration of flammable gases in the SPSLS Room reached 14% of the LEL (for methane) on July 14, 2020. While still within the regulated limit under the COHSR (<50% of the LEL), it should be noted that this would exceed the applicable regulated limit (<10% of the LEL) when a potential ignition source is present, including when hot work is conducted.
  - Based on the results, it is recommended that any work to be conducted within or near the SPSLS Room that involves hot work, or that could introduce potential ignition sources into or near the room, is completed only after appropriate control measures have been put in place. Such control measures would commonly include, but are not necessarily limited to, additional ventilation of the space and ongoing gas monitoring before, during, and after the work.
  - It is further recommended that any proposed control measures are reviewed by a qualified health and safety professional, such as a Certified Industrial Hygienist (CIH), Registered Occupational Hygienist (ROH), Canadian Registered Safety Professional (CRSP) or Certified Safety Professional (CSP) prior to their implementation.
  - PSPC may wish to consider the completion of additional long-term LEL monitoring within the SPSLS Room to evaluate the frequency and intensity of spikes in flammable gas concentrations within the room, thus allowing for the application of more targeted and robust control measures for future work in the space.
- A detailed review of all equipment in the subject areas by an electrician or electrical engineer to establish its potential as an ignition source was not conducted, however, based on discussions with CSC staff and visual observations of the types of equipment present, no obvious sources of an ignition hazard (e.g. equipment that could readily create sparks, flames, etc. were identified in the subject areas.
- As per the COHSR, a copy of this report must be provided to the Joint Health and Safety Committee and posted in one or more areas within the workplace where workers at the facility are likely to see it

- As per requirements of the NJC OHSD, a record of the air sampling results contained within this report must be retained for a minimum five-year period.
- Stantec would recommend that the results of this study are also shared with any affected and participating individuals.

Additional information regarding our findings and recommendations can be found in **Sections 7.0 through 10.0** of this report.

The statements made in this Executive Summary text are subject to the same limitations included in the Limitations and Closure sections of this report.

Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
CIH	Certified Industrial Hygienist
CO	carbon monoxide
COHSR	*Canada Occupational Health and Safety Regulations*
CRSP	Canadian Registered Safety Professional
CSC	Correctional Service of Canada
CSP	Certified Safety Professional
H_2S	hydrogen sulfide
IRSST	Institute de recherche Robert-Sauvé en santé et en sécurité du travail
LEL	lower explosive limit
NH_3	ammonia
NIOSH	National Institute of Science and Technology
NJC OHSD	National Joint Council Occupational Health and Safety Directive
NO_2	nitrogen dioxide
O_2	oxygen
OEL	occupational exposure limit
PEV	permissible exposure value
PPE	personal protective equipment
PSPC	Public Services and Procurement Canada
REL	Recommended Exposure Limit
ROH	Registered Occupational Hygienist
SO_2	sulfur dioxide
SPSLS	Sump Pump & Sewage Lift Station
STEL	short-term exposure limit

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was commissioned by Public Services and Procurement Canada (PSPC) to assess for the presence of various sewer gases that could be introduced to the Sump Pump & Sewage Lift Station Room (SPSLS Room) and adjacent tunnels (subject areas) via sewage treatment activities undertaken in the SPSLS Room. The objectives of the assessment were:

1. To evaluate the potential for Correctional Service of Canada (CSC) guards and other workers spending time in the subject areas, to be exposed to specific airborne chemical agents associated with sewer gas at concentrations exceeding applicable occupational exposure limits (OELs), as set out within the *Canada Labour Code, Part II, Canada Occupational Health and Safety Regulations (COHSR)* and/or *National Joint Council Occupational Health and Safety Directive (NJC OHSD)*.
2. To assess for the presence of flammable gases within the subject areas and conduct interviews with knowledgeable site staff and a non-destructive visual review of the subject areas, with the aim of noting readily-identifiable ignition sources that could present a flammability/explosion risk within the subject areas in support of planned upcoming renovations.

The assessment was conducted at the CSC Kent Institution (subject site) located at 4732 Cemetery Road, Agassiz, British Columbia.

Spot measurements and continuous monitoring of ammonia (NH_3), carbon monoxide (CO), hydrogen sulfide (H_2S), sulfur dioxide (SO_2), was conducted in the two subject areas over a continuous period of approximately 72-hours using real-time monitoring equipment with datalogging capabilities. Oxygen (O_2) concentrations were also monitored continuously over this period to confirm adequate O_2 levels both for human occupancy and proper function of the flammable gas detection (LEL) sensor (see below).
Air samples for nitrogen dioxide (NO_2) in the two subject areas were also collected in each of the two subject areas on each of the three days of the monitoring period.

The assessment also included the use of continuous monitoring devices (calibrated to methane) to determine the percentage of the lower explosive limit (LEL) of flammable gases in the two subject areas, as well as interviews with the site escort, and the collection of visual observations to evaluate for the presence of readily-identifiable ignition sources.

The assessment was conducted by Amanda Bell of Stantec on July 14 through July 17, 2020.

2.0 SITE DESCRIPTION

The subject areas consist of four subterranean tunnels laid out in a square and separated by fire doors, with the north tunnel containing an access door to the Sump Pump & Sewage Lift Station Room. The tunnels connect the administration/discharge building, pc programs corridor, living units, kitchen, academic centre and the Sump Pump & Sewage Lift Station room. The typical structural components and finishes associated with the subject areas consist of bare concrete floors, walls, and ceilings. Electrical conduits and a sprinkler system run throughout the tunnels and the main power box for the institution is located in the north tunnel. The main power box is enclosed in a metal casing and approximately ten feet away from the door to the SPSLS Room door.

CSC guards are present at the site 24 hours a day, 7 days a week, but typically spend minimal amounts of time within the subject areas. The tunnels are only used for movement between locations except when specific construction/renovation projects within the tunnels are undertaken. Every four hours, the guards switch posts, using the tunnels to travel between posts. A maximum of 11 guards would be present simultaneously within the tunnels, with typically no more than two guards simultaneously present within a single tunnel. During the assessment, workers were present in the east tunnel for a security camera upgrade. Lockers are present in the east tunnel; no guards were observed using the lockers at the time of the assessment.

CSC guards at the subject building typically work a 7.5 hour shift, 5 days a week, but guards can work up to 12-hours a shift. The maximum typical work hours for a guard over any given week is 37.5 hours. For the purposes of evaluating area sampling results over this assessment, the worst-case scenario of 12-hour extended shift lengths was applied (see further details in Section 4.0)

3.0 SCOPE OF WORK

The occupational exposure assessment conducted by Stantec was completed over a consecutive period of approximately 72 hours (spanning July 14–17, 2020) and included the following activities:

- Execution of approved investigation strategy to determine if there is a potential for adverse health effects to CSC guards or contractors under the *Canada Labour Code Part II, Canada Occupational Health and Safety Regulations* or *National Joint Council OHS Directive*, including:
  - Use, calibration, and maintenance of sampling equipment in accordance with manufacturer recommendations and in accordance with good industrial hygiene practices, such as those endorsed by the American Industrial Hygiene Association.
  - Pre- and post-use verification measures and/or daily bump and/or performance testing of sampling equipment, where possible and where doing so does not present a safety hazard to Stantec or CSC staff.
  - Collection of a representative number of samples according to approved or accredited methodologies by recognized authorities, such as the US National Institute for Safety and Health (NIOSH) or US Occupational Safety and Health Administration (OSHA).
    - Continuous monitoring, with datalogging at regular intervals, in the Sump Pump & Sewage Lift Station room and one in the north tunnel adjacent to the room for the concentrations of ammonia (NH_3), carbon monoxide (CO), hydrogen sulfide (H_2S), lower explosive limit (LEL), oxygen (O_2) and sulfur dioxide (SO_2) on each of the three days and nights of sampling.
    - Collection of spot measurements throughout the tunnels for the concentrations of ammonia (NH_3), carbon monoxide (CO), hydrogen sulfide (H_2S), lower explosive limit (LEL), oxygen (O_2) and sulfur dioxide (SO_2) once in the morning and once in the afternoon of each of the three days of sampling.
    - Collection of two long-term area samples for nitrogen dioxide (NO_2) on each of the three days of sampling.
    - Collection of one field blank sample for nitrogen dioxide (NO_2) on each of the three days of sampling for quality assurance/quality control purposes.
- Submission of samples for analysis to SGS Galson Laboratories, an AIHA-accredited laboratory with proficiency in the analytical methodologies employed.

- Interpretation of the laboratory results and continuous monitoring data, including comparison of results against appropriate federal occupational exposure limits, and other guideline long-term exposure limits.

- Visual assessment for any readily identifiable ignition sources that could present a flammability/explosion risk within the subject areas in the presence of flammable gases.

4.0 OCCUPATIONAL EXPOSURE LIMITS AND GUIDELINES

The CSC is regulated by the *Canada Occupational Health and Safety Regulations (SOR/86-304)* (COHSR) made under Part II of the *Canada Labour Code.* Part X of the COHSR prescribes as regulation those occupational exposure limits (OELs) for airborne hazardous substances set forth in the most recent version (2019 edition) of the *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* published by the American Conference of Governmental Industrial Hygienists (ACGIH). Occupational exposure limits (OELs) for the evaluated compound(s) are generally expressed as time-weighted average (TWA) limits, 15-minute short-term exposure limits (STEL), or ceiling limits. The different types of exposure limit are defined as follows.

- 8-hr occupational exposure limit (TWA): the time-weighted average airborne concentration of a biological or chemical agent to which a worker may be exposed in an eight-hour workday, over a 40-hour work week.
- Short-term exposure limit (STEL): the maximum airborne concentration of a biological or chemical agent to which a worker may be exposed:
  - In any 15-minute period,
  - No more than four times during an eight-hour work shift, and
  - With at least one hour between exposures
- Ceiling limit: the maximum (i.e., peak) airborne concentration of a biological or chemical agent to which a worker may be exposed at any time.

Most TWA OELs are established based on the assumption that exposure occurs over an 8-hour period, following which exposure to the substance in question ceases, and the body is allowed to recover for the next 16 hours. When work shifts exceed eight hours, the recovery period is shortened, and the employer must ensure the worker is still protected by not permitting the worker's exposure to exceed an adjusted TWA-OEL. The adjusted TWA-OEL is established by starting with the 8-hour TWA-OEL value and lowering it by multiplying it by an appropriate reduction factor (expressed as a fraction or decimal value that is always less than 1). STELs and ceiling limits are intended to provide protection against short-term exposures and are therefore not adjusted for extended work shifts.

Many methods exist to determine the appropriate reduction factor for extended shifts. For the purposes of this project, Stantec used the method endorsed by Québec's Institute de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST), as set forth in their *Technical Guideline T-22: Guide for the adjustment of permissible exposure values (PEVs) for unusual work schedules, Edition 4.* This method is widely regarded as one of the most accurate methods available relative to what actually occurs to chemicals in the body from a toxicological/ pharmacokinetic perspective. The IRSST method involves classification of substances into the following categories:

- Those that present a very low overall health risk (e.g., irritation) or where adjustment is otherwise not necessary to protect workers,

- Those that cause effects after short-term exposure (i.e., effects occurring immediately or after short periods of exposure),
- Those that cause effects after long-term exposure (i.e., effects occurring after days to weeks of continuous exposure), and
- Those that cause effects after both short-term and long-term exposures.

Where necessary, the basis upon which the applicable occupational exposure limits were established was reviewed to determine the appropriate IRSST categorization.

For the purposes of this project, substances categorized as being able to cause health effects after short-term or both short-term and long-term exposure had their TWA-OELs adjusted to protect against possible overexposures during extended daily shifts, using the following formula:

$$\text{Daily Reduction Factor} = 8/T_d, \text{ where } T_d = \text{exposure duration (in hours) per shift}$$

For these substances, the TWA-OEL was reduced by multiplying the 8-hr TWA-OEL by a factor of 0.67 (the “standard” shift length of 8 hours divided by the worst-case extended shift length of 12 hours). Because officers’ typical weekly shift lengths (37.5 hours) are less than or equal to a “standard” 40-hour work week, no adjustments to TWA-OELs were required for substances categorized as only being able to cause health effects after long-term exposure.

Where an ACGIH TWA, STEL or ceiling value has not been published and an equivalent guideline US National Institute of Science and Technology (NIOSH) Recommended Exposure Limit (REL) exists, the REL is cited in this report as a guidance exposure limit.

5.0 METHODOLOGY

The following methodologies were used for the collection of samples and subsequent laboratory analysis and the collection of continuous air monitoring data. Occupational air sampling and analysis was conducted following recognized industrial hygiene protocols and procedures.

Long-term area air samples and continuous monitoring equipment collected/used during the assessment were placed on tripods at an approximate height of 1.5 to 2 metres above floor level, roughly representative of human head height.

During the sampling program, other pertinent information regarding work conditions during the shift (e.g., fan operating conditions within the tunnels, readily-identifiable ignition sources within the subject areas, CSC guard work activities) were directly observed and/or this information was obtained from discussions with the site escort.

Details for each of the sampling methodologies are provided below. Long-term area sampling results are considered representative of the conditions in the measurement areas over the course of a typical shift.

5.1 AIR SAMPLING

5.1.1 Nitrogen Dioxide

The long-term area samples were collected using SKC UMEx 200 passive sampling badges. Two long-term area samples were collected each day for a total of six samples over the course of the assessment. One long-term sample was collected within the SPSLS Room and one outside the room in the north tunnel each day. The sampling media was kept in a light sensitive bag both prior to and following sample collection to preserve sample integrity prior to analysis.

The samples were submitted to SGS Galson Laboratories for analysis of nitrogen dioxide by ion chromatography, following the US Occupational Safety and Health Administration Method ID-182 (modified).

The sampling protocol included the analysis of a total of three field blanks (one per day of sampling) for quality control purposes. Collection and analysis of field blanks was performed to verify that the sampling procedures did not introduce contamination in the sampling media which would cause results to be biased high. Field blank samples were handled, stored and shipped in the same manner as other sampling media. No concerns with field blank results were noted.

5.2 Continuous MONITORING AND SPOT MEASUREMENTS

Continuous air monitoring and logging of data was performed using monitors placed in the SPSLS Room and in the north tunnel, adjacent to the SPSLS Room (providing area air sampling data) during the assessment.

Teflon tubing was used for connections between sampling tripods and continuous monitoring equipment to ensure no impact on sampling results. Ranges of measurements were recorded over the full approximately 72-hour sampling period in each location, with only brief pauses for the collection of spot measurements twice daily, throughout the tunnels and SPSLS Room, near the start and near the end of the day shift..

The applicable specifications for each type of direct-reading instrument used are provided in the table below.

Table 5.2.1 Direct-Reading Instrument Specifications

Direct-Reading Instrument	Sensor/Parameter	Range	Resolution
Pine Environmental MultiRAE	NH_3	<1–100 ppm	1 ppm
	H_2S	<0.1–200 ppm	0.1 ppm
	LEL	<1–100 %	1 %
	O_2	<0.1–30% by volume	0.1 % by volume
	SO_2	<0.1–20 ppm	0.1 ppm
Pine Environmental ToxiRAE	CO	<1–500 ppm	1 ppm

Airborne concentrations of ammonia (NH_3), carbon monoxide (CO), hydrogen sulfide (H_2S) and sulfur dioxide (SO_2) were measured and logged using Pine Environmental MultiRAE and ToxiRAE area monitors equipped with individual sensors responsive to each gas. Percent oxygen (O_2) by volume and the percent of the lower explosive limit (LEL) for methane were also measured and logged.

At the start of the sampling fieldwork, one MultiRAE and one ToxiRAE monitor were placed inside the SPSLS Room, and one MultiRAE and one ToxiRAE monitor were placed outside the SPSLS Room in the north tunnel. The equipment was allowed to run continuously throughout the approximately 72-hour assessment period to measure concentrations of the above-noted gases, except during calibrations and while briefly being used for the collection of spot measurements throughout the tunnels. Multi-gas monitors were set to datalog at 10-second intervals.

The percent lower explosive limit (LEL) sensor on the MultiRAE was calibrated to methane gas, which is most typically used for comparison against published LEL limits. Due to equipment error, it was not possible to re-calibrate the LEL sensor on the MultiRAE located within the SPSLS Room on the afternoon of July 16 and the morning of July 17, 2020. Due to the consistency of readings collected throughout the assessment period, and based on the manufacturer’s suggestion that calibration should not be required on a daily basis, sensor readings are still considered valid.

Calibration and bump test certificates for each MultiRAE and ToxiRAE unit used during this assessment are provided in Appendix H.

5.2.1 Quality Assurance and Quality Control

At the start and end of each day, the MultiRAE instruments underwent a full calibration using the appropriate calibration gas via an automated docking station (RAE Systems AutoRAE 2) connected to appropriate calibration gases (NH_3, H_2S, O_2, SO_2).

At the start and end of each day, the ToxiRAE instruments underwent a full calibration using zero air and carbon monoxide calibration gas.

Calibration certificates for the real-time detection equipment used during this assessment are provided in Appendix H.

6.0 RESULTS AND DISCUSSION

6.1 AIR SAMPLING

During the occupational exposure assessment, air samples were collected as noted in the above Scope of Work and Methodology sections. The sections below summarize the air sampling results for each parameter.

6.1.1 Nitrogen Dioxide

Airborne concentrations of nitrogen dioxide (NO_2) were measured via long-term area sampling. Results were found to be well below the applicable regulated time-weighted average occupational exposure limit of 0.13 ppm, as adjusted for a 12-hour shift length in area samples collected, and below the limit of detection for the analytical method (< 0.5 µg).

A summary table detailing individual sample results and the laboratory analytical report can be found in **Appendix A**.

Results of the field blank laboratory analysis were satisfactory and did not suggest a quality control issue with the samples.

6.2 CONTINUOUS MONITORING

During the occupational exposure assessment, continuous monitoring was conducted using various direct-reading instruments as noted in the above Scope of Work and Methodology sections. The sections below summarize the findings for each type of measurement collected.

Where a short-term exposure limit (STEL) was specified for the parameter in question, the continuous monitoring data was divided into running 15-minute averages, beginning at the start of the monitoring period and ending at the end of the monitoring period for each officer or booth (i.e., the end of each sample), or the end of the sampling period in the case of the continuous monitoring data collected from the secondary inspection area. In this way, every possible 15-minute average within the measured dataset was evaluated against the applicable STEL.

Based on the measurement results, readings obtained using the electrochemical sensors for NH_3, CO, H_2S, LEL, O_2, or SO_2 are not anticipated to have been significantly impacted by negative or positive sensor interferences from other gases to which the sensors are known to react.

6.2.1 Ammonia, Carbon Monoxide, Hydrogen Sulfide, Lower Explosive Limit, Oxygen, and Sulfur Dioxide

Over the three-day sampling period, airborne concentrations of NH_3, CO, H_2S, SO_2, oxygen (O_2) and the percent of the lower explosive limit (LEL) for methane were monitored in the SPSLS Room and in the north tunnel adjacent to the SPSLS Room using real-time monitoring equipment.

A summary of the monitoring results is shown in the table below. Logged concentration data for each parameter measured via continuous monitoring in the two locations are provided in the graphs in Appendix B to Appendix G. Each graph shows the time-varying concentration of each individual parameter recorded at 60-second intervals.

6.2.1.1 Ammonia

During this assessment, the concentration of NH_3 during the continuous monitoring was well below the regulated TWA OEL of 25 ppm, applicable for a 12-hour shift length. Concentrations of NH_3 were also well below the regulated 15-min STEL of 35 ppm.

6.2.1.2 Carbon Monoxide

During this assessment, the concentration of CO during the continuous monitoring was less than the applicable regulated TWA OEL of 16.7 ppm, adjusted for a 12-hour shift length. Concentrations of CO were also well below the guideline NIOSH ceiling limit of 200 ppm.

6.2.1.3 Hydrogen Sulfide

During this assessment, the concentration of H_2S during the continuous monitoring was below the regulated TWA OEL of 1 ppm applicable for a 12-hour shift length. Concentrations of H_2S were also well below the regulated 15-min STEL of 5 ppm.

6.2.1.4 Sulfur Dioxide

During this assessment, the concentration of SO_2 during the continuous monitoring was below the adjusted guideline NIOSH REL of 2 ppm, applicable for a 12-hour shift length. Concentrations of SO_2 were also well below the regulated 15-min STEL of 0.25 ppm.

6.2.1.5 Oxygen

During this assessment, the percent by volume of O_2 during the continuous monitoring was consistently at normal atmospheric levels (20.9%), above the regulated oxygen-deficiency limit of 18% and below the acceptable upper oxygen concentration limit for hot work of 23%.

6.2.1.6 Lower Explosive Limit (LEL)

During this assessment, percent LEL measurements were well below the regulated limit of 50% of the LEL for environments in which no ignition sources are present and no hot work is conducted. The highest recorded percent LEL values (14%) were identified within the SPSLS Room on July 14, 2020. While still well within the regulated OEL, these values would exceed the limit of 10% of the LEL applicable when hot work is conducted or when ignition sources are present.

6.3 VISUAL OBSERVATIONS/STAFF INTERVIEW FINDINGS

- CSC guards observed by Stantec to be using the tunnels during the three monitored day shifts did not wear personal protective equipment (PPE) associated with hazardous chemical exposure control (e.g. respiratory protection, etc.). The workers present in the east tunnel upgrading the security cameras were also not observed to use any PPE.
- A detailed review of all equipment present by an electrician or electrical engineer to establish its potential as an ignition source was not conducted, however, based on discussions with CSC staff and visual observations of the types of equipment present, no obvious sources of an ignition hazard (e.g. equipment that could readily create sparks, flames, etc. were identified in the subject areas.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on site observations, the results of continuous air monitoring and laboratory analysis of air samples, and statistical analysis of the results, the following conclusions are provided:

- Long-term area air sampling and continuous monitoring results collected in the tunnel and SPSLS Room during the assessment were less than the applicable published occupational exposure limits (OELs) for the measured parameters. This suggests the actual exposures of CSC guards and workers to the measured parameters were likely to have been acceptable over the assessment period.
  - Note that area sample results are indicative of the potential for worker exposures in a given area; they do not directly represent the actual exposure of any worker on the day(s) of sampling. As such, area sampling results cannot be directly compared to occupational exposure limits to determine compliance with occupational exposure limits. Rather, the results are used to assess the potential for workers exposures to exceed the applicable OELs.
- The concentration of flammable gases in the SPSLS Room reached 14% of the LEL (for methane) on July 14, 2020. While still within the regulated limit under the COHSR (<50% of the LEL), it should be noted that this would exceed the applicable regulated limit (<10% of the LEL) when a potential ignition source is present, including when hot work is conducted.
  - Based on the results, it is recommended that any work to be conducted within or near the SPSLS Room that involves hot work, or that could introduce potential ignition sources into or near the room, is completed only after appropriate control measures have been put in place. Such control measures would commonly include, but are not necessarily limited to, additional ventilation of the space and ongoing gas monitoring before, during, and after the work.
  - It is further recommended that any proposed control measures are reviewed by a qualified health and safety professional, such as a Certified Industrial Hygienist (CIH), Registered Occupational Hygienist (ROH), Canadian Registered Safety Professional (CRSP) or Certified Safety Professional (CSP) prior to their implementation.
  - PSPC may wish to consider the completion of additional long-term LEL monitoring within the SPSLS Room to evaluate the frequency and intensity of spikes in flammable gas concentrations within the room, thus allowing for the application of more targeted and robust control measures for future work in the space.
- A detailed review of all equipment in the subject areas by an electrician or electrical engineer to establish its potential as an ignition source was not conducted, however, based on discussions with CSC staff and visual observations of the types of equipment present, no obvious sources of an ignition hazard (e.g. equipment that could readily create sparks, flames, etc. were identified in the subject areas.
- As per the COHSR, a copy of this report must be provided to the Joint Health and Safety Committee and posted in one or more areas within the workplace where workers at the facility are likely to see it
- As per requirements of the NJC OHSD, a record of the air sampling results contained within this report must be retained for a minimum five-year period.
- Stantec would recommend that the results of this study are also shared with any affected and participating individuals.

8.0 CLOSURE

This report has been prepared for the sole benefit of Public Services and Procurement Canada (PSPC). The report may not be used by any other person or entity without the express written consent of Stantec Consulting Ltd. and PSPC.

Any use which a third party makes of this report, or any reliance on decisions based on it are the responsibility of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The information and conclusions contained in this report are based upon work undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. Conclusions presented in this report should not be construed as legal advice.

The conclusions presented in this report represent the best technical judgment of Stantec Consulting Ltd. based on the data obtained from the work. The conclusions are based on the site conditions encountered by Stantec Consulting Ltd. at the time the work was performed at the specific inspection and/or sampling locations, and can only be extrapolated to an undefined limited area around these locations. The extent of the limited area depends on building construction and conditions, weather, building usage and other factors. Due to the nature of the assessment and the limited data available, Stantec Consulting Ltd. cannot warrant against undiscovered environmental liabilities.

Should additional information become available, Stantec requests that this information be brought to our attention so that we may re-assess the conclusions presented herein.

This report was prepared by Amanda Bell, and reviewed by Craig Maunder, and Sean Brigden.

Closure
August 14, 2020

We trust that this information is sufficient for your requirements at the present time. Should you or your colleagues have any questions, or require any additional information, please do not hesitate to contact the undersigned at your convenience.

Respectfully Submitted,

STANTEC CONSULTING LTD.

Amanda Bell B.Sc., E.Pt.
Environmental Technologist
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Reviewed by:

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Senior Associate
Phone: 250-655-6062
Sean.Brigden@stantec.com

AB/CM/SW/RR/jt

APPENDIX A

Summary of Results – Nitrogen Dioxide Air Samples

Table 1
Air Monitoring Results
CSC Kent Institution
4732 Cemetery Road, Agassiz, BC
July 14 - 16, 2020

SAMPLE # / ID	SAMPLE DATE	NAME / AREA	LOCATION / ACTIVITY / FREQUENCY	DURATION (MINS)	PARAMETER ANALYZED	ANALYTICAL RESULTS	REGULATED OEL (as an adjusted 12-hr TWA)*	
S-01	14-Jul-20	Sump Pump & Sewage Lift Station Room	Area sample - positioned between the empty work desk on the east side of the room and the sump pump	298	Nitrogen Dioxide (NO_2)	<0.05 ppm	0.13	ppm
S-02	14-Jul-20	North Tunnel Outside Sump Pump & Sewage Lift Station Room	Area sample - positioned in the north tunnel, west of the Sump Pump & Sewage Lift Station door	298	Nitrogen Dioxide (NO_2)	<0.05 ppm	0.13	ppm
S-03	15-Jul-20	Sump Pump & Sewage Lift Station Room	Area sample - positioned between the empty work desk on the east side of the room and the sump pump	437	Nitrogen Dioxide (NO_2)	<0.03 ppm	0.13	ppm
S-04	15-Jul-20	North Tunnel Outside Sump Pump & Sewage Lift Station Room	Area sample - positioned in the north tunnel, west of the Sump Pump & Sewage Lift Station door	438	Nitrogen Dioxide (NO_2)	<0.03 ppm	0.13	ppm
S-05	16-Jul-20	Sump Pump & Sewage Lift Station Room	Area sample - positioned between the empty work desk on the east side of the room and the sump pump	480	Nitrogen Dioxide (NO_2)	<0.03 ppm	0.13	ppm
S-06	16-Jul-20	North Tunnel Outside Sump Pump & Sewage Lift Station Room	Area sample - positioned in the north tunnel, west of the Sump Pump & Sewage Lift Station door	480	Nitrogen Dioxide (NO_2)	<0.03 ppm	0.13	ppm
BLANK 1	15-Jul-20	Field Blank	N/A	N/A	Nitrogen Dioxide (NO_2)	-	-	
BLANK 2	14-Jul-20	Field Blank	N/A	N/A	Nitrogen Dioxide (NO_2)	-	-	
BLANK 3	16-Jul-20	Field Blank	N/A	N/A	Nitrogen Dioxide (NO_2)	-	-	

Notes:
Results for all field blanks collected for quality control purposes were acceptable (below the laboratory analytical reporting limit)

N/A Not applicable
- or NE: None established
OEL Occupational Exposure Limit
ppm: parts per million
TWA: Time-Weighted Average

SGS GALSON

6601 Kirkville Road
East Syracuse, NY 13057
(315) 432-5227
FAX: (315) 437-0571
www.sgsgalson.com

LABORATORY ANALYSIS REPORT

Client : Stantec Consulting Ltd.
Site : KENT TUNNELS IAQ
Project No. : 123221640
Date Sampled : 14-JUL-20 - 16-JUL-20
Date Received : 30-JUL-20

Account No.: 90689
Login No. : L516121
Date Analyzed : 03-AUG-20
Report ID : 1205226

Nitrogen Dioxide

Sample ID	Lab ID	Time minutes	Total ug	Conc mg/m3	ppm
S-01 A149180	L516121-1	298	<0.5	<0.1	<0.05
S-02 A149171	L516121-2	298	<0.5	<0.1	<0.05
S-03 A149156	L516121-3	437	<0.5	<0.06	<0.03
S-04 A149167	L516121-4	438	<0.5	<0.06	<0.03
S-05 A149158	L516121-5	480	<0.5	<0.06	<0.03
S-06 A149150	L516121-6	480	<0.5	<0.06	<0.03
BLANK 1 A149160	L516121-7	NA	<0.5	NA	NA
BLANK 2 A149164	L516121-8	NA	<0.5	NA	NA
BLANK 3 A149162	L516121-9	NA	<0.5	NA	NA

COMMENTS: Please see attached lab footnote report for any applicable footnotes.

Level of Quantitation: 0.5 ug
Analytical Method : In-house: IC-SOP-14; IC
Collection Media : 500-200

Submitted by: KLS
Date : 04-AUG-20
Supervisor : MWJ

Approved by: NKP

SGS GALSON

6601 Kirkville Road
East Syracuse, NY 13057
(315) 432-5227
FAX: (315) 437-0571
www.sgsgalson.com

LABORATORY FOOTNOTE REPORT

Client Name : Stantec Consulting Ltd.
Site : KENT TUNNELS IAQ
Project No. : 123221640

Date Sampled : 14-JUL-20 - 16-JUL-20 Account No.: 90689
Date Received: 30-JUL-20 Login No. : L516121
Date Analyzed: 03-AUG-20

L516121 (Report ID: 1205226):
SOPs: IC-SOP-14(19)
Total ug corrected for a desorption efficiency of 102%.

L516121 (Report ID: 1205226):
Accuracy and mean recovery data presented below is based on a 95% confidence interval (k=2). The estimated accuracy applies to the media, technology, and SOP referenced in this report and does not account for the uncertainty associated with the sampling process. The accuracy is based solely on spike recovery data from internal quality control samples. Where N/A appears below, insufficient data is available to provide statistical accuracy and mean recovery values for the associated analyte.

Parameter	Accuracy	Mean Recovery
Nitrogen Dioxide	+/-7.3%	105%

APPENDIX B

Continuous Monitoring Data – Ammonia

Appendix B CONTINUOUS MONITORING DATA – AMMONIA

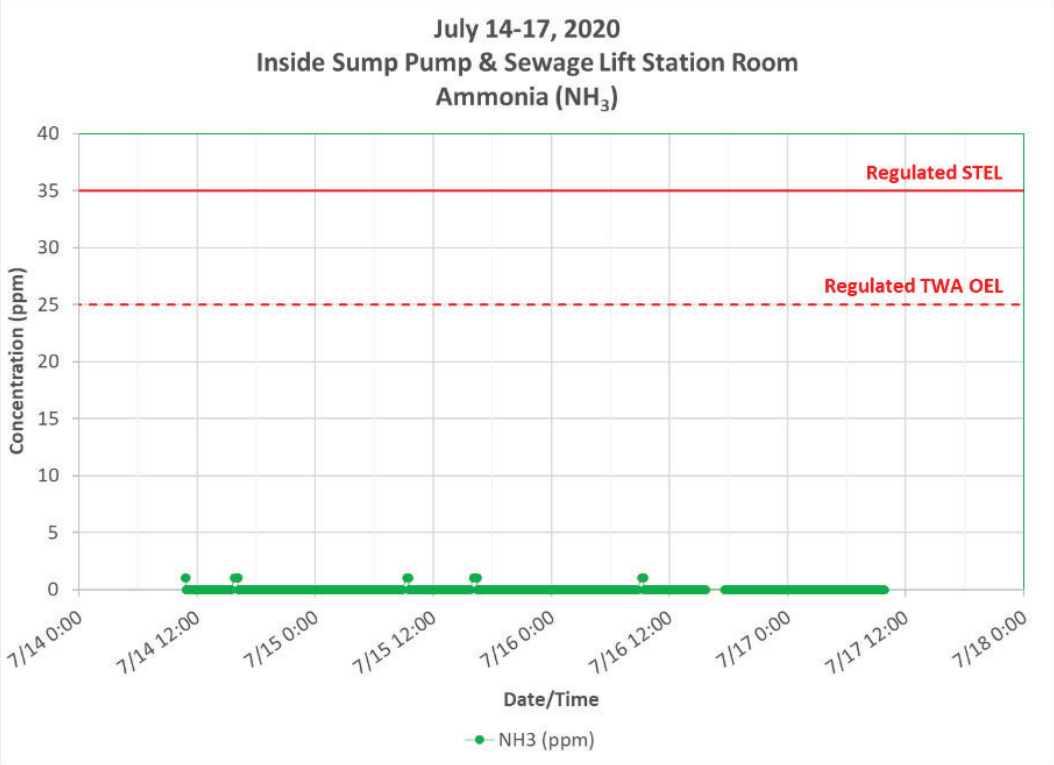

Figure 1: NH_3 concentration values measured within the SPSLS Room from July 14 through July 17, 2020. The TWA NH_3 concentration over the measurement period was less than the instrument's detection limit (<1 ppm) and well below the applicable regulated 12-hour TWA limit. 15-minute average concentrations over the assessment period were also well below the regulated STEL.

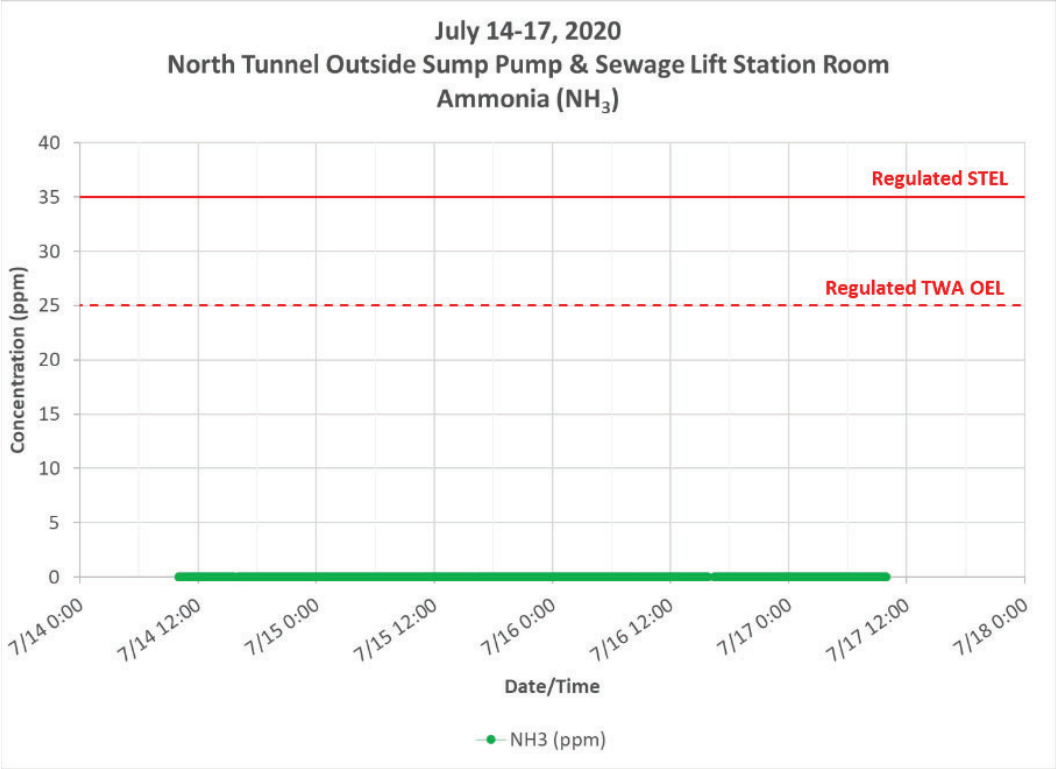

Figure 2: NH_3 concentration values measured in the north tunnel outside the SPSLS Room from July 14 through July 17, 2020. The TWA NH_3 concentration over the measurement period was less than the instrument's detection limit (<1 ppm) and well below the applicable regulated 12-hour TWA limit. 15-minute average concentrations over the assessment period were also well below the regulated STEL.

APPENDIX C

Continuous Monitoring Data – Carbon Monoxide

Appendix C CONTINUOUS MONITORING DATA – CARBON MONOXIDE

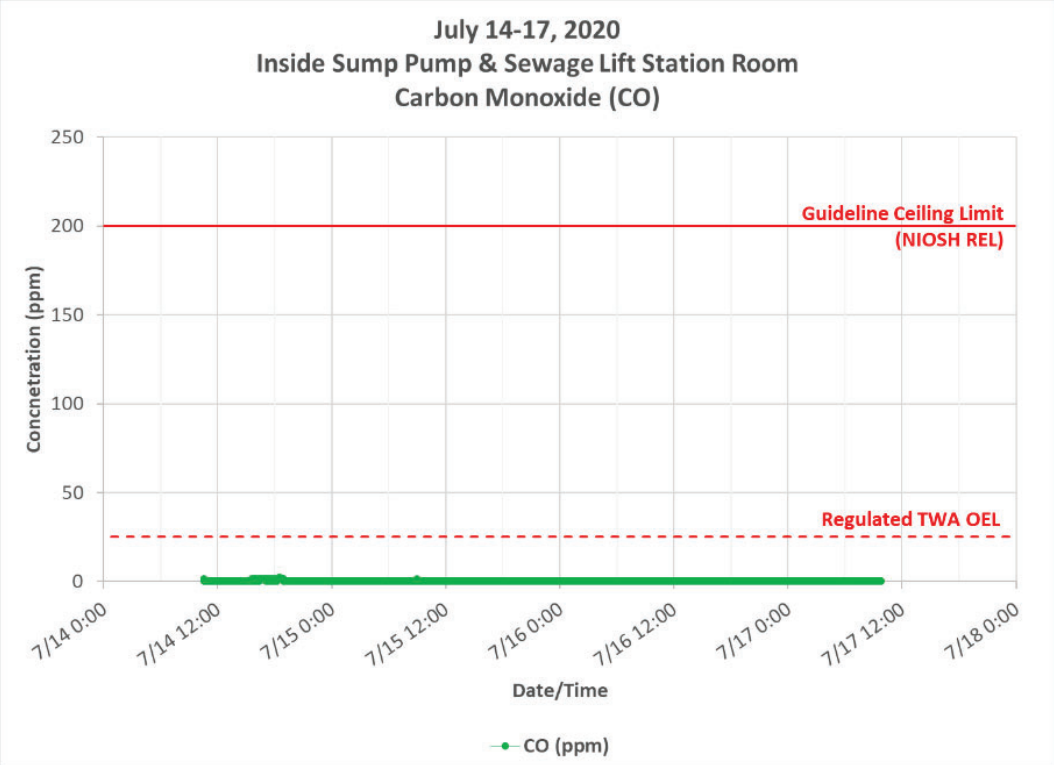

Figure 3: CO concentration values measured within the SPSLS Room from July 14 through July 17, 2020. The TWA CO concentration over the measurement period was less than the instrument's detection limit (<1 ppm) and well below the applicable regulated 12-hour TWA limit. No exceedances of the guideline 200 ppm ceiling limit occurred.

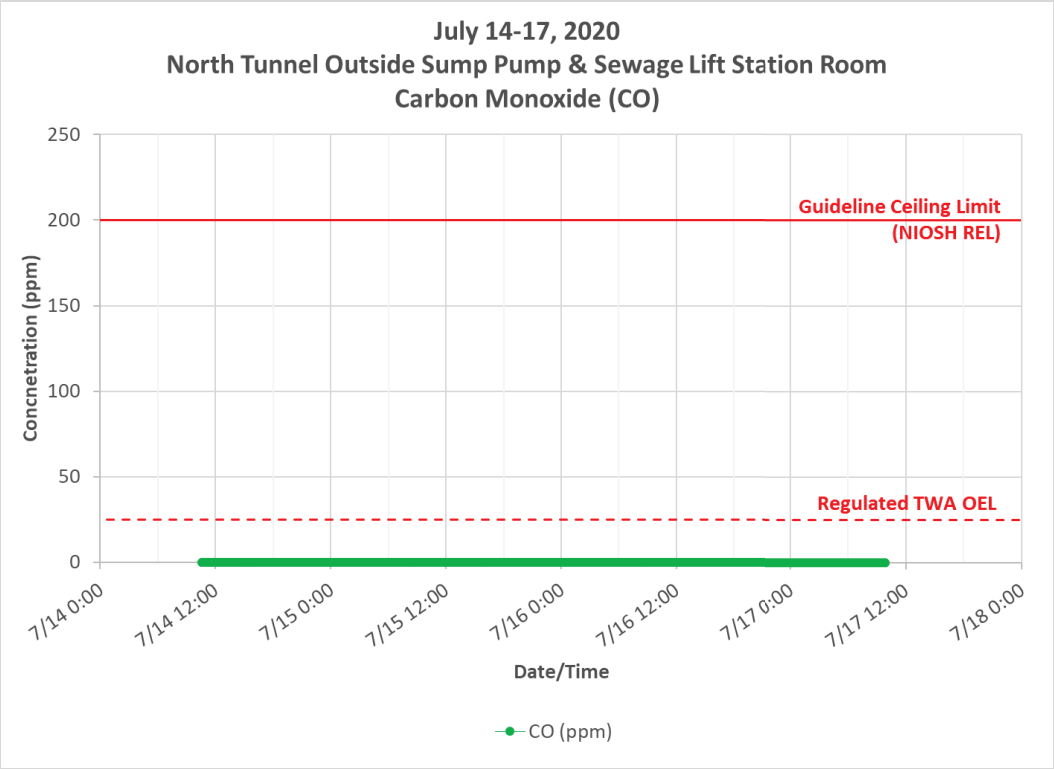

Figure 4: CO concentration values measured in the north tunnel outside the SPSLS Room from July 14 through July 17, 2020. The TWA CO concentration over the measurement period was less than the instrument's detection limit (<1 ppm) and well below the applicable regulated 12-hour TWA limit. No exceedances of the guideline 200 ppm ceiling limit occurred.

APPENDIX D

Continuous Monitoring Data – Hydrogen Sulfide

Appendix D CONTINUOUS MONITORING DATA – HYDROGEN SULFIDE

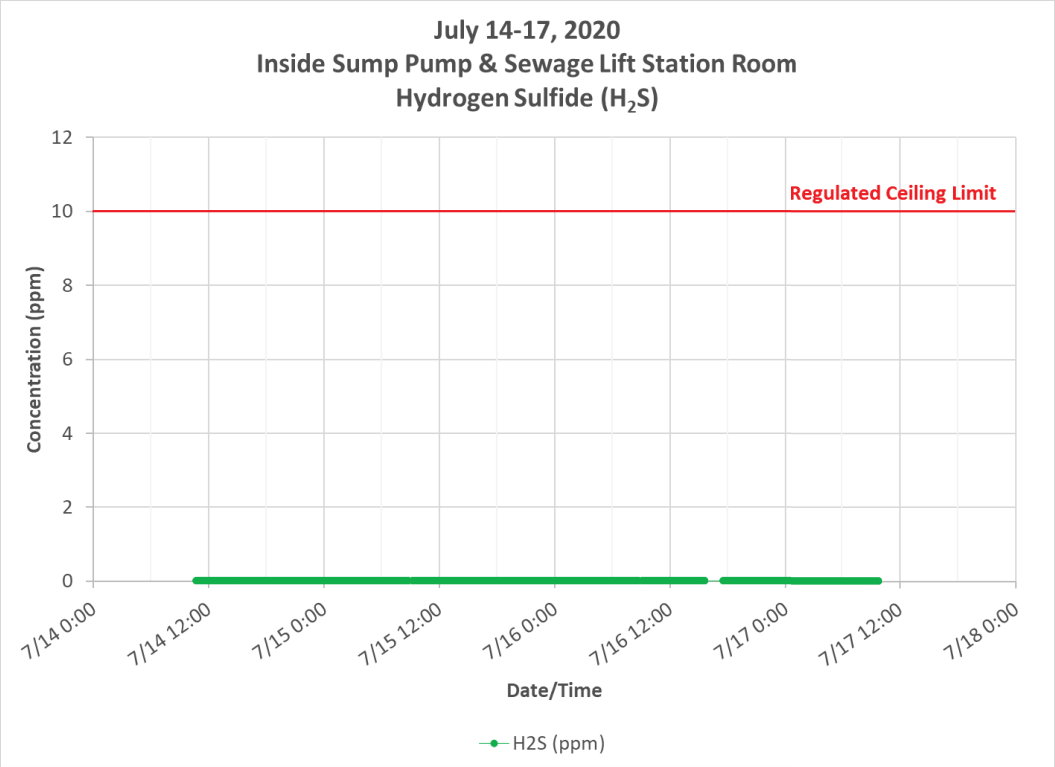

Figure 5: H_2S concentration values measured within the SPSLS Room from July 14 through July 17, 2020. The TWA H_2S concentration over the measurement period was less than the instrument's detection limit (<0.1 ppm) and well below the applicable regulated 12-hour TWA limit. 15-minute average concentrations over the assessment period were also well below the regulated STEL.

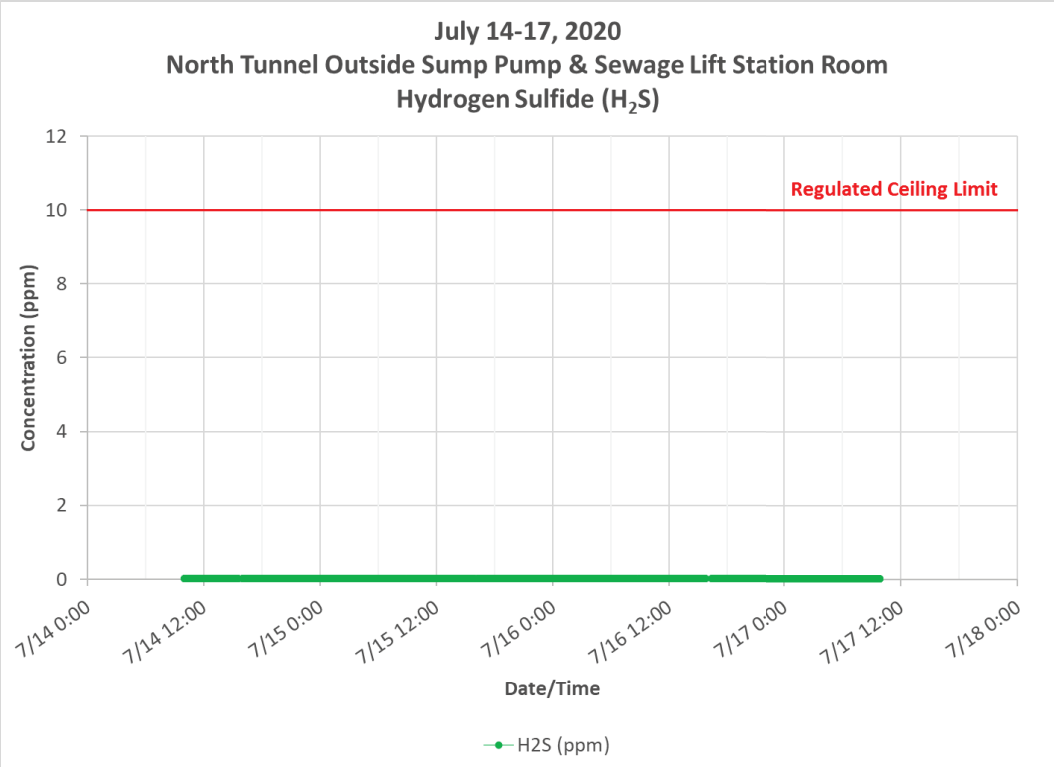

Figure 6: H_2S concentration values measured in the north tunnel outside the SPSLS Room from July 14 through July 17, 2020. The TWA H_2S concentration over the measurement period was less than the instrument's detection limit (<0.1 ppm) and well below the applicable regulated 12-hour TWA limit. 15-minute average concentrations over the assessment period were also well below the regulated STEL.

APPENDIX E

Continuous Monitoring Data – Sulfur Dioxide

Appendix E CONTINUOUS MONITORING DATA – SULFUR DIOXIDE

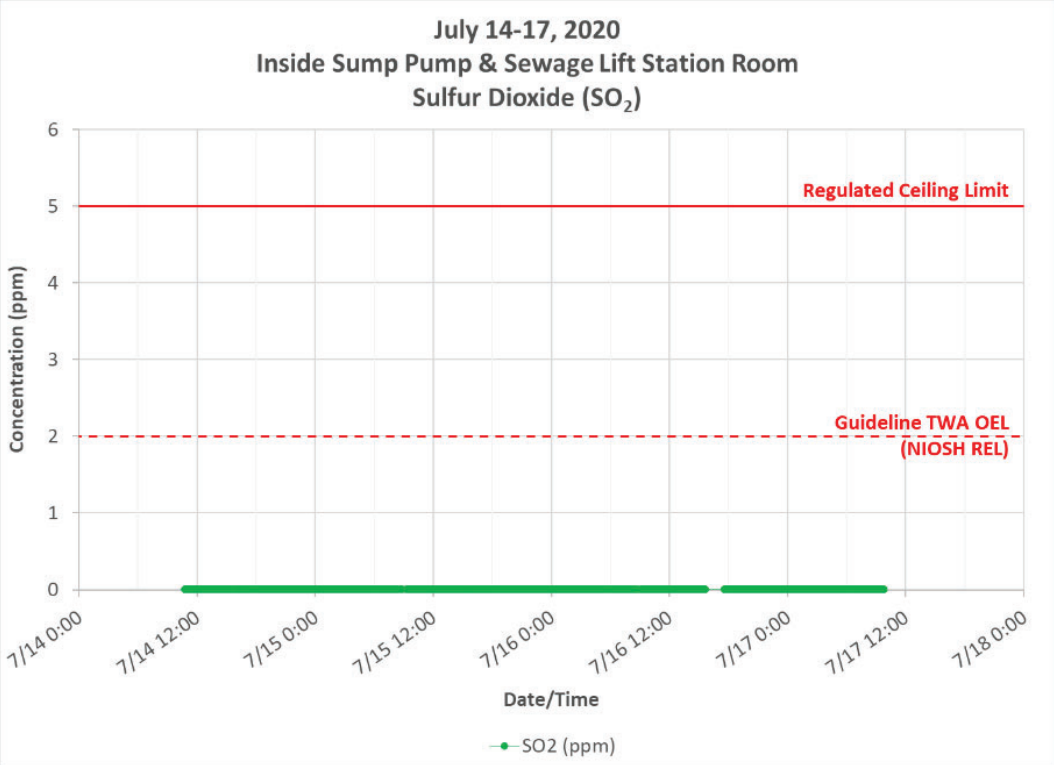

Figure 11: SO_2 concentration values measured within the SPSLS Room from July 14 through July 17, 2020. The TWA SO_2 concentration over the measurement period was less than the instrument's detection limit (<0.1 ppm) and well below the applicable guideline NIOSH 12-hour TWA limit. 15-minute average concentrations over the assessment period were also well below the regulated STEL. No exceedances of the 5 ppm ceiling limit occurred.

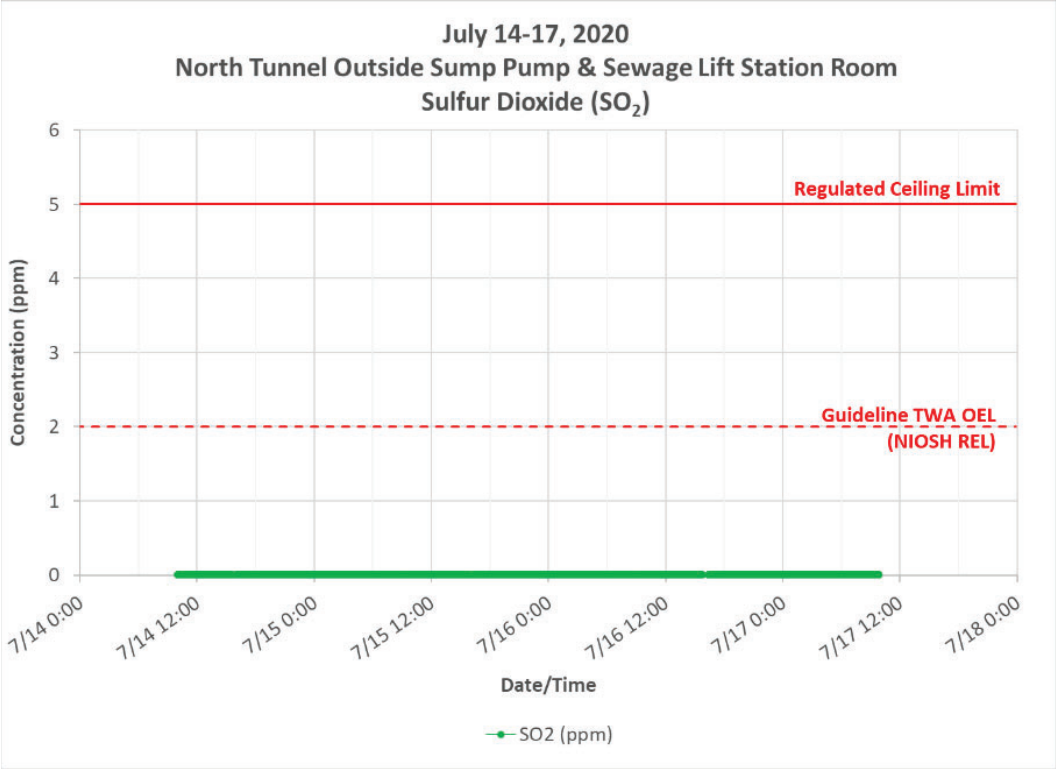

Figure 12: SO_2 concentration values measured in the north tunnel outside the SPSLS Room from July 14 through July 17, 2020. The TWA SO_2 concentration over the measurement period was less than the instrument's detection limit (<0.1 ppm) and well below the applicable guideline NIOSH 12-hour TWA limit. 15-minute average concentrations over the assessment period were also well below the regulated STEL. No exceedances of the 5 ppm ceiling limit occurred.

APPENDIX F

Continuous Monitoring Data – Oxygen

Appendix F CONTINUOUS MONITORING DATA – OXYGEN

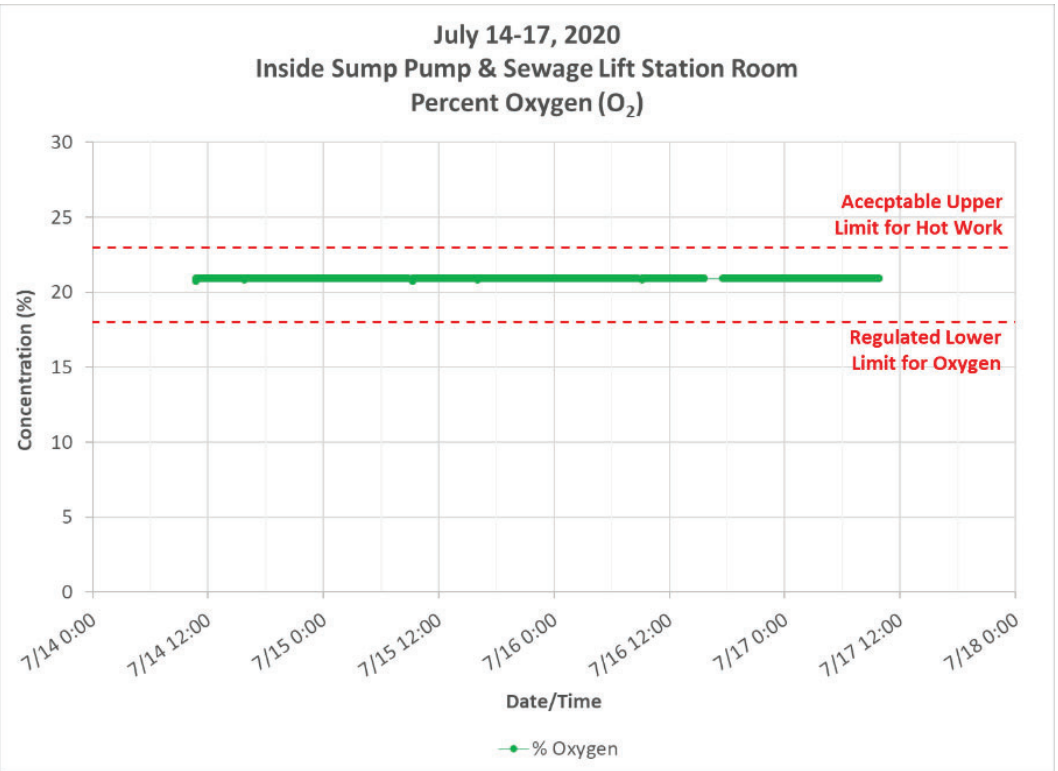

Figure 9: Percent O_2 by volume measurements within the SPSLS Room from July 14 through July 17, 2020. The percent O_2 values during the measurement period were consistent with expected atmospheric O_2 levels (20.9%), well above the regulated lower limit of 18% and the regulated upper limit of 23% for hot work.

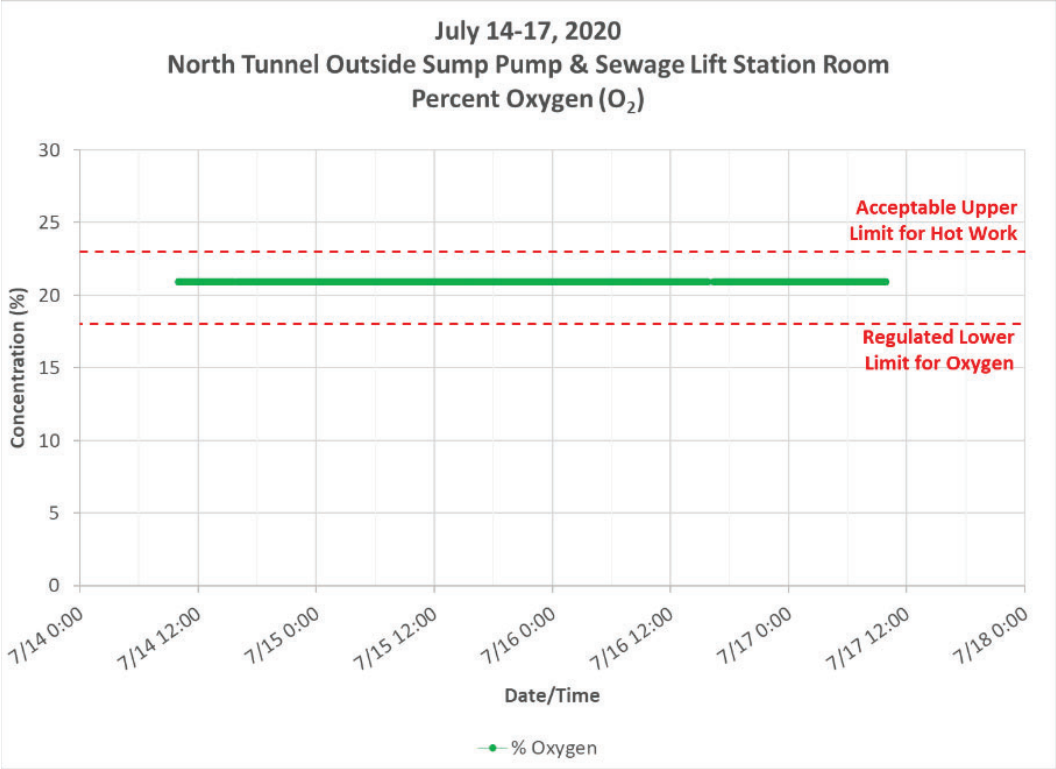

Figure 10: Percent O_2 by volume measurements in the north tunnel outside the SPSLS Room from July 14 through July 17, 2020. The percent O_2 values during the measurement period were consistent with expected atmospheric O_2 levels (20.9%), well above the regulated lower limit of 18% and the regulated upper limit of 23% for hot work.

APPENDIX G

Continuous Monitoring Data – Lower Explosive Limit

Appendix G CONTINUOUS MONITORING DATA – LOWER EXPLOSIVE LIMIT

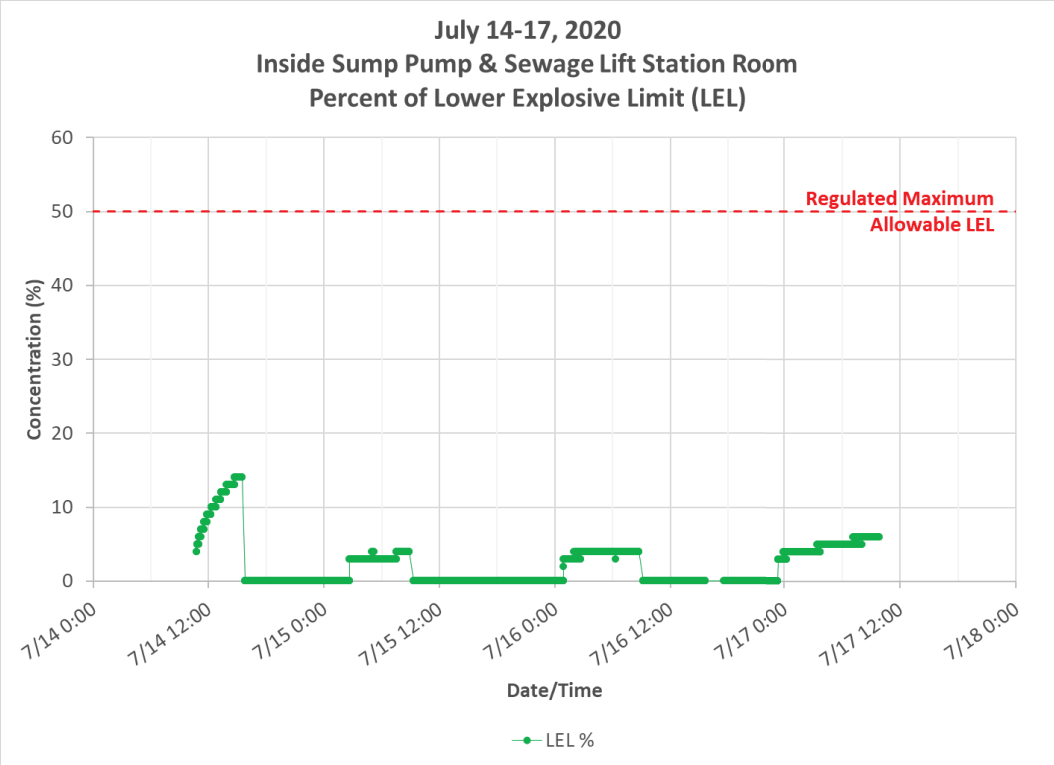

Figure 7: LEL concentration values measured within the SPSLS Room from July 14 through July 17, 2020. Percent LEL values over the measurement period were below the regulated ceiling limit of 50%. Note that the LEL sensor failed the scheduled calibration procedures on the evening of July 16 and morning of July 17, 2020, but readings remained consistent with those taken beforehand.

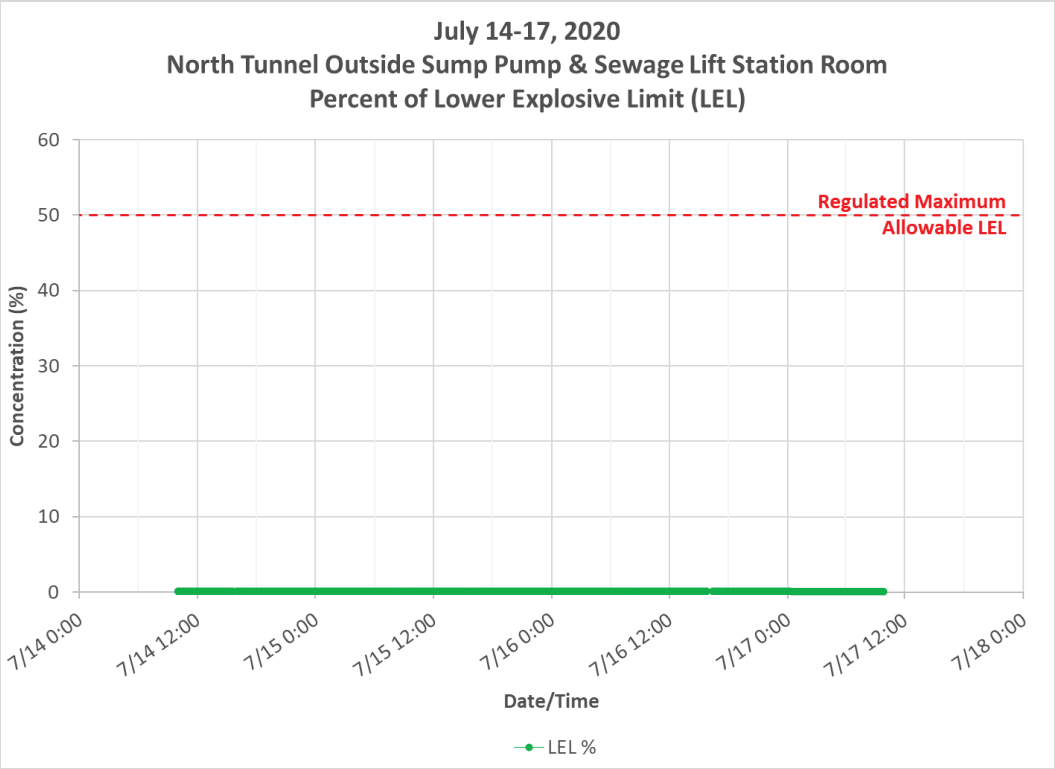

Figure 8: LEL concentration values measured in the north tunnel outside the SPSLS Room from July 14 through July 17, 2020. The percent LEL values over the measurement period were less than the instrument's detection limit (<1 %) and below the regulated limit of 50%.

APPENDIX H

Equipment Calibration Record

INSTRUMENT CALIBRATION REPORT

Pine Environmental Services LLC
3470 Gardner Court
Burnaby, BC V5G 3K4
Toll-free: (877) 678-8383

Pine Environmental Services, Inc.

Instrument ID 36337
Description AutoRAE 2 Controller
Calibrated 7/13/2020 8:57:26PM

Manufacturer	Rae Systems	**State Certified**	
Model Number	T02-0103-000	**Status**	Pass
Serial Number/ Lot Number	T021001943	**Temp °C**	23.8
Location	British Columbia	**Humidity %**	37
Department			

Calibration Specifications

Group # 1
Group Name Functionality Test
Test Performed: Yes **As Found Result: Pass** **As Left Result: Pass**

Test Instruments Used During the Calibration **(As Of Cal Entry Date)**

Test Standard ID	Description	Manufacturer	Model Number	Serial Number / Lot Number	Next Cal Date / Last Cal Date/ Expiration Date Opened Date

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated Val Eftenaru

All instruments are calibrated by Pine Environmental Services LLC according to the manufacturer's specifications, but it is the customer's responsibility to calibrate and maintain this unit in accordance with the manufacturer's specifications and/or the customer's own specific needs.

Notify Pine Environmental Services LLC of any defect within 24 hours of receipt of equipment
Please call 800-301-9663 for Technical Assistance

INSTRUMENT CALIBRATION REPORT

Pine Environmental Services LLC

3470 Gardner Court
Burnaby, BC V5G 3K4
Toll-free: (877) 678-8383

Pine Environmental Services, Inc.

Instrument ID 36334
Description AutoRAE 2 Cradle
Calibrated 7/13/2020 8:58:14PM

Manufacturer	Rae Systems	**State Certified**	
Model Number	T02-3004-000	**Status**	Pass
Serial Number/ Lot Number	T023002793TC	**Temp °C**	23.8
Location	British Columbia	**Humidity %**	37
Department			

Calibration Specifications

Group # 1
Group Name Functionality Test
Test Performed: Yes **As Found Result: Pass** **As Left Result: Pass**

Test Instruments Used During the Calibration **(As Of Cal Entry Date)**

Test Standard ID	Description	Manufacturer	Model Number	Serial Number / Lot Number	Next Cal Date / Last Cal Date/ Expiration Date Opened Date

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated Val Eftenaru

All instruments are calibrated by Pine Environmental Services LLC according to the manufacturer's specifications, but it is the customer's responsibility to calibrate and maintain this unit in accordance with the manufacturer's specifications and/or the customer's own specific needs.

Notify Pine Environmental Services LLC of any defect within 24 hours of receipt of equipment
Please call 800-301-9663 for Technical Assistance

INSTRUMENT CALIBRATION REPORT

Pine Environmental Services LLC
3470 Gardner Court
Burnaby, BC V5G 3K4
Toll-free: (877) 678-8383

Pine Environmental Services, Inc.

Instrument ID 19961
Description MultiRAE PGM6228
Calibrated 7/13/2020 8:44:03PM

Manufacturer Rae Systems
Model Number PGM6228
Serial Number/ Lot Number MBB3Z028P9
Location British Columbia
Department

State Certified
Status Pass
Temp °C 23.8
Humidity % 38

Calibration Specifications

Group # 1
Group Name SO2
Stated Accy Pct of Reading
Range Acc % 0.0000
Reading Acc % 3.0000
Plus/Minus 0.0

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
5.0 / 5.0	PPM	5.0	PPM	5.0	5.0	0.00%	Pass

Group # 2
Group Name NH3
Stated Accy Pct of Reading
Range Acc % 0.0000
Reading Acc % 3.0000
Plus/Minus 0

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
50 / 50	PPM	50	PPM	50	50	0.00%	Pass

Group # 3
Group Name CH4
Stated Accy Pct of Reading
Range Acc % 0.0000
Reading Acc % 3.0000
Plus/Minus 0

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
50 / 50	%LEL	50	%LEL	50	50	0.00%	Pass

Group # 4
Group Name O2
Stated Accy Pct of Reading
Range Acc % 0.0000
Reading Acc % 3.0000
Plus/Minus 0.0

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
18.0 / 18.0	%	18.0	%	18.0	18.0	0.00%	Pass

Group # 5
Group Name H2S
Stated Accy Pct of Reading
Range Acc % 0.0000
Reading Acc % 3.0000
Plus/Minus 0.0

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
10.0 / 10.0	PPM	10.0	PPM	10.0	10.0	0.00%	Pass

INSTRUMENT CALIBRATION REPORT

Pine Environmental Services LLC

3470 Gardner Court
Burnaby, BC V5G 3K4
Toll-free: (877) 678-8383

Pine Environmental Services, Inc.

Instrument ID 19961
Description MultiRAE PGM6228
Calibrated 7/13/2020 8:44:03PM

Test Instruments Used During the Calibration **(As Of Cal Entry Date)**

Test Standard ID	Description	Manufacturer	Model Number	Serial Number / Lot Number	Last Cal Date/ Opened Date	Next Cal Date / Expiration Date
BC(2019)_SO2	Sulfur Dioxide - 5 PPM / N2 Balance	Calgaz	31835	997049		8/30/2020
BC(2020)_NH3 - 50 PPM	NH3_50 ppm / N2 Balance	Calgaz	31735	1207194		4/30/2021
BC(2020)_QUAD - 18% O2	H2S-10ppm / CO-50ppm / CH4-50%LEL / O2-18% / N2 Balance	Calgaz	31513	1280001		2/28/2022

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated Val Eftenaru

All instruments are calibrated by Pine Environmental Services LLC according to the manufacturer's specifications, but it is the customer's responsibility to calibrate and maintain this unit in accordance with the manufacturer's specifications and/or the customer's own specific needs.

Notify Pine Environmental Services LLC of any defect within 24 hours of receipt of equipment
Please call 800-301-9663 for Technical Assistance

INSTRUMENT CALIBRATION REPORT

Pine Environmental Services LLC

3470 Gardner Court
Burnaby, BC V5G 3K4
Toll-free: (877) 678-8383

Pine Environmental Services, Inc.

Instrument ID 22061
Description MultiRae PGM6228
Calibrated 7/13/2020 8:48:35PM

Manufacturer Rae Systems
Model Number PGM6228
Serial Number/ Lot Number MBB3Z062Q8
Location British Columbia
Department

State Certified
Status Pass
Temp °C 23.8
Humidity % 38

Calibration Specifications

Group # 1
Group Name NH3
Stated Accy Pct of Reading
Range Acc % 0.0000
Reading Acc % 3.0000
Plus/Minus 0

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
50 / 50	PPM	50	PPM	50	50	0.00%	Pass

Group # 2
Group Name SO2
Stated Accy Pct of Reading
Range Acc % 0.0000
Reading Acc % 3.0000
Plus/Minus 0.0

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
5.0 / 5.0	PPM	5.0	PPM	5.0	5.0	0.00%	Pass

Group # 3
Group Name CH4
Stated Accy Pct of Reading
Range Acc % 0.0000
Reading Acc % 3.0000
Plus/Minus 0

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
50 / 50	%LEL	50	%LEL	50	50	0.00%	Pass

Group # 4
Group Name O2
Stated Accy Pct of Reading
Range Acc % 0.0000
Reading Acc % 3.0000
Plus/Minus 0.0

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
18.0 / 18.0	PPM	18.0	PPM	18.0	18.0	0.00%	Pass

Group # 5
Group Name H2S
Stated Accy Pct of Reading
Range Acc % 0.0000
Reading Acc % 3.0000
Plus/Minus 0.0

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
10.0 / 10.0	PPM	10.0	PPM	10.0	10.0	0.00%	Pass

INSTRUMENT CALIBRATION REPORT

Pine Environmental Services LLC

3470 Gardner Court
Burnaby, BC V5G 3K4
Toll-free: (877) 678-8383

Pine Environmental Services, Inc.

Instrument ID 22061
Description MultiRae PGM6228
Calibrated 7/13/2020 8:48:35PM

Test Instruments Used During the Calibration **(As Of Cal Entry Date)**

Test Standard ID	Description	Manufacturer	Model Number	Serial Number / Lot Number	Next Cal Date / Last Cal Date/ Expiration Date Opened Date
BC(2019)_SO2	Sulfur Dioxide - 5 PPM / N2 Balance	Calgaz	31835	997049	8/30/2020
BC(2020)_NH3 - 50 PPM	NH3_50 ppm / N2 Balance	Calgaz	31735	1207194	4/30/2021
BC(2020)_QUAD - 18% O2	H2S-10ppm / CO-50ppm / CH4-50%LEL / O2-18% / N2 Balance	Calgaz	31513	1280001	2/28/2022

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated Val Eftenaru

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INSTRUMENT CALIBRATION REPORT

Pine Environmental Services LLC

3470 Gardner Court
Burnaby, BC V5G 3K4
Toll-free: (877) 678-8383

Pine Environmental Services, Inc.

Instrument ID 33732
Description RAE Systems ToxiRAE Pro
Calibrated 7/13/2020 6:25:05PM

Manufacturer Rae Systems
Model Number PGM-1860
Serial Number/ Lot Number G024002492
Location British Columbia
Department

State Certified
Status Pass
Temp °C 22.9
Humidity % 39

Calibration Specifications

Group # 1
Group Name CO
Stated Accy Pct of Reading
Range Acc % 0.0000
Reading Acc % 3.0000
Plus/Minus 0

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
50 / 50	PPM	50	PPM	49	50	0.00%	Pass

Test Instruments Used During the Calibration (As Of Cal Entry Date)

Test Standard ID	Description	Manufacturer	Model Number	Serial Number / Lot Number	Last Cal Date/ Opened Date	Next Cal Date / Expiration Date
BC(2020)_CO - 50 PPM	Carbon Monoxide 50ppm/N2 Balance	Calgaz	33351	1219339		2/28/2025

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated Val Eftenaru

All instruments are calibrated by Pine Environmental Services LLC according to the manufacturer's specifications, but it is the customer's responsibility to calibrate and maintain this unit in accordance with the manufacturer's specifications and/or the customer's own specific needs.

Notify Pine Environmental Services LLC of any defect within 24 hours of receipt of equipment
Please call 800-301-9663 for Technical Assistance

INSTRUMENT CALIBRATION REPORT

Pine Environmental Services LLC

3470 Gardner Court
Burnaby, BC V5G 3K4
Toll-free: (877) 678-8383

Pine Environmental Services, Inc.

Instrument ID 40921
Description ToxiRAE Pro
Calibrated 7/13/2020 6:25:46PM

Manufacturer Rae Systems
Model Number PGM-1860
Serial Number/ Lot Number G024006542
Location British Columbia
Department

State Certified
Status Pass
Temp °C 22.9
Humidity % 39

Calibration Specifications

Group # 1
Group Name CO
Stated Accy Pct of Reading

Range Acc % 0.0000
Reading Acc % 3.0000
Plus/Minus 0

Nom In Val / In Val	In Type	Out Val	Out Type	Fnd As	Lft As	Dev%	Pass/Fail
50 / 50	PPM	50	PPM	47	50	0.00%	Pass

Test Instruments Used During the Calibration (As Of Cal Entry Date)

Test Standard ID	Description	Manufacturer	Model Number	Serial Number / Lot Number	Last Cal Date/ Opened Date	Next Cal Date / Expiration Date
BC(2020)_CO - 50 PPM	Carbon Monoxide 50ppm/N2 Balance	Calgaz	33351	1219339		2/28/2025

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated Val Eftenaru

All instruments are calibrated by Pine Environmental Services LLC according to the manufacturer's specifications, but it is the customer's responsibility to calibrate and maintain this unit in accordance with the manufacturer's specifications and/or the customer's own specific needs.

Notify Pine Environmental Services LLC of any defect within 24 hours of receipt of equipment
Please call 800-301-9663 for Technical Assistance

APPENDIX B

Pre-Renovation Hazmat Assessment – Site Review Report

Stantec

PRE-RENOVATION HAZMAT ASSESSMENT
SITE REVIEW REPORT

Client:	Public Services and Procurement Canada	Client Project #:	R.106216.002
Stantec Site Assessor:	Amanda Bell	Stantec Project #:	123221940
		Date of Site Visit:	August 20, 2021
Location:	CSC Kent Institution— 4732 Cemetery Road, Agassiz, BC	Date:	August 30, 2021

Project Name: Kent Institution Exhaust Ventilation Upgrade

Stantec Consulting Ltd. (Stantec) was retained by Public Services and Procurement Canada (PSPC) on behalf of Correction Service of Canada (CSC) to provide a pre-renovation hazardous building materials assessment within areas pertaining to building materials that are anticipated to be impacted by planned renovation activities associated with the exhaust ventilation upgrade project (the Project) at CSC Kent Institution located at 4732 Cemetery Road, Agassiz, British Columbia (BC) (subject facility).

The following areas are expected to be impacted by the Project:

- Building TU – tunnels
- Building PC – programs corridor, room PC130 chapel
- Building N – administration, roof

This assessment was conducted on August 20, 2021, and was intended to supplement the information provided in the following report:

- Stantec Consulting Ltd. report project no. 123221164 entitled “Hazardous Building Materials Assessments, 42 Buildings/Structures at CSC Kent Institution, 4732 Cemetery Road, Agassiz, BC”, dated February 2019 prepared for Public Services and Procurement Canada (Initial Assessment Report).

The work was carried out in accordance with the requirements of the current versions of the following:

- Canada Labour Code, Part II Canada Occupational Health and Safety Regulations (COHSR)
- British Columbia’s Occupational Health and Safety Regulation (BC Reg. 296/97)
- WorkSafeBC 2017 publication “Safe Work Practices for Handling Asbestos” (BC Asbestos Guide)
- PSPC June 5, 2017 “Asbestos Management Standard” (AMS) and “Asbestos Management Directive” (AMD)

STANDARDS, SCOPE AND METHODOLOGY

Site work was conducted in general compliance with the requirements of the COHSR, the PSPC AMS and AMD, BC Reg. 296/97 and Stantec’s Safe Work Practices (SWPs).

Mechanical systems, structures and finishes were visually examined to determine the suspected presence of the following potential hazardous building materials, specific to those building materials anticipated to be impacted by the Project:

- asbestos-containing materials (ACMs), in limited applications (e.g., cement pipes, sealants, etc.)
- lead, including lead-containing paints (LCPs)
- polychlorinated biphenyls (PCBs)
- mould and/or moisture-impacted building materials
- components containing mercury
- ozone-depleting substances (ODSs) and ODS-containing equipment
- materials containing silica

Applicable standards for each hazardous building material considered during this assessment are summarized below, along with the scope and methodology completed pertaining to those materials, during this assessment.

- Asbestos
  - Asbestos is a naturally occurring form of fibrous silicate that is durable and flexible; has high thermal and tensile strength; is resistant to heat, chemical corrosion, and friction; does not conduct electricity; and insulates well against condensation, heat, and noise. Due to these properties, asbestos was used in over 3,000 commercial products, and it is estimated that approximately 70% of the asbestos that was used in North America was used in building materials.
  - The common use of asbestos in various building materials started to decline due to changes in industry practices and/or legislation beginning in the mid-1970s. Although many types of ACMs were no longer in use by the 1990s, some ACMs, primarily non-friable materials such as asbestos cement products (e.g., pipes, shingles, wall panels) and sealants (e.g., roofing products, firestopping products, penetration sealants, pipe thread sealants) saw continued use through the end of 2018 in Canada, when an official ban on the import, manufacture, sale, trade or use of asbestos-containing products was implemented.
  - Undisturbed asbestos within building materials poses no health risks. Asbestos poses a risk when building materials containing asbestos are impacted, or disturbed, thereby releasing the asbestos fibres into the air.
  - Asbestos-related diseases are caused when suspended airborne asbestos fibres are inhaled and the fibres settle into various regions of the lungs and remain for extended periods. Once embedded in the lungs the asbestos fibres cause scarring within the lung tissue, ultimately leading to impaired lung function (asbestosis) and/or various cancers (lung cancer; mesothelioma).
  - The presence of asbestos in federal workplaces and pertaining to federally regulated workers is governed by the COHSR. According to the COHSR, ACM means:
    - Any article that is manufactured and contains 1% or more asbestos (by weight) at the time of manufacture, or any material that contains 1% or more asbestos when tested in accordance with accepted methods.

  - The presence of asbestos in the workplace in British Columbia pertaining to provincially regulated workers is governed by BC Reg. 296/97. According to the current version of BC Reg. 296/97, ACM means:
    - Any material containing at least 0.5% asbestos, or vermiculite insulation with any asbestos.
  - As both federally regulated workers and provincially regulated workers (e.g., contractors) are expected to carry out work activities within the subject building, and as the provincial regulations have a more stringent definition of ACM, and generally include the requirements noted in the COHSR, this assessment was conducted to meet the requirements of BC Reg. 296/97.
  - Where observed, samples were collected from each "homogenous application" of suspected ACMs (materials suspected to contain asbestos that are uniform in material type, colour, texture application and estimated installation date) that were anticipated to be impacted by the Project, and submitted to EMSL Canada Inc. (EMSL) in Burnaby, BC for analysis of asbestos content using polarized light microscopy (PLM) with dispersion staining, in accordance with the United States Environmental Protection Agency (EPA) 600/R-93/116 analytical method "Asbestos (bulk) by PLM." EMSL's analytical laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).
  - The number of samples collected for each homogenous application of a suspected ACM was based on the recommendations provided in the 2017 WorkSafeBC publication "Safe Work Practices for Handling Asbestos", (BC Asbestos Guide) along with the assessor's experience and understanding of the consistency of the observed building material applications.

- Lead
  - Lead is commonly found in buildings in items such as the solder used on copper domestic pipes; the caulking on bell fittings of cast iron drainage pipes; electrical equipment/wiring; batteries (e.g., emergency exit signage batteries); lead sheeting (e.g., x-ray rooms); vent and pipe flashings; and paints and ceramic tile glazes.
  - Elemental lead and inorganic lead compounds are absorbed through ingestion or inhalation and can incorporate into the bone marrow, nerve tissue, brain, and kidneys, causing a variety of health effects.
  - Excessive airborne lead and surface contamination can be transferred to employees' hands and may results in lead inhalation or ingestion. Typically, regimented work practices are developed and implemented to minimize airborne and surface lead concentrations during work that may impact lead and lead-containing coatings.
  - Under the COHSR and BC Reg. 296/97, a regulatory limit has been established for occupational exposure to airborne lead that may be present in a workplace. The occupational exposure limit (OEL) for airborne lead dust or fumes per both regulatory instruments should not exceed the time-weighted average value of 0.05 milligram per cubic metre of air (mg/m^3). The OEL represents the time-weighted average concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse health effects.
  - In Canada, the *Surface Coating Materials Regulations* (SOR/2005-109) under the federal *Hazardous Products Act* provides a concentration of lead that must not be exceeded in surface coatings that are presently sold in this country (90 parts per million, or "ppm"). However, it is important to note that this regulation does not comment on the potential occupational exposure if the material is disturbed.

- Work involving lead-containing paints (LCPs) and lead-containing coatings in British Columbia is to be conducted in accordance with applicable regulations, guidelines and standards including, but not limited to the current versions of the following, at a minimum:
  - WorkSafeBC 2017 publication entitled Safe Work Practices for Handling Lead (BC Lead Guide)
  - BC Reg. 296/97
- With respect to potential lead exposures associated with disturbance to surfaces coated with lead-containing products, the 2011 WorkSafeBC manual titled Lead-Containing Paint and Coatings: Preventing Exposure in the Construction Industry, indicates the following:
  - Improper removal of lead paint containing 600 mg/kg (equivalent to “parts per million” or “ppm”) lead results in airborne lead concentrations that exceed half of the exposure limit.
    - Potential for exposure exceeding half of the occupational exposure limit would be the trigger for implementation of an exposure control plan.
  - Lead concentrations as low as 90 mg/kg may present a risk to pregnant women and children.
    - Any risk assessment should include for the presence of high risk individuals within the workplace.
- In addition to the above, the BC Lead Guide indicates the following:
  - Unlike for asbestos-containing material, WorkSafeBC does not numerically define what would be considered a lead-containing paint or coating. All suspected paints or coatings should be tested for lead because, depending on the nature of the work, even a small amount could pose a risk to workers. In order to determine which controls and personal protective equipment would be required for a particular job, a qualified person must consider this information as part of the risk assessment.
    - When reviewing the above, “high risk” individuals are not expected to be present in the workplace associated with this building/structure/site during building material alteration activities (i.e., renovation) that would create significant disturbance to paint with such individuals present. As such, paints containing 600 ppm lead or more will be considered “lead-containing” for the purpose of this report, such that appropriate risk assessments can be completed for demolition planning. However, information regarding the lead content of all paints tested is provided herein, for reference and risk assessment should the consideration of high risk individuals be necessary, based on the requirements of a particular situation.
- Using an arc welder or oxyacetylene torch on steel that is coated with lead-containing paint can create hazardous lead fumes and is prohibited by section 12.115 of BC Reg. 296/97. In addition, the following information is provided in the BC Lead Guide:
  - Welding or torch cutting of paints or coatings on metal can create very high concentrations of airborne lead fumes. Torch cutting structural steel, coated with paint containing as little as 130 mg/kg (equivalent to ppm) lead, can release airborne levels of lead as high as 0.8 mg/m^3 (16 times the exposure limit).
  - Given this information and that the analytical detection limit for lead paint analysis is 90 ppm (not significantly different than 130 ppm, which, per above, may release airborne lead levels 16 times the exposure limit), any paint coating on a metal surface to be welded, burned or torch-cut represents a potential lead exposure hazard.

- Other hazardous building materials:
  - Various other hazardous building materials may be present that would have special management requirements, and/or requirements for appropriate handling and/or disposal if they were to be impacted by the Project.
  - Assessment for the presence of other hazardous building materials, specific to those building materials anticipated to be impacted by the Project, was completed through visual means, as follows:
    - Visual review for the presence of PCBs in electrical equipment was completed. Equipment that is generally suspected of containing PCBs includes lamp ballasts, transformers, hydraulic systems, compressors, switchgear and capacitors. No sampling of dielectric fluids was undertaken as part of this assessment.
    - Presence of suspect visible mould and/or animal waste was assessed through visual observations. Material observed with dark-coloured staining and/or a textured and discoloured appearance is described as “suspected mould”. Mould identified visually is defined as “suspected mould” unless it is confirmed as mould by laboratory analysis.
    - Assessment for equipment likely to contain ODSs was completed. Information on the type of equipment, manufacturer and type and quantity of refrigerants was recorded, where available.
    - Assessment for equipment that is likely to contain mercury was completed visually. Information on the type of equipment (i.e., gauges, switches, batteries, thermometers, etc.), model and serial numbers and quantities was recorded, where such information was available.
    - Assessment for the presence of silica was conducted. The presence of silica in building materials such as concrete, masonry, stone, terrazzo, refractory brick, ceramic tile, ceiling tile etc. was noted.

RESULTS

Based on the information in the Initial Assessment Report, the following hazardous building materials are present but are NOT anticipated to be impacted by the Project:

- Building TU – tunnels
  - ACMs (grey or black fibrous gasket material inside plumbing fixtures)
  - LCPs (orange on cast iron pipe flanges)
  - lead-containing items (lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment)
  - PCBs (fluorescent light ballasts of approximately 60 light fixtures)
  - mercury (light tubes within approximately 60 fluorescent light fixtures)
  - silica-containing items (concrete floors, brick/masonry units and associated grout and mortar)
- Building PC – programs corridor, room PC130 chapel
  - ACMs (blue pipe sealant on sprinkler lines, 12”x12” cream floor tile with brown smears in rooms PC141, PC 131, PC138, PC113, grey or black fibrous gasket material inside plumbing fixtures)
  - LCPs (brown on metal trim and doors)

  - lead-containing items (lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment, ceramic tile glaze, vent and pipe flashings)
  - PCBs (fluorescent light ballasts of approximately 100 light fixtures)
  - mercury (light tubes within approximately 100 fluorescent light fixtures)
  - mould-impacted materials (moisture-stained ceiling tiles in rooms PC122 and PC112)
  - ODSs (two unknown rooftop air handling units suspected to contain ODSs)
  - silica-containing items (concrete floors, walls, blocks, brick/masonry units and associated grout and mortar, stone/ceramic floor tiles and associated grouts and mortars, gypsum and associated wall/ ceiling finish materials, suspended ceiling tiles, asphalt and asphalt products containing rock or stone)
- Building N – administration, roof
  - ACMs (black window pane caulking, drywall joint compound throughout the first floor, grey pipe sealant on sprinkler lines, 12”x12” red floor tile with cream streaks, 12”x12” grey floor tile with brown streaks, white vinyl floor tile, ceiling texture coat, brown under sink coating, grey or black fibrous gasket material inside plumbing fixtures)
  - LCPs (red on cast iron sprinkler lines, brown on metal bars over windows)
  - lead-containing items (lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment, ceramic tile glaze, vent and pipe flashings)
  - PCBs (fluorescent light ballasts of approximately 50 light fixtures)
  - mercury (light tubes within approximately 50 fluorescent light fixtures)
  - mould-impacted materials (moisture stained ceiling tiles in various locations throughout, mould impacted drywall in room N116)
  - silica-containing items (concrete floors, walls, blocks, brick/masonry units and associated grout and mortar, stone/ceramic floor tiles and associated grouts and mortars, gypsum and associated wall/ ceiling finish materials, suspended ceiling tiles, asphalt and asphalt products containing rock or stone)

Table 1 below summarizes the findings of the assessment and sampling activities undertaken pertaining specifically to previously identified and or additional suspected hazardous building materials that may be impacted by the Project.

Table 1 Assessment Summary

Location	Hazardous Building Material Observations	Photo	Samples Collected?	Analytical Results
Building N – Administration, roof	Suspected ACM roof core walls in area where openings will be created • observed to be in good condition • includes the following layers: – asphalt (red and grey) – asphalt board – foam layer – building paper – vapour barrier – tar layer (grey) – gypsum – building paper – gypsum – building paper – tar on steel deck	 	RC-01A RC-01B RC-01C RC-01D RC-01E RC-01F RC-01G RC-01H RC-01I RC-01J RC-01K RC-01L	No asbestos detected
Throughout assessed areas (general)	ACM red HVAC duct mastic on seams of HVAC ducting throughout • observed to be in good condition • may be impacted by the Project		Previously identified in Initial Assessment Report	<0.25–3% Chrysotile asbestos
Building PC – Programs Corridor, room PC130, chapel	ACM 12”x12” cream floor tile with brown smears • observed to be in good condition • may be impacted by the Project		Previously identified in Initial Assessment Report	1.5% Chrysotile asbestos

Table 1 Assessment Summary

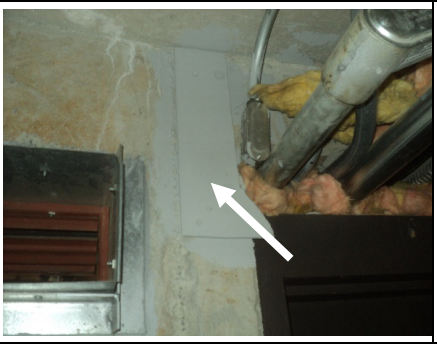
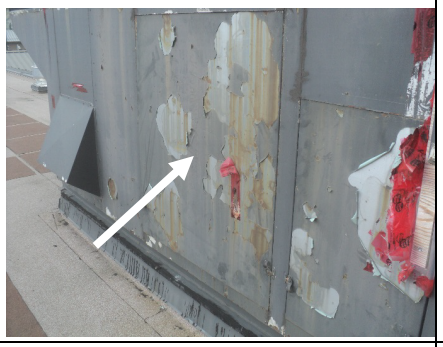
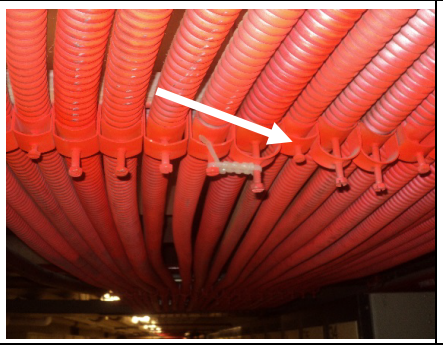
Location	Hazardous Building Material Observations	Photo	Samples Collected?	Analytical Results
Building TU – Tunnels	ACM cement panels on electrical penetrations above doors • observed to be in good condition • may be impacted by the Project		Previously identified in Initial Assessment Report	15% Chrysotile asbestos
Roof	LCP grey paint on HVAC units and vents • may be impacted by the Project		Previously identified in Initial Assessment Report	5,400 ppm
Building TU – Tunnels	LCP red paint electrical conduits throughout • may be impacted by the Project		Previously identified in Initial Assessment Report	1.0 mg/cm$_2$ (approximately 15,000 ppm)

Table 1 Assessment Summary

Location	Hazardous Building Material Observations	Photo	Samples Collected?	Analytical Results
Throughout assessed areas (general)	Silica is expected to be present in the following which were observed in various locations throughout: • concrete floors, walls and ceilings; masonry units and associated grout and mortar; gypsum and associated wall finish materials; and asphalt and asphalt products containing rock or stone (roof membrane)	 	N/A	N/A

The certificates of analysis for the samples submitted as part of this assessment, as provided by EMSL, are attached to this document, for reference.

CONCLUSIONS AND RECOMMENDATIONS

In summary, the following hazardous building materials were identified that are anticipated to be or may be impacted by the Project:

- Red HVAC duct mastic on seams of HVAC ducting throughout
- 12”x12” cream floor tile with brown smears within Building PC, room PC130 – chapel
- ACM cement panels on electrical penetrations above doors in Building TU
- Lead-containing grey paint on HVAC units and vents on the roof
- Lead-containing red paint electrical conduits throughout Building TU
- Various silica-containing items (concrete floors, walls and ceilings; masonry units and associated grout and mortar; gypsum and associated wall finish materials; asphalt and asphalt products containing rock or stone)

Based on the above, the following recommendations are provided for renovation planning purposes:

- Asbestos
  - ACMs that may be impacted during the renovations and/or demolition activities should be removed by appropriately trained personnel (e.g., asbestos abatement contractor personnel), in accordance with the requirements of the COHSR, BC Reg. 296/97 and the Asbestos Guide, and prior to the initiation of project work that will disturb them.
  - If encountered during renovation activities, any suspected ACMs not accessible during this assessment should be considered as asbestos-containing and handled as such, unless appropriate assessment and analytical testing as required by BC Reg. 296/97 proves otherwise.
  - Ensure asbestos containing waste is handled, stored, transported and disposed of in accordance with the requirements of the Federal Transportation of Dangerous Goods Regulation and the British Columbia Hazardous Waste Regulation (BC Reg. 63/88).
- Lead
  - When paints or other lead-containing equipment/materials are to be disturbed and/or removed, ensure compliance with the following:
    - exposure protection requirements of the BC Reg. 296/97, including the provisions of the BC Lead Guide
    - transportation and disposal requirements of BC Reg. 63/88
    - transportation requirements of the Federal Transportation of Dangerous Goods Regulation
  - Any paint coating on a metal surface to be welded, burned or torch-cut must be removed prior to that action being undertaken, unless a project-specific or tasks-specific risk assessment and safe work practices are developed by a qualified person. Development of such risk assessments and work practices will involve consideration of information including, but not limited to, the following:
    - composition of the material to be disturbed
    - lead content of the paint coating
    - methods and tools to be used, including exhaust ventilation
    - duration of the work/work shift
    - training of the personnel conducting the task
    - respiratory protection program in effect
  - Ultimately, the Contractor is responsible to review the work tasks required and the ways in which lead-containing materials (including materials coated with paints that may contain lead in varying concentrations) will be impacted, as well as the individuals that will be present in the immediate vicinity of the work (i.e., potential for high-risk individuals) in order to determine the appropriate personal protective equipment (PPE—including respirators and protective clothing), containment and/or decontamination measures and work procedures that should be followed to protect workers from lead exposure.

- PCBs
  - Fluorescent lamp ballasts that may contain PCBs can be managed in place, where these items are operating and in good condition. No further action is currently required until such time that renovation or demolition activities are to be conducted, or until 2025, when PCB-containing ballasts will require removal and disposal.
  - If removal of fluorescent light fixtures is required during the Project, when decommissioned, verify the PCB content of fluorescent lamp ballasts as per the Environment Canada publication *Identification of Lamp Ballasts Containing PCBs*, 1991 (or equivalent reference).
  - PCB-containing items identified for removal and disposal should be handled, transported, stored and disposed of in accordance with the following:
    - Transportation and disposal requirements of the British Columbia Hazardous Waste Regulation (BC Reg. 63/88)
    - Transportation requirements of the Federal Transportation of Dangerous Goods Regulation
    - Federal PCB Regulations (SOR/2008-273)
- Mercury
  - Identified mercury-containing items can be managed in place, therefore no further action is recommended at this time. Mercury vapour within light fixtures poses no risk to workers or occupants provided the mercury containers remain intact and undisturbed.
  - Complete removal of mercury-containing equipment is required prior to renovation or demolition activities that may disturb the equipment. When mercury-containing items (e.g., fluorescent light tubes) are removed (i.e. if Project requirements change), ensure all mercury waste is handled, stored transported and disposed of in accordance with the requirements the following:
    - Transportation and disposal requirements of BC Reg. 63/88
    - Transportation requirements of the Federal Transportation of Dangerous Goods Regulation
  - Precautions should be taken if workers may potentially be exposed to mercury or mercury vapours to ensure that workers exposure levels do not exceed the occupational exposure limit of 0.025 mg/m^3 as per the BC Reg. 296/97. This can be achieved by providing respiratory and skin protection applicable to the hazard and task to be completed.
- Silica
  - When silica-containing materials are to be disturbed during the Project, ensure dust control measures are employed such that airborne silica dust concentrations do not exceed the exposure limit as stipulated by BC Reg. 296/97 (cristobalite and quartz—each 0.025 mg/m^3). This would include, but not be limited to, the following:
    - providing workers with respiratory protection
    - wetting the surface of the materials, use of water or dust suppressing agents to prevent dust emissions
    - providing workers with facilities to properly wash prior to exiting the work area

- Other hazardous building materials
  - Other hazardous building materials were not identified. As such, no additional recommendations have been provided.

LIMITATIONS

This report has been prepared for general information purposes to support the Project. This report does not necessarily constitute an assessment that would be sufficient to support other renovation projects or building demolition, which would typically require destructive removal of building finishes to observe concealed conditions. Prior to any other renovation or demolition work within the subject facility, this report should be reviewed by an appropriately qualified professional (with education and experience associated with the management of hazardous building materials) to determine what, if any, additional assessment is necessary.

Assessment for hazardous building materials was conducted pertaining to readily visible ceiling surfaces within accessible spaces only, and only pertaining to those materials anticipated to be impacted by the Project. Our understanding of the materials that would be impacted by the Project was based on information provided in project design documents. Stantec cannot predict the actual methods to be implemented by contractors completing work of the Project, which may change the extent to which various building materials are impacted, leading to additional suspected hazardous building materials that may require characterization.

In preparation of this report, Stantec used professional judgment based on experience. The work was conducted in accordance with generally accepted professional standards. Stantec relied on information gathered during the site investigation and laboratory analytical reports.

This report has been prepared for the exclusive use of PSPC/CSC for the purpose of assessing general conditions in the assessed areas, only as they pertain to the Project. Any use that a third party makes of this report, or reliance on, or decisions to be made on it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

CLOSING

If any conditions become apparent that differ significantly from our understanding of conditions as presented in this document, we request that we be notified immediately to reassess the information provided herein.

We trust that the document meets your current requirements. Should you have any questions or concerns regarding the above, please do not hesitate to contact the undersigned.

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Attachments: Attachment 1: Suspected ACM Bulk Sample Analytical Record (EMSL)—3 pages

ATTACHMENT 1

Suspected ACM Bulk Sample Analytical Record (EMSL)

EMSL Canada Inc.

7964 Winston Street Suite 200 Burnaby, BC V5A 2H5
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http://www.EMSL.com / vancouverlab@EMSL.com

EMSL Canada Order 692102073
Customer ID: 55JACQ30L
Customer PO:
Project ID:

Attn: Amanda Bell
Stantec Consulting Ltd.
500 - 4730 Kingsway
Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Collected: 8/20/2021
Received: 8/20/2021
Analyzed: 8/23/2021

Proj: KENT

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: RC- 01A ***Lab Sample ID:*** **692102073-0001**
Sample Description: ADMIN ROOF (UPPER)/ROOF CORE- ASPHALT (RED + GREY)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/23/2021	Black	0.0%	100%	None Detected	

Client Sample ID: RC- 01B ***Lab Sample ID:*** **692102073-0002**
Sample Description: ADMIN ROOF (UPPER)/ROOF CORE- ASPHALT BOARD

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/23/2021	Black	0.0%	100%	None Detected	

Client Sample ID: RC- 01C ***Lab Sample ID:*** **692102073-0003**
Sample Description: ADMIN ROOF (UPPER)/ROOF CORE- FOAM LAYER

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/23/2021	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: RC- 01D ***Lab Sample ID:*** **692102073-0004**
Sample Description: ADMIN ROOF (UPPER)/ROOF CORE- BUILDIN GPAPER

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/23/2021	Brown	65.0%	35.0%	None Detected	

Client Sample ID: RC- 01E ***Lab Sample ID:*** **692102073-0005**
Sample Description: ADMIN ROOF (UPPER)/ROOF CORE- VAPOUR BARRIER

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/23/2021	Black	0.0%	100%	None Detected	

Client Sample ID: RC- 01F ***Lab Sample ID:*** **692102073-0006**
Sample Description: ADMIN ROOF (UPPER)/ROOF CORE- TAR LAYER (GREY)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/23/2021	White/Black	0.0%	100%	None Detected	

Client Sample ID: RC- 01G ***Lab Sample ID:*** **692102073-0007**
Sample Description: ADMIN ROOF (UPPER)/ROOF CORE- GYPSUM

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/23/2021	White	0.0%	100.0%	None Detected	

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EMSL Canada Order 692102073
Customer ID: 55JACQ30L
Customer PO:
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: RC- 01H ***Lab Sample ID:*** **692102073-0008**

Sample Description: ADMIN ROOF (UPPER)/ROOF CORE- FIBRE LAYER

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/23/2021	White	10.0%	90.0%	None Detected	

Client Sample ID: RC- 01I ***Lab Sample ID:*** **692102073-0009**

Sample Description: ADMIN ROOF (UPPER)/ROOF CORE- BUILDING PAPER

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/23/2021	Gray	40.0%	60.0%	None Detected	

Client Sample ID: RC- 01J ***Lab Sample ID:*** **692102073-0010**

Sample Description: ADMIN ROOF (UPPER)/ROOF CORE- GYPSUM

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/23/2021	Gray	0.0%	100.0%	None Detected	

Client Sample ID: RC - 01K ***Lab Sample ID:*** **692102073-0011**

Sample Description: ADMIN ROOF (UPPER)/ROOF CORE- BUILDING PAPER

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/23/2021	Gray	30.0%	70.0%	None Detected	

Client Sample ID: RC- 01L ***Lab Sample ID:*** **692102073-0012**

Sample Description: ADMIN ROOF (UPPER)/ROOF CORE- TAR ON STEEL DECK

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/23/2021	Black	0.0%	100%	None Detected	

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EMSL Canada Order 692102073
Customer ID: 55JACQ30L
Customer PO:
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Analyst(s):

Nicole Yeo	PLM Grav. Reduction (5)
Omid Ghayyur	PLM (7)

Reviewed and approved by:

Nicole Yeo, Laboratory Manager
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. Estimation of uncertainty available upon request. This report is a summary of multiple methods of analysis, fully compliant reports are available upon request. A combination of PLM and TEM analysis may be necessary to ensure consistently reliable detection of asbestos. This report must not be used to claim product endorsement by NVLAP of any agency or the U.S. Government.

Samples analyzed by EMSL Canada Inc. Burnaby, BC NVLAP Lab Code 201068-0

Initial report from: 08/23/202114:51:59

APPENDIX C

Hazardous Building Materials Assessment

Hazardous Building Materials Assessments

42 Buildings/Structures at CSC Kent Institution

4732 Cemetery Road, Agassiz, BC

February 2019

Prepared for:

Public Services and Procurement Canada
219–800 Burrard Street
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Executive Summary

Stantec Consulting Ltd. (Stantec) was retained by Public Services and Procurement Canada (PSPC) on behalf of Correctional Services Canada (CSC) to conduct hazardous building materials assessments within 42 buildings at the CSC Kent Institution located in Agassiz, British Columbia. A list of the buildings assessed is included in Appendix 1.

The purpose of the assessment was to check for potential hazardous building materials that may require special management practices in accordance with the requirements of the Canada Labour Code, Part II Canada Occupational Health and Safety Regulations (COHSR) and the current version of British Columbia's Occupational Health and Safety Regulation *(*BC Reg. 296/97) during continued operations and maintenance, as well as for renovation planning.

The hazardous building materials considered included asbestos-containing materials (ACMs, including presumed ACMs, or "PACMs"), lead-containing materials including lead-containing paints (LCPs), polychlorinated biphenyls (PCBs), mercury-containing items, ozone-depleting substances (ODSs), mould or moisture affected building materials, and silica.

Based on Stantec's visual assessment and on the laboratory analyses performed on samples collected, hazardous building materials were identified within the buildings assessed.

A summary of our findings and recommendations is presented below, on a building-by-building basis. It should be noted that this summary is subject to the same restrictions and limitations as presented in Section 4.0 (Assessment Limitations) and Section 7.0 (Closure) of this report. The information provided is to be read in conjunction with the remainder of this report.

NOTE: Where particular hazardous building materials are not listed in the following table, they were not identified in that particular building.

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building A&B— Living Unit A&B (836-08-RP)	**Asbestos** The following ACMs were identified: • Red mastic applied to both the outer and inner seams of HVAC ducting throughout • Gold under sink coating in rooms A107 and B107 • Remnant floor tile mastic present on edges of concrete floors throughout • Black putty on perimeter edge of concrete ceilings of mechanical chases between cells (not observed by Stantec but can't confirm removal) • Grey mortar between a 4" diameter pipe and surrounding concrete in janitor's room ceilings • Grey or black fibrous gasket material inside plumbing fixtures (not observed by Stantec but can't confirm removal) • Remnant floor tile expected to be present in various locations throughout (e.g., underneath floor basins in janitor's rooms as noted in the SNC Plumbing Fixture and Tile Replacement Report, 2017 and under black/grey speckled linoleum in control bubble as noted in the RJ Pipe Chase and Control Bubble Report, 2009) • Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed **Lead** The following LCPs were identified: • Beige on steel and concrete bars over windows and concrete walls in cell and common areas • Light blue on concrete cell walls • White coloured paint on metal base of HVAC ducting Lead is also expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and ceramic tile glaze. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 100 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 100 fluorescent light fixtures observed **Ozone Depleting Substances** The following equipment was identified by labels to be ODS-containing: • One Thermoplus air conditioning unit that services the control post (0.68 Kg of R-22) **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar – Ceramic floor tiles and associated grouts/mortars • Gypsum board and associated wall/ceiling finish materials • Plaster and associated wall/ceiling finish materials • Asphalt and asphalt products containing rock or stone (e.g. roof membrane)

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building AC—Academic Centre (836-08-RP)	**Asbestos** The following ACMs were identified: • Black window pane caulking • Red HVAC duct mastic on ducting throughout (Not observed by Stantec but presumed to be present in ceiling spaces not accessed) • Cement panel on the ceiling of room AC216. Not observed by Stantec but presumed to be present in ceiling spaces • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures • Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed **Lead** The following LCPs were identified: • Yellow coloured paint on interior metal handrail and cage in the corridor Lead is also expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment, ceramic tile glaze and vent and pipe flashings. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 30 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 30 fluorescent light fixtures observed **Mould** The following mould and/or moisture issues were observed: • Moisture-stained ceiling tiles in rooms AC203 security files, AC219 CMO, AC224 boardroom, AC221 office, AC213 corridor and AC220 corridor **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar • Gypsum board and associated wall/ceiling finish materials • Suspended ceiling tiles • Asphalt and asphalt products containing rock or stone (e.g., roof membrane)

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building AD—Admission/Discharge (836-08-RP)	**Asbestos** The following ACM was identified: • 12”x12” cream vinyl floor tile with brown streaks in room AD106 • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures • Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed **Lead** The following LCPs were identified: • Dark brown coloured paint on steel bars over windows • Dark brown coloured paint on metal door frames and fire doors • Dark brown coloured paint on metal holding area cage • Grey coloured paint on metal bathroom door and frame • Red coloured paint on primer on inmate bathroom cage • White coloured paint on metal visitor phone room door and frame • Beige coloured paint on metal visitor phone room window frames • Light brown coloured paint on metal visitor phone room window frames • Yellow coloured paint on concrete walls in the inmate bathroom Lead is also expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and vent and pipe flashings. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 45 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 45 fluorescent light fixtures observed **Mould** The following mould and/or moisture issues were observed: • Moisture-stained ceiling tiles in room AD104, inmate effects storage **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar • Gypsum board and associated wall/ceiling finish materials • Suspended ceiling tiles • Asphalt and asphalt products containing rock or stone (e.g., roof membrane)

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building BR— Boiler Room/South Mechanical Room (836-08-RP)	**Asbestos** The following ACMs were identified: • Cement panel on upper walls of KG207 and V200 • Drywall joint compound applied to large pillar of KG 207 • Mechanical gasket—Black with grey hanging on wall. May also be present in various mechanical fittings throughout the subject building • Mechanical gasket—Light grey with dark grey hanging on wall. May also be present in various mechanical fittings throughout the subject building • Cement panel on upper walls of KG200a • 12”x12” tan floor tile with brown streaks in rooms KG200, KG200a, and KG201 • Black window pane caulking on windows throughout the kitchen gunwalk • Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed • Red mastic applied to both the outer and inner seams of HVAC ducting throughout **Lead** The following LCPs were identified: • Brown coloured paint on interior metal door and structural steel • Light blue coloured paint on metal ceiling and structural steel • Blue coloured paint on metal doors and frames • Blue coloured paint on metal boilers • Brown coloured paint on metal air handling units • Brown coloured paint on metal stairs, railing and ladder • Yellow coloured paint on steel pipes • White coloured paint on 1” metal drain pipes • Red coloured paint on 8’ steel horizontal pipes • Blue/red coloured paint on structural steel in KG207 • Blue coloured paint on ceiling structure in KG207 • Brown coloured paint on metal post in KG207 Lead is also expected to be present in older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and vent and pipe flashings. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 30 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 30 fluorescent light fixtures observed **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar • Gypsum board and associated wall/ceiling finish materials

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building C&D— Living Unit C&D (836-08-RP)	**Asbestos** The following ACMs were identified: • Red mastic applied to both the outer and inner seams of HVAC ducting throughout • Gold under sink coating in rooms C107 and D107 • Remnant floor tile mastic present on edges of concrete floors throughout including the thresholds of the doors to the mechanical chases between cells • Black putty on perimeter edge of concrete ceilings of mechanical chases between cells (not observed by Stantec but can't confirm removal) • Grey mortar between a 4" diameter pipe and surrounding concrete in janitor's room ceilings • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures • Remnant floor tile expected to be present in various locations throughout (e.g., underneath floor basins in janitor's rooms as noted in the SNC Plumbing Fixture and Tile Replacement Report, 2017 and under black/grey speckled linoleum in control bubble as noted in the RJ Pipe Chase and Control Bubble Report, 2009) • Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed **Lead** The following LCP was identified: • Beige coloured paint on steel bars over windows, steel door frames and concrete walls in cells and common areas • White coloured paint on cell desks throughout • Blue coloured paint on concrete walls • Dark brown coloured paint on metal fire doors and frames, radiator wall heaters and structural steel • Dark red coloured paint on metal sprinkler lines Lead is also expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and ceramic tile glaze. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 100 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 100 fluorescent light fixtures observed **Ozone Depleting Substances** The following equipment was identified by labels to be ODS-containing: • One Thermoplus air conditioning unit that services the control post (0.68 Kg of R-22)

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
	Silica Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar – Ceramic floor tiles and associated grouts/mortar • Gypsum board and associated wall/ceiling finish materials • Plaster and associated wall/ceiling finish materials • Asphalt and asphalt products containing rock or stone (e.g., roof membrane)
Building COMP—Composter & Storage (836-00-RP)	**Silica** Silica is expected to be present in the concrete foundation, floor and blocks observed.
Building CS-L-S—Clothing & Supplies/Laundry/ Stores (836-08-RP)	**Asbestos** The following ACM was identified: • Red duct mastic on HVAC ducting throughout (painted blue in some areas) • 12”x12” light grey floor tile with brown streaks in rooms COR115, L101, L102, L103, CS100, CS102, CS103 (under carpet), S100 (under carpet) and S101 (under carpet) • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures • Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed **Lead** The following LCPs were identified: • Brown coloured paint on interior metal door and frames • Brown coloured paint on structural steel Lead is also expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and vent and pipe flashings. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 120 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the 120 fluorescent light fixtures observed **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick and masonry units and associated grouts and mortars • Asphalt and asphalt products containing rock or stone (e.g., roof membrane)

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building CZE—Construction Zone Entry Building (836-00-RP)	**Lead** Lead is expected to be present in solder used in bell fittings for cast iron pipes and in electrical equipment. **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation • Asphalt and asphalt products containing rock or stone (e.g., roof shingles)
Building E&F—Living Unit E&F (836-08-RP)	**Asbestos** The following ACMs were identified: • Red mastic applied to both the outer and inner seams of HVAC ducting throughout • Grey pipe sealant applied to threads of sprinkler lines • Gold under sink coating in rooms E107 and F107 • Remnant floor tile mastic present around the edges of the concrete floors throughout including the thresholds of the doors to the mechanical chases between cells • Remnant floor tile mastic present around the edges of the concrete floors throughout including the thresholds of the doors to the mechanical chases between cells • Black putty on perimeter edge of concrete ceilings of mechanical chases between cells (not observed but can't confirm removal) • Grey mortar between a 4" diameter pipe and surrounding concrete in janitor's room ceilings • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures • Remnant floor tile may be present in various locations throughout (e.g., underneath floor basins in janitor's rooms as noted in the SNC Plumbing Fixture and Tile Replacement Report, 2017 and under black/grey speckled linoleum in control bubble as noted in the RJ Pipe Chase and Control Bubble Report, 2009) • Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed **Lead** The following LCPs were identified: • Beige coloured paint on cell doors • Dark brown coloured paint on metal fire doors and frames, radiator wall heaters and structural steel • Dark red coloured paint on metal sprinkler lines Lead is also expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and ceramic tile glaze. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 100 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 100 fluorescent light fixtures observed

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Cont'd Building E&F—Living Unit E&F (836-08-RP)	**Ozone Depleting Substances** The following equipment was identified by labels to be ODS-containing: • One Thermoplus air conditioning unit that services the control post (0.60 Kg of R-22) **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar – Ceramic floor tiles and associated grouts and mortars • Gypsum board and associated wall/ceiling finish materials • Plaster and associated wall/ceiling finish materials Asphalt and asphalt products containing rock or stone (e.g., roof membrane)
Building G&H—Living Unit G&H (836-08-RP)	**Asbestos** The following ACMs were identified: • Joint compound applied to drywall walls, ceilings and bulkheads throughout • Red mastic applied to both the outer and inner seams of HVAC ducting throughout • Remnant floor tile observed around the edges of cell G006. May be present in other locations throughout (e.g. underneath floor basins in janitor's rooms as noted in the SNC Plumbing Fixture and Tile Replacement Report and under black/grey speckled linoleum in control bubble as noted in the RJ Pipe Chase and Control Bubble Report, 2009) • Remnant floor tile mastic present around the edges of the concrete floors throughout including the thresholds of the doors to the mechanical chases between cells • Black putty on perimeter edge of concrete ceilings of mechanical chases between cells (not observed by Stantec but can't confirm removal) • Grey mortar between a 4" diameter pipe and surrounding concrete in janitor's room ceilings (not observed but can't confirm removal) • Gold under sink coating in G107 and H107 (not observed but can't confirm removal) • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures • Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed **Lead** The following LCPs were identified: • Brown coloured paint on metal interior doors throughout • Brown coloured paint on metal exterior doors • Beige coloured paint on concrete hallway walls • White coloured paint on metal HVAC ducting and ceiling • Red coloured paint on metal sprinkler lines throughout • Grey coloured paint on metal staircase in control post • Brown coloured paint on metal staircase in control post • Beige coloured paint on steel bars over windows • Light blue coloured paint on steel bars over windows, metal doors and concrete walls • Dark brown coloured paint on metal fire doors and frames, radiator wall heaters and structural steel • Dark red coloured paint on metal sprinkler lines

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
	Lead is also expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and ceramic tile glaze. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 100 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 100 fluorescent light fixtures observed **Ozone Depleting Substances** The following equipment was identified by labels to be ODS-containing: • One Thermoplus air conditioning unit that services the control post (0.60 Kg of R-22) **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks, tiles – Brick/masonry units and associated grout and mortar – Ceramic floor tiles and associated grouts and mortars • Gypsum board and associated wall/ceiling finish materials • Plaster and associated wall/ceiling finish materials • Asphalt and asphalt products containing rock or stone (e.g., roof membrane)

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building GO—General Operations/ G.O. Building (836-19-RP)	**Lead** The following LCP was identified: • Yellow coloured paint on exterior HVAC casing Lead is also expected to be present in lead-acid batteries used in emergency lighting, solder used on domestic water lines and solder used in bell fittings for cast iron pipes and in electrical equipment. **Polychlorinated Biphenyls** Based on the construction date of the subject building, PCBs are not anticipated to be present. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 100 fluorescent light fixtures observed **Ozone Depleting Substances** The roof was not accessed as part of this assessment. Building-related cooling and refrigeration equipment located on the roof may contain ODSs. **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls – Brick/masonry units and associated grout and mortar – Stone/ceramic floor tiles and associated grouts and mortars • Gypsum board and associated wall/ceiling finish materials • Suspended ceiling tiles

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building GT01—Guard Tower (836-03-RP)	**Asbestos** The following ACM was identified: • Black window pane caulking on windows throughout • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures **Lead** The following LCPs were identified: • Brown coloured paint on exterior metal walls • Green coloured paint on interior metal stairs, trim and doors • Beige coloured paint on interior metal siding Lead is also expected to be present in older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and vent and pipe flashings. **Polychlorinated Biphenyls** The one fluorescent light fixture present was observed to have high-efficiency light tubes. The ballasts within the fixture are not suspected to contain PCBs. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the one fluorescent light fixture observed **Mould** The following mould and/or moisture issues were observed: • Moisture-stained drywall ceiling in room GT200, observation level **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors • Gypsum board and associated wall/ceiling finish materials

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building GT02—Guard Tower (836-03-RP)	**Asbestos** The following ACMs were identified: • Black window pane caulking on windows throughout • Grey penetration putty on exterior first floor penetrations • Grey penetration putty on exterior upper floor electrical penetrations • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures **Lead** The following LCPs were identified: • Brown coloured paint on exterior metal walls • Green coloured paint on interior metal stairs, trim and doors • Light grey coloured paint on wood countertop • Beige coloured paint on interior metal siding Lead is also expected to be present in older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and vent and pipe flashings. **Polychlorinated Biphenyls** The one fluorescent light fixture present was observed to have high-efficiency light tubes. The ballasts within the fixture are not suspected to contain PCBs. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the one fluorescent light fixture observed **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors • Gypsum board and associated wall/ceiling finish materials

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building GT03—Guard Tower (836-03-RP)	**Asbestos** The following ACMs were identified: • Black window pane caulking on windows throughout • Grey penetration putty on exterior upper floor penetrations • Grey penetration putty on exterior first floor electrical penetrations • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures **Lead** The following LCPs were identified: • Brown coloured paint on exterior metal walls • Green coloured paint on interior metal stairs, trim and doors • Beige coloured paint on interior metal siding Lead is also expected to be present in older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and vent and pipe flashings. **Polychlorinated Biphenyls** The one fluorescent light fixture present was observed to have high-efficiency light tubes. The ballasts within the fixture are not suspected to contain PCBs. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the one fluorescent light fixture observed **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors • Gypsum board and associated wall/ceiling finish materials

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building GT04—Guard Tower (836-03-RP)	**Asbestos** The following ACMs were identified: • Black window pane caulking on windows throughout • Grey penetration putty on exterior first floor penetrations • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures **Lead** The following LCPs were identified: • Brown coloured paint on exterior metal walls • Green coloured paint on interior metal stairs, trim and doors • Beige coloured paint on interior metal siding Lead is also expected to be present in older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and vent and pipe flashings. **Polychlorinated Biphenyls** The one fluorescent light fixture present was observed to have high-efficiency light tubes. The ballasts within the fixture are not suspected to contain PCBs. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the one fluorescent light fixture observed **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors • Gypsum board and associated wall/ceiling finish materials

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building HC—Health Care (836-08-RP)	**Asbestos** The following ACMs were identified: • 12”x12” light blue vinyl floor tile with brown streaks in HC101 • Black window pane caulking applied to windows throughout • Red duct mastic on ducting throughout • Drywall joint compound applied to walls and ceilings throughout • Blue pipe sealant applied to threads of sprinkler lines • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures • Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed **Lead** The following LCP was identified: • Grey coloured paint on metal doors and frames Lead is also expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines and solder used in bell fittings for cast iron pipes and in electrical equipment. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 55 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 55 fluorescent light fixtures observed **Mould** The following mould and/or moisture issues were observed: • Paint bubbling on concrete from moisture intrusion in room HC120, office **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick/masonry and associated grouts and mortars – Stone/ceramic floor tiles and associated grouts and mortars • Gypsum board and associated wall/ceiling finish materials • Asphalt and asphalt products containing rock or stone (e.g., roof membrane)

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building J&K—Living Unit K/Segregation Unit J (836-08-RP)	**Asbestos** The following ACMs were identified: • Floor tile may be present under black/grey speckled linoleum in the control bubble • Black putty on perimeter edge of concrete ceilings of mechanical chases between cells (not observed but can't confirm removal) • White mastic on floors around 3" and 4" pipes in rooms MR 301 and MR302 (not observed but can't confirm removal) • White mastic between metal roof panels in room MR 301 and MR302 (not observed, but can't confirm removal) • Gold undersink coating on one sink in each of J215 (not observed but can't confirm removal) • White packing material between the metal pipe and surrounding concrete in the ceiling of the lower level janitor's room in J017 • Black mastic inside thresholds of the doors to the mechanical rooms between cells. Mechanical rooms (pipe chases) between cells were not accessed during this assessment but this material is presumed to be present • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures • Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed • Red mastic applied to both the outer and inner seams of HVAC ducting throughout • Black window mastic on interior partition windows. Reportedly removed from the control post (SNC Asbestos Window Caulking Abatement Report, 2017) but may remain present on other interior partition windows **Lead** The following LCPs were identified: • Red coloured paint on metal sprinkler line • Cream coloured paint on structural steel throughout • Brown coloured paint on metal handrailing and staircase in the control post • Orange coloured paint on insulation wrap for the hot water piping supply/return insulation • Cream coloured paint on metal window frames and concrete walls • Off-white coloured paint on vertical roof support pillars Lead is also expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment, ceramic tile glaze and vent and pipe flashings. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 115 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 115 fluorescent light fixtures observed

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
	Mould The following mould and/or moisture issues were observed: • Moisture stained ceiling tiles in room 128, court room • Water damaged drywall ceiling in room 016, common area **Ozone Depleting Substances** The following equipment was identified by labels to be ODS-containing: • One Guardian air conditioning unit that services the control post (R-22) **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar – Ceramic tiles and associated wall/ceiling finish materials • Gypsum board and associated wall/ceiling finish materials • Suspended ceiling tiles • Asphalt and asphalt products containing rock or stone (e.g., roof membrane)
Building M—Site Storage Building (836-00-RP)	**Silica** • Silica is expected to be present in the concrete foundation and lock blocks.
Building MS—Motorcycle Shed (836-00-RP)	**Lead** The following LCPs were identified: • Black/red coloured paint on metal structure/frame • Yellow coloured paint on metal bench **Silica** Silica is expected to be present in the concrete foundation.
Building N—Administration (836-08-RP)	**Asbestos** The following ACMs were identified: • Red HVAC duct mastic on seams of ducting throughout • Black window pane caulking applied to windows throughout • Black window pane caulking applied to window in tactical room N205 • Drywall joint compound on walls throughout the first floor • Grey pipe sealant on threads of sprinkler lines • 12”x12” red floor tile with cream streaks in rooms: C100, N101 (under laminate), N102 (under laminate), N103 (under laminate), N107 (under laminate), N108 (under laminate), N109 (under laminate), N110, N112 (under laminate), N151 and N152 • 12”x12” grey floor tile with brown streaks in room N108, N116, and N215A • White vinyl floor tile in the lobby concealed under laminate • Ceiling texture coat in the lobby • Brown under sink coating in room N112, staff lounge. Not observed by Stantec but presumed to be present (no records provided to confirm removal) • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures • Vermiculite insulation within block walls in sporadic locations (confirmed by others as present in the block wall between rooms N102 and N103 SIO offices). Not observed by Stantec in discrete locations assessed

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
	Lead The following LCPs were identified: • Red coloured paint on cast iron sprinkler lines • Brown coloured paint on bars over windows Lead is also expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment, ceramic tile glaze and vent and pipe flashings. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 50 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 50 fluorescent light fixtures observed **Mould** The following mould and/or moisture issues were observed: • Moisture stained ceiling tiles in various locations throughout • Moisture damaged drywall by the sink in room N116 **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, blocks – Brick/masonry units and associated grout and mortar – Stone/ceramic floor tiles and associated grouts and mortars • Gypsum and associated wall/ceiling finish materials • Suspended ceiling tiles • Asphalt and asphalt products containing rock or stone (e.g. roof membrane)

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building PC—Programs Corridor (836-08-RP)	**Asbestos** The following ACMs were identified: • Red HVAC duct mastic on ducting throughout • Blue pipe sealant on threads of sprinkler lines throughout • 12”x12” cream floor tile with brown smears in rooms PC141 common room, PC130 chapel, PC131 chaplain office (under laminate), PC138 day keepers office (under laminate), and PC113 office storage (under laminate) • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures • Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed **Lead** The following LCP was identified: • Brown coloured paint on metal trim and doors Lead is also expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment, ceramic tile glaze and vent and pipe flashings. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 100 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 100 fluorescent light fixtures observed **Mould** The following mould and/or moisture issues were observed: • Moisture stained ceiling tiles in rooms PC122 deliberation room and PC112 office **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, blocks – Brick/masonry units and associated grout and mortar – Stone/ceramic floor tiles and associated grouts and mortars • Gypsum and associated wall/ceiling finish materials • Suspended ceiling tiles • Asphalt and asphalt products containing rock or stone (e.g., roof membrane)

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building PE—Principal Entrance (836-04-RP)	**Asbestos** The following ACMs were identified: • Black window pane caulking applied to partition and perimeter windows throughout • Grey/white pipe sealant applied to threads of sprinkler lines throughout • 12”x12” off-white/light grey floor tile with brown streaks in rooms PE105, PE109, PE112, PE200, PE201, PE204 (under sheet flooring) and stairwell landings in two stairwells • Cement panel on PE102 ceiling and exterior perimeter walls (construction barrier). Although cement panel was not observed by Stantec it is presumed to still be present in concealed areas • Red HVAC duct mastic. Although red mastic was not observed by Stantec it is presumed to still be present in concealed areas • Black mastic around wire entry perforation in telephone distribution box in PE208. Although black mastic was not observed by Stantec it is presumed to still be present in concealed areas • Grey/green HVAC duct mastic • Black vent mastic on rooftop vents **Lead** The following LCPs were identified: • Grey coloured paint on metal doors and frames • Red coloured paint on structural steel • Yellow coloured paint on metal gas lines • Red coloured paint on metal sprinkler lines • Brown/orange coloured paint on metal doors • Off-white coloured paint on metal duplicate key safe • Brown coloured paint on metal exhaust fan hood • Brown coloured paint on metal handrails • White coloured paint on metal walls • Black coloured paint on metal window frames • Pale yellow coloured paint on metal natural gas service piping • White coloured paint on metal window frames Lead is also expected to be present in older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and vent and pipe flashings. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 50 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 50 fluorescent light fixtures observed **Mould** The following mould and/or moisture issues were observed: • Moisture stained ceiling tiles in various locations throughout **Ozone Depleting Substances** The following equipment was identified by labels to be ODS-containing: • Two York rooftop HVAC units (18 lbs. of R-22)

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
	Silica Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar – Stone/ceramic floor tiles and associated grouts and mortars • Gypsum and associated wall/ceiling finish materials • Suspended ceiling tiles • Asphalt and asphalt products containing rock or stone (e.g., roof shingles)
Building PFS—PF Storage/UCCO Office (836-11-RP)	**Asbestos** The following ACM was identified: • Orange and yellow pattern sheet flooring in rooms UCCO100, PFS/FE100 and FE101 **Lead** The following LCP was identified: • White coloured paint on exterior doors Lead is also expected to be present in older electrical wiring materials and sheathing, solder used on domestic water lines and solder used in bell fittings for cast iron pipes and in electrical equipment. **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation • Gypsum and associated wall/ceiling finish materials • Asphalt and asphalt products containing rock or stone (e.g., roof shingles)
Building PFV1—Private Family Visiting 01 North (836-05-RP)	**Asbestos** The following ACMs were identified: • Drywall joint compound applied to walls and ceilings throughout • Yellow/orange marble patterned sheet flooring **Lead** Lead is expected to be present in older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and vent and pipe flashings. **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation • Gypsum and associated wall/ceiling finish materials • Asphalt and asphalt products containing rock or stone (e.g., roof shingles)

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building PFV2—Private Family Visiting 02 East (836-06-RP)	**Asbestos** The following ACM was identified: • Drywall joint compound applied to walls and ceilings throughout **Lead** Lead is expected to be present in older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment, ceramic tile glaze and vent and pipe flashings. **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete – foundation, floors • Gypsum and associated wall/ceiling finish materials • Asphalt and asphalt products containing rock or stone (e.g., roof shingles)
Building PFV3—Private Family Visiting 03 South (836-07-RP)	**Lead** The following LCP was identified: • Grey coloured paint on exterior wood ramp Lead is also expected to be present in older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and vent and pipe flashings. **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors • Gypsum and associated wall/ceiling finish materials • Asphalt and asphalt products containing rock or stone (e.g., roof shingles)
Building PMPH—Pump House (836-17-RP)	**Lead** Lead is expected to be present in solder used in bell fittings for cast iron pipes. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 12 fluorescent light fixtures observed **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks • Brick/masonry units and associated grout and mortar

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building POD1—POD1 – 96-Man Living Unit (836-15-RP)	**Lead** Lead is expected to be present in lead-acid batteries used in emergency lighting. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 200 fluorescent light fixtures observed **Mould** The following mould and/or moisture issues were observed: • Moisture stained ceiling tiles in the admin area • Moisture stained drywall in room 2803, pneumatic equipment room **Ozone Depleting Substances** The following equipment was identified in the Halocarbon Inventory for the subject facility, provided by PSPC to have ODS-containing refrigerant: • One Engineered Air unit (AHU3) that services POD1 Administration (3.63 Kg of R-22) • One Engineered Air unit (AHU4) that services POD1 Multi Purpose (4.54 Kg of R-22) **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar – Panels • Gypsum and associated wall/ceiling finish materials • Suspended ceiling tiles
Building POD2—POD2—96-Man Living Unit (836-18-RP)	**Lead** The following LCP was identified: • Teal/green coloured paint on metal boiler valve assembly Lead is also expected to be present in lead-acid batteries used in emergency lighting and solder used on domestic water lines. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 200 fluorescent light fixtures observed **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete – foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar – Panels • Gypsum and associated wall/ceiling finish materials • Suspended ceiling tiles

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building PST—Public Works Storage Trailer (836-13-RP)	**Lead** The following LCP was identified: • White coloured paint on metal door Lead is also expected to be present in solder used in bell fittings for cast iron pipes and in electrical equipment. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the two fluorescent light fixtures observed **Silica** Silica is expected to be present in the concrete foundation.
Building PWC—Public Works Site Office (836-09-RP)	**Asbestos** The following ACMs were identified: • 12”x12” cream vinyl floor tile with beige streaks in room PWC 110 • Vinyl floor tile under sheet flooring and sub floor in rooms PWC100, PWC101 and PWC108 • Black window pane caulking applied to windows throughout **Lead** Lead is expected to be present in older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and vent and pipe flashings. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 30 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 30 fluorescent light fixtures observed • Two mercury-containing thermostats were identified in rooms PWC108, common area, and PWC112, boardroom **Mould** The following mould and/or moisture issues were observed: • Moisture stained ceiling tiles in various locations throughout **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation • Gypsum and associated wall/ceiling finish materials • Suspended ceiling tiles

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building PWRH—Power House (836-16-RP)	**Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the 17 fluorescent light fixtures observed **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar
Building Q—Kitchen Staff/Inmate Dining (836-08-RP)	**Asbestos** The following ACMs were identified: • Red HVAC duct mastic applied to ducting throughout • Drywall joint compound applied to walls and ceilings throughout • Black window pane caulking applied to partition windows throughout • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures • Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed **Lead** The following LCPs were identified: • Brown coloured paint on metal doors, frames, and trim • Red coloured paint on structural steel • Off-white coloured paint on concrete block walls • Off-white coloured paint on drywall ceiling • White coloured paint on metal door frames Lead is also expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment, ceramic tile glaze and vent and pipe flashings. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 150 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 150 fluorescent light fixtures observed **Mould** The following mould and/or moisture issues were observed: • Suspect mould observed in the ceiling space (“top”) side of drywall ceilings in various locations throughout the cooking assembly area • Rodent droppings within ceiling space in various locations throughout

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
	Silica Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete – foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar – Ceramic tiles and associated grouts and mortars • Gypsum and associated wall/ceiling finish materials • Asphalt and asphalt products containing rock or stone (e.g., roof membrane)
Building R—Recreation (836-08-RP)	**Asbestos** The following ACMs were identified: • Red HVAC duct mastic (painted grey in some areas) applied to seams of ducting throughout • 12”x12” grey/blue vinyl floor tile with brown streaks in room R100, R200, R203 and R201 • Black window mastic between glazing and frames in R201 • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures • Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed **Lead** The following LCPs were identified: • Blue coloured paint on metal doors and frames • Light brown coloured paint on metal doors and frames • Greenish grey coloured paint on metal doors and frames • Brown coloured paint on metal window frames Lead is also expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and vent and pipe flashings. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 35 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 35 fluorescent light fixtures observed **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar – Ceramic tiles and associated grouts and mortars • Gypsum and associated wall/ceiling finish materials • Asphalt and asphalt products containing rock or stone (e.g., roof membrane)

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building ST— Storage Building (836-14-RP)	**Asbestos** The following ACM was identified: • Heat shield within the incandescent light fixture in room ST101, washroom/lift station **Lead** The following LCPs were identified: • Yellow coloured paint on interior metal doors and trim • Brown coloured paint on exterior metal doors • Yellow coloured paint on exterior metal loading dock • Tan coloured paint on exterior metal siding • Burgundy coloured paint on metal exterior bay doors • Green coloured paint on exterior metal bollards Lead is also expected to be present in lead-acid batteries used in emergency lighting, solder used in bell fittings for cast iron pipes and in electrical equipment and vent and pipe flashings. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 47 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 47 fluorescent light fixtures observed **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors • Gypsum and associated wall/ceiling finish materials

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building SUB—Main Substation (836-02-RP)	**Asbestos** The following ACMs were identified: • Grey penetration sealant around pipes on roof • Black and white roof mastic **Lead** The following LCPs were identified: • Red coloured paint on concrete floors • Red coloured paint on metal pipes and flanges • Blue coloured paint on metal pipes and flanges • Cream/red coloured paint on metal roof hatch Lead is also expected to be present in older electrical wiring materials and sheathing, solder used in bell fittings for cast iron pipes and in electrical equipment and vent and pipe flashings. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 25 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 25 fluorescent light fixtures observed **Silica** Silica is expected to be present in the concrete foundation, floors, walls, blocks and roof
Building SWT—Sweat Lodge (836-00-RP)	**Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete – foundation • Asphalt and asphalt products containing rock or stone (e.g., roof shingles)

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building TU—Tunnels (836-08-RP)	**Asbestos** The following ACMs were identified: • Cement panel on electrical penetrations above doors • Red duct mastic applied to ducting throughout • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures **Lead** The following LCP was identified: • Orange coloured paint on cast iron pipe flanges • Red coloured paint on electrical conduits Lead is also expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing and solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 60 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 60 fluorescent light fixtures observed **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar • Gypsum and associated wall/ceiling finish materials

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building V – Industries (836-08-RP)	**Asbestos** The following ACMs were identified: • Grey window pane caulking applied to windows throughout • Red HVAC duct mastic applied to ducting throughout • Tan cement panel on upper walls and where mechanical system penetrates wall • 12”x12” cream floor tile with brown streaks in rooms V105a, KG202, KG203 and KG204 • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures • Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed **Lead** The following LCPs were identified: • Dark blue coloured paint on concrete columns, stairs and partition walls • Sky blue coloured paint on metal structural steel, q-decking and ducting • Beige coloured paint on metal doors and frames • Red coloured paint on concrete floors • Yellow coloured paint on concrete floors • Brown coloured paint on metal washroom door frames • Blue on metal washroom doors Lead is also expected to be present in older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment and vent, ceramic tile glaze and pipe flashings. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 40 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 40 fluorescent light fixtures observed **Mould** The following mould and/or moisture issues were observed: • Moisture damaged drywall in room ENVI100 **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar – Stone/ceramic floor tiles and associated grouts and mortars – Panels/boards and pipes • Gypsum and associated wall/ceiling finish materials • Asphalt and asphalt products containing rock or stone (e.g., roof membrane)

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building VC—Visiting & Correspondence (836-08-RP)	**Asbestos** The following ACMs were identified: • 12”x12” orange floor tile with white streaks in room C100, corridor • 12”x12” cream vinyl floor tile with brown streaks in room VC105, inmate wait & search and the second layer under carpet in room VC103, visiting lounge • Red HVAC duct mastic applied to ducting throughout. This material was not observed to be present by Stantec but is presumed to be present in concealed locations not accessed • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures • Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed **Lead** The following LCP was identified: • Orange coloured paint on metal doors Lead is also expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment, ceramic tile glaze and vent and pipe flashings. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 30 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 30 fluorescent light fixtures observed **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar – Ceramic floor tiles and associated grouts and mortars • Suspended ceiling tiles • Asphalt and asphalt products containing rock or stone (e.g., roof membrane)

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building VS—Volatile Storage (836-12-RP)	**Asbestos** The following ACM was identified: • Unknown debris double bagged and labeled as ACM waste, one unlabeled black garbage bag (potentially ACM debris) and one Tyvek suit in a clear garbage bag (potentially asbestos contaminated) **Lead** The following LCPs were identified: • Beige coloured paint on metal exterior walls • Brown coloured paint on metal exterior doors and trim Lead is also expected to be present in older electrical wiring materials and sheathing and solder used in bell fittings for cast iron pipes and in electrical equipment. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the one fluorescent light fixture observed **Silica** • Silica is expected to be present in the concrete foundation.

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Building W-X—Maintenance Storage & Shops (836-08-RP)	**Asbestos** The following ACMs were identified: • Red duct mastic applied to seams of HVAC ducting throughout • 12”x12” cream vinyl floor tile with brown streaks in rooms W100a, W100 (under sheet flooring), W103, W106, W108, W111 and W123 • Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures • Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed **Lead** The following LCPs were identified: • Brown coloured paint on metal doors, frames and bay doors • Yellow coloured paint on metal exterior stairs and scissor lift • Light blue coloured paint on metal HVAC ducting Lead is also expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes and in electrical equipment, ceramic tile glaze and vent and pipe flashings. **Polychlorinated Biphenyls** PCBs may be present in the fluorescent light ballasts of the approximately 105 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons. **Mercury** The following was observed pertaining to mercury-containing items: • Mercury vapour is present in the light tubes within the approximately 105 fluorescent light fixtures observed **Mould** The following mould and/or moisture issues were observed: • Moisture stained ceiling tiles in room W106, maintenance records **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Cement products such as: – Concrete—foundation, floors, walls, blocks – Brick/masonry units and associated grout and mortar – Ceramic floor tiles and associated grouts and mortars • Gypsum and associated wall/ceiling finish materials • Suspended ceiling tiles • Asphalt and asphalt products containing rock or stone (e.g., roof membrane)

Table ES 1 Summary of Identified Hazardous Building Materials

Building Name	Identified Hazardous Building Materials
Roof	**Asbestos** The following ACM was identified: • Grey mastic on exterior living unit roofs around louvers **Lead** The following LCP was identified: • Grey coloured paint on metal HVAC units and vents Lead is also expected to be present in vent and pipe flashings. **Ozone Depleting Substances** The following equipment was identified by labels to be ODS-containing: • Three rooftop Trane A/C units (10 lbs. total of R-22) The following equipment is suspected to be ODS-containing (labels were worn away/not present): • Two unknown rooftop air handling units above building PC (no label visible) **Silica** Silica is expected to be present in the following, which were observed in various locations throughout: • Asphalt and asphalt products containing rock or stone (e.g., roof membrane)

Building-by-building summaries of the identified hazardous building materials are provided in Appendix 1 through Appendix 5.43. General findings pertaining to hazardous building materials are provided in Section 5.0 and the building-by-building appendices of this report. General recommendations are provided in Section 6.0 of this report and building-specific recommendations regarding identified hazardous building materials in “non-compliant” condition (materials requiring action) are provided in the building-by-building appendices.

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Public Services and Procurement Canada (PSPC) on behalf of Correctional Services Canada (CSC) to conduct hazardous building materials assessments for the following buildings (subject buildings) at the CSC Kent Institution, which is located at 4732 Cemetery Road in Agassiz, British Columbia:

- 836-08-RP Building A&B—Living Unit A&B (1979)
- 836-08-RP Building AC—Academic Centre (1979)
- 836-08-RP Building AD—Admission/Discharge (1979)
- 836-08-RP Building BR—Boiler Room/South Mechanical Room (1979)
- 836-08-RP Building C&D—Living Unit C&D (1979)
- 836-00-RP Building COMP—Composter & Storage (unknown)
- 836-08-RP Building CS-L-S—Clothing & Supplies/Laundry/Stores (1979)
- 836-00-RP Building CZE—Construction Zone Entry Building (2005)
- 836-08-RP Building E&F—Living Unit E&F (1979)
- 836-08-RP Building G&H—Living Unit G&H (1979)
- 836-19-RP Building GO—General Operations/ G.O. Building (2013)
- 836-03-RP Building GT01—Guard Tower (1979)
- 836-03-RP Building GT02—Guard Tower (1979)
- 836-03-RP Building GT03—Guard Tower (1979)
- 836-03-RP Building GT04—Guard Tower (1979)
- 836-08-RP Building HC—Health Care (1979)
- 836-08-RP Building J&K—Living Unit K/Segregation Unit J (1984)
- 836-00-RP Building M—Site Storage Building (unknown)
- 836-00-RP Building MS—Motorcycle Shed (unknown)
- 836-08-RP Building N—Administration (1979)
- 836-08-RP Building PC—Programs Corridor (1979)
- 836-04-RP Building PE—Principal Entrance (1979)
- 836-11-RP Building PFS—PF Storage/UCCO Office (1981)
- 836-05-RP Building PFV1—Private Family Visiting (1981)
- 836-06-RP Building PFV2—Private Family Visiting 02 East (1981)
- 836-07-RP Building PFV3—Private Family Visiting 03 South (1994)
- 836-17-RP Building PMPH—Pump House (2011)
- 836-15-RP Building POD1—POD1—96-Man Living Unit (2009)
- 836-18-RP Building POD2—POD2—96-Man Living Unit (2012)
- 836-13-RP Building PST—Public Works Storage Trailer (1992)
- 836-09-RP Building PWC—Public Works Site Office (1983)
- 836-16-RP Building PWRH—Power House (2011)
- 836-08-RP Building Q—Kitchen Staff/Inmate Dining (1979)
- 836-08-RP Building R—Recreation (1979)

- 836-14-RP Building ST—Storage Building (1998)
- 836-02-RP Building SUB—Main Substation (1979)
- 836-00-RP Building SWT—Sweat Lodge (2005)
- 836-08-RP Building TU—Tunnels (1979)
- 836-08-RP Building V—Industries (1979)
- 836-08-RP Building VC—Visiting & Correspondence (1979)
- 836-12-RP Building VS—Volatile Storage (1995)
- 836-08-RP Building W-X—Maintenance Storage & Shops (1979)

An overall site plan of Kent Institution, which shows the locations of the buildings assessed, is presented in the drawings in Appendix 1. In addition, a list of the buildings included in this assessment, with additional information pertaining to building construction dates, is also provided in Appendix 1.

The purpose of the assessment was to check for potential hazardous building materials that may require special management practices in accordance with the requirements of the Canada Labour Code, Part II Canada Occupational Health and Safety Regulations (COHSR) and the current version of British Columbia's Occupational Health and Safety Regulation *(*BC Reg. 296/97) during continued operations and maintenance.

The hazardous building materials considered included asbestos-containing materials (ACMs, including presumed ACMs, or "PACMs"), lead-containing materials including lead-containing paints (LCPs), polychlorinated biphenyls (PCBs), mercury-containing items, ozone-depleting substances (ODSs), mould or moisture affected building materials, and silica.

The site work was conducted by Kim Wiese, Keith Irwin, and Amanda Bell on July 16–20 and 23–27, 2018.

2.0 BACKGROUND

Stantec understands that the subject buildings were generally constructed during time periods when hazardous building materials were commonly or potentially used in construction, and that information pertaining to the identity, location and approximate extent of hazardous building materials within the subject buildings was incomplete, outdated and/or required review and update to meet current standards, guidelines and/or regulations. As such, and in accordance with the COHSR and BC Reg. 296/97 pertaining to identifying hazards associated with hazardous building materials in the workplace, and to assist with future renovation planning, PSPC commissioned this assessment on behalf of the CSC.

2.1 DOCUMENT REVIEW

The following documentation (further referred to collectively as the Previous Reports, and individually as noted with each list item, where applicable) was reviewed prior to undertaking the assessment:

- Arcadis Canada Inc. Report No. 702358-027 entitled *Hazardous Materials Assessment for the Kent Institution Boiler Room V200, 4732 Cemetery Road, Agassiz, British Columbia,* dated January 4, 2017, prepared for Public Works and Government Services Canada
- RJ & Associates Environmental Consulting Inc. Report entitled *Living Unit F, Kent Institution, 4732 Cemetary Road, Agassiz, British Columbia, Air Monitoring & Hazmat Abatement Summary Report* dated June 21, 2010, prepared for Public Works and Government Services Canada
- RJ & Associates Environmental Consulting Inc. Report entitled *Lower Tier, Living Unit H, Kent Institution, 4732 Cemetery Road, Agassiz, British Columbia, Air Monitoring & Hazmat Abatement Summary Report* dated December 28, 2009, prepared for Public Works and Government Services Canada
- RJ & Associates Environmental Consulting Inc. Report entitled *Localized Asbestos Assessment within Living Unit Pipe chases and Control bubbles of the Kent Maximum Security Institution, Agassiz, BC* dated July 28, 2009, prepared for Public Works and Government Services Canada (RJ Pipe Chase and Control Bubble Report, 2009)
- BC Asbestos Services Ltd. Bulk Asbestos Results No. BE-VC-017804, dated June 2015, prepared for DST Consulting Engineers
- DST Consulting Engineers Lead Analysis Report No. BE-VC-017804, dated June 19, 2015, prepared for Public Works and Government Services Canada
- Asbestos Analytical Services Ltd., Asbestos Analysis Report No. BE-VC-016211, dated February 20, 2013
- Data Chem Laboratories Inc., Asbestos in Bulk Building Material Analysis No. 8870, dated April 14, 2009
- DST Consulting Engineers Asbestos Analysis Report No. BE-VC-016211, dated July 27, 2013, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Asbestos Analysis Report No. BE-VC-016211, dated February 19, 2013, prepared for Public Works and Government Services Canada

- DST Consulting Engineers Report No. BE-VC-016211, dated July 27, 2013, prepared for Public Works and Government Services Canada
- Maxxam TCLP Certificate of Analysis, dated April 26, 2013, prepared for DST Consulting Engineers
- Maxxam TCLP Certificate of Analysis, dated November 7, 2014, prepared for DST Consulting Engineers
- Maxxam TCLP Certificate of Analysis, dated November 6, 2014, prepared for DST Consulting Engineers
- EMSL Canada Inc. Project No. #GV-VC-035763.01 Certificate of Analysis, dated November 15, 2018, prepared for DST Consulting Engineers
- Golder Associates Ltd. Report No. 10-1437-0101 entitled *Asbestos and Concrete (Containing Crystalline Silica) Removal Monitoring and Supervision, Kent Institution, 4732 Cemetery Road, Agassiz, BC* dated March 30, 2012, prepared for Public Works and Government Services Canada
- Can Test Ltd. Report entitled *Report on Asbestos-Containing Construction Materials, Kent Maximum Security Institution, Agassiz, BC* dated July 1988, prepared for Public Works Canada Pacific Regional Architectural and Engineering Services;
- DST Consulting Engineers Report No. BE-VC-021508 entitled *Site Inspection Report No. 1 – Kent Institution – J Unit Exercise Yard, 4732 Cemetery Road, Agassiz, British Columbia* dated October 22, 2015, prepared for Public Works and Government Services Canada
- SNC-Lavalin Inc. Report No. 644051 entitled *Hazardous Building Materials Assessment, Select Portions of Living Unit F, Kent Institution, Agassiz, BC* dated February 14, 2017, prepared for Public Works and Government Services Canada (SNC Living Unit F Report, 2017)
- SNC-Lavalin Inc. Report No. 644051 entitled *Results for Silica and Lead Air Sampling within the Living Unit F Control Post at the Kent Institution, Agassiz, BC* dated March 13, 2017, prepared for Public Works and Government Services Canada
- Pottinger Gaherty Environmental Consultants Ltd. Report No. 125-54.01 entitled *Asbestos Containing Material Survey Report, Kent Maximum Security Institution, Agassiz, British Columbia* dated March 2004, prepared for Public Works and Government Services Canada (PGL, ACM Survey Report 2004)
- RJ & Associates Environmental Consulting Inc. Report No. RG090827-01MS entitled *Site Inspection Report, Kent Institution – Toilet Project Asbestos Abatement* dated August 27, 2009, prepared for Public Works and Government Services Canada
- SNC-Lavalin Inc. Report No. 647081 entitled *Asbestos Window Caulking Abatement Closure Report, Living Unit J/K Control Post, Kent Institution, Agassiz, BC* dated December 5, 2017, prepared for Public Services and Procurement Canada
- Arcadis Canada Inc. Report No. 702358-027 entitled *Hazardous Materials Assessment for the Kent Institution Living Unit F, 4732 Cemetary Road, Agassiz, British Columbia* dated December 12, 2016, prepared for Public Works and Government Services Canada
- PHH ARC Environmental Ltd. Report No. 109221 entitled *Pre-Renovation Hazardous Building Materials Survey Report, CSC Kent Institution – N115, N117, N118, and N106 – New MCCP and CER Upgrade, 4732 Cemetery Road, Agassiz, BC* dated March 11, 2013, prepared for Public Works and Government Services Canada (PHH Pre-Reno Hazmat 2013)
- SNC-Lavalin Inc. Report No. 651548 entitled *Hazardous Building Materials Assessment, POD 2 Boiler Room Mechanical Room, and Select Portions of the Roof, Kent Institution, Agassiz, BC* dated July 22, 2018, prepared for Public Services and Procurement Canada (SNC POD 2 Report 2018)

- Arcadis Canada Inc. Report No. 702358-017 entitled *Air Monitoring and Supervision During Asbestos-Containing Floor Tile Replacement CSC Kent Institution Kitchen, 4732 Cemetery Road, Agassiz, British Columbia* dated November 28, 2016, prepared for Public Works and Government Services Canada
- Arcose Consulting Ltd. Report No. 150-12763-2014 entitled *Kent Institution Admissions/Discharge Area Renovations, Retrospective Exposure Assessment* dated July 20, 2015, prepared for Public Works and Government Services Canada (Arcose A/D Exposure Assessment, 2015)
- DST Consulting Engineers Report No. BE-VC-017336 entitled *Sampling and Analysis – Asbestos-Containing Gaskets, 4732 Cemetery Road, Agassiz, British Columbia* dated December 13, 2013, prepared for Correctional Service of Canada (DST Gasket Report, 2013)
- DST Consulting Engineers Report No. BE-VC-017804 entitled *Final Site Inspection Report for Kent Institution A&D Building Upgrades, 4732 Cemetery Road, Agassiz, British Columbia* dated December 2, 2014, prepared for Public Works and Government Services Canada (DST A&D Site Inspection Report 2014)
- DST Consulting Engineers Report No. BE-VC-017804 entitled *Site Inspection Report No. 3 - Kent Institution A&D Building Renovation, 4732 Cemetery Road, Agassiz, British Columbia* dated February 24, 2015, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Report No. BE-VC-017804 entitled *Site Inspection Report No. 5 - Kent Institution A&D Building Renovation, 4732 Cemetery Road, Agassiz, British Columbia* dated March 25, 2015, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Report No. BE-VC-017804 entitled *Site Inspection Report No. 9 - Kent Institution A&D Building Renovation, 4732 Cemetery Road, Agassiz, British Columbia* dated June 22, 2015, prepared for Public Works and Government Services Canada
- Golder Associates Ltd. Report No. 11-1437-0103/1000 entitled *Hazardous Building Materials Assessment – Health Care X-Ray Unit, Kent Institution, 4732 Cemetery Road, Agassiz, BC* dated February 8, 2012, prepared for Public Works and Government Services Canada (Golder Health Care X-Ray Hazmat 2012)
- Golder Associates Ltd. Report No. 11-1437-0103/2000 entitled *Hazardous Building Materials Assessment – Drug Loo, Kent Institution, 4732 Cemetery Road, Agassiz, BC* dated February 7, 2012, prepared for Public Works and Government Services Canada
- PHH ARC Environmental Ltd. Report No. 109221 entitled *Pre-Renovation Hazardous Building Materials Survey Report, CSC Kent Institution – KG207 Mechanical Room, 4732 Cemetery Road, Agassiz, BC* dated March 11, 2013, prepared for Public Works and Government Services Canada
- RJ & Associates Environmental Consulting Inc. Report entitled *Indoor Air Quality Report, Silica Monitoring, Kent Institution, 4732 Cemetery Road, Agassiz, B.C.* dated February 4, 2010, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Report No. BE-VC-016306 entitled *Lead in Air Analytical Results – Furniture Replacement, Living Units A&B - Kent Institution, Agassiz, British Columbia* dated April 26, 2013, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Report No. BE-VC-016306 entitled *Lead in Air Analytical Results – Furniture Replacement, Living Units E&F - Kent Institution, Agassiz, British Columbia* dated April 11, 2013, prepared for Public Works and Government Services Canada

- DST Consulting Engineers Report No. BE-VC-016306 entitled *Lead in Air Analytical Results – Furniture Replacement, Living Units C&D - Kent Institution, Agassiz, British Columbia* dated June 4, 2013, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Report No. BE-VC-016306 entitled *Lead in Air Analytical Results – Furniture Replacement, Living Units C&D - Kent Institution, Agassiz, British Columbia* dated May 27, 2013, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Report No. BE-VC-016306 entitled *Lead in Air Analytical Results – Furniture Replacement, Living Units G&H - Kent Institution, Agassiz, British Columbia* dated July 3, 2013, prepared for Public Works and Government Services Canada
- RJ & Associates Environmental Consulting Inc. Report entitled *Localized Lead Investigation Report for Living Units E, F, and G, 4732 Cemetery Road, Agassiz, B.C.* dated September 14, 2009, prepared for Public Works and Government Services Canada (RJ Lead Survey for Living Units E, F, G, 2009)
- Arcadis Canada Inc. Report No. 702358-015 entitled *Flooring Testing for Asbestos CSC Kent Institution Kitchen,* dated July 26, 2016 prepared for Public Works and Government Services Canada (Arcadis, Kitchen Flooring Testing, 2016)
- DST Consulting Engineers Report No. BE-VC-017372 entitled *Kent Institution – Admissions and Discharge (A&D) Redevelopment Hazardous Building Material Assessment,* dated September 19, 2013, prepared for Public Works and Government Services Canada (DST A&D Redevelopment Report, 2013)
- DST Consulting Engineers Report No. BE-VC-016211 entitled *Final Report – Lead-Based Coatings Assessment – Living Units A, B, C, D, and H - Kent Institution, Agassiz, British Columbia* dated January 31, 2013, prepared for Public Works and Government Services Canada (DST Living Units LBC Report, 2013)
- DST Consulting Engineers Report No. BE-VC-016456 entitled *Hazardous Building Materials Assessment, DDC Upgrade – Kent Institution, Agassiz, British Columbia* dated March 26, 2013, prepared for Public Works and Government Services Canada (DST DDC Upgrade Report 2013);
- PHH ARC Environmental Ltd. Report No. 10922M entitled *Pre-Renovation Hazardous Building Materials Survey Report, CSC Kent Institution – Lobby, Corridor, and N105 – New MCCP Upgrade, 4732 Cemetery Road, Agassiz, BC* dated October 17, 2013, prepared for Public Works and Government Services Canada (PHH Pre-Reno MCCP Upgrade, 2013)
- DST Consulting Engineers Report No. BE-VC-020166 entitled *Limited Hazardous Building Materials Assessment, Kitchen of Unit Q – Dishwasher Replacement – Kent Institution, 4732 Cemetery Road, Agassiz, British Columbia* dated July 6, 2015, prepared for Public Works and Government Services Canada (DST Limited Hazmat, Kitchen of Unit Q, 2015)
- DST Consulting Engineers Report No. BE-VC-021108 entitled *Final Report - Hazardous Building Materials Abatement Closure Report – Kent Institution, Kitchen Area, 4732 Cemetery Road, Agassiz, British Columbia* dated June 30, 2015, prepared for Public Works and Government Services Canada (DST Unit Q Dishwasher Replacement 2015)
- DST Consulting Engineers Report No. BE-VC-021108 entitled *Site Inspection Report No. 1 – Kent Institution - Kitchen Area Renovation, 4732 Cemetery Road, Agassiz, British Columbia* dated May 14, 2015, prepared for Public Works and Government Services Canada

- DST Consulting Engineers Report No. BE-VC-021108 entitled *Site Inspection Report No. 2 – Kent Institution - Kitchen Area Renovation, 4732 Cemetery Road, Agassiz, British Columbia* dated May 14, 2015, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Report No. BE-VC-021108 entitled *Site Inspection Report No. 3 – Kent Institution - Kitchen Area Renovation, 4732 Cemetery Road, Agassiz, British Columbia* dated May 20, 2015, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Report No. BE-VC-021108 entitled *Site Inspection Report No. 4 – Kent Institution - Kitchen Area Renovation, 4732 Cemetery Road, Agassiz, British Columbia* dated May 23, 2015, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Report No. BE-VC-021108 entitled *Site Inspection Report No. 5 – Kent Institution - Kitchen Area Renovation, 4732 Cemetery Road, Agassiz, British Columbia* dated June 3, 2015, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Report No. BE-VC-021108 entitled *Site Inspection Report No. 6 – Kent Institution - Kitchen Area Renovation, 4732 Cemetery Road, Agassiz, British Columbia* dated June 10, 2015, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Report No. BE-VC-021508 entitled *Site Inspection Report No. 1 – Kent Institution – J Unit Exercise, 4732 Cemetery Road, Agassiz, British Columbia* dated October 22, 2015, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Report No. BE-VC-021207.02 entitled *Site Inspection Report No. 1 – Kent Institution – Living Unit Window Replacement - 4732 Cemetery Road, Agassiz, British Columbia* dated September 24, 2015, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Report No. BE-VC-021207.02 entitled *Site Inspection Report No. 2 – Kent Institution – Living Unit Window Replacement - 4732 Cemetery Road, Agassiz, British Columbia* dated September 24, 2015, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Report No. BE-VC-021207.02 entitled *Site Inspection Report No. 3 – Kent Institution – Living Unit Window Replacement - 4732 Cemetery Road, Agassiz, British Columbia* dated September 30, 2015, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Report No. BE-VC-021207.02 entitled *Site Inspection Report No. 4 – Kent Institution – Living Unit Window Replacement - 4732 Cemetery Road, Agassiz, British Columbia* dated October 9, 2015, prepared for Public Works and Government Services Canada
- DST Consulting Engineers Report No. BE-VC-021207.02 entitled *Site Inspection Report No. 5 – Kent Institution – Living Unit Window Replacement - 4732 Cemetery Road, Agassiz, British Columbia* dated October 19, 2015, prepared for Public Works and Government Services Canada
- SNC-Lavalin Inc. Report No. 644051 entitled *Pre-Renovation Hazardous Building Materials Assessment, Living Units J&K Segregation Control Post, Kent Institution, Agassiz, BC* dated February 16, 2017, prepared for Public Works and Government Services Canada (SNC Segregation Control Post Pre-Reno Report 2017)
- SNC-Lavalin Inc. Report No. 644051 entitled *Hazardous Building Materials Assessment, Mechanical Rooms, North and South Blocks, Kent Institution, Agassiz, BC* dated March 16, 2017, prepared for Public Works and Government Services Canada (SNC Living Unit Mechanical Room Reports 2017);
- SNC-Lavalin Inc. Report No. 648171 entitled *Hazardous Building Materials Assessment, Valve and Grill Replacement Project for Mechanical and Plumbing Upgrades, Kent Institution, Agassiz, BC* dated July 31, 2017, prepared for Public Services and Procurement Canada

HAZARDOUS BUILDING MATERIALS ASSESSMENTS

Background
February 2019

- SNC-Lavalin Inc. Report No. 644051 entitled *Hazardous Building Materials Assessment, Mechanical Rooms, Living Units A through H and J/K Segregation Units, Kent Institution, Agassiz, BC* dated March 16, 2017, prepared for Public Works and Government Services Canada
- Arcadis Canada Inc. Report No. 702358-049 entitled *Pre-Renovation Hazardous Building Materials Assessment at the Kent Institution, 4732 Cemetery Road, Agassiz, British Columbia,* dated September 27, 2017, prepared for Public Services and Procurement Canada (Arcadis Area Specific Pre-Reno Hazmat Report 2017)
- SNC-Lavalin Inc. Report No. 647991 entitled *Hazardous Building Materials Assessment, Principle Entrance, Kent Institution, Agassiz, BC* dated September 6, 2017, prepared for Public Services and Procurement Canada (SNC, Principal Entrance Pre-Demo Report 2017)
- SNC-Lavalin Inc. Report No. 644051 entitled *Hazardous Building Materials Assessment, Select Portions of the Living Units, Plumbing Fixtures and Tile Replacement, Kent Institution, Agassiz, BC* dated March 6, 2017, prepared for Public Works and Government Services Canada (SNC Plumbing Fixture and Tile Replacement Report, 2017)
- SNC-Lavalin Inc. Report No. 644051 entitled *Hazardous Building Materials Assessment, Select Portions of the Administration Areas, Plumbing Fixture and Tile Replacement, Kent Institution, Agassiz, BC* dated March 1, 2017, prepared for Public Works and Government Services Canada (SNC Admin Report 2017)
- SNC-Lavalin Inc. Report No. 644051 entitled *Hazardous Building Materials Assessment, Select Portions of the Support Areas, Plumbing Fixtures and Tile Replacement, Kent Institution, Agassiz, BC* dated March 3, 2017, prepared for Public Works and Government Services Canada (SNC Support Areas Report, 2017)
- SNC-Lavalin Inc. Report No. 644051 entitled *Hazardous Building Materials Assessment, Select Portions of the Health Care and Recreation Facilities, Plumbing Fixtures and Tile Replacement, Kent Institution, Agassiz, BC* dated March 3, 2017, prepared for Public Works and Government Services Canada (SNC Area Specific Health Care and Recreation Report 2017)
- SNC-Lavalin Inc. Report No. 644051 entitled *Results for Silica and Lead Air Sampling within the Living Unit F Control Post at the Kent Institution, Agassiz, BC* dated March 13, 2017, prepared for Public Works and Government Services Canada
- Wes-Har Bulk Asbestos Report No. 9153 for RJ and Associates, *Plumbing Fixture in Pipe Chase, Kent Institution Living Unit A/B* dated August 17, 2009 (Wes-Har Analytical Results for RJ dated August 17, 2009)
- Stantec Consulting Inc. Report No. 123220979 entitled Pre-Demolition *Hazardous Building Materials Assessment, Kent and Mountain Institutions Waste Water Treatment Plant, Agassiz, BC* dated October 30, 2017, prepared for Public Services and Procurement Canada (Stantec WWTP Report 2017); DST Consulting Report No. R.083910.001 entitled *Kent Institution – Hazardous Building Material Abatement Closure Report – PPTR Project* prepared for Public Services and Procurement Canada

3.0 SCOPE AND METHODOLOGY

Kim Wiese, Keith Irwin, and Amanda Bell of Stantec conducted visual assessments within the subject buildings on July 16–20 and 23–27, 2018. Site work was conducted in general compliance with the requirements of the COHSR, BC Reg. 296/97 and Stantec's Safe Work Practices (SWPs).

Mechanical systems, structures and finishes of the subject buildings were visually examined to determine the suspected presence of ACMs, lead including LCPs, PCBs, mercury, ODSs, mould, and silica. Where building materials were suspected but not confirmed to contain asbestos or lead (in paint) samples were collected for analysis to confirm or deny the presence of these hazardous materials. Based on analytical results, visually similar materials were referenced to specific analyzed samples to reduce the number of samples collected.

Additional background information and the methodology used for the determination of presence or absence of each specific hazardous material considered in this assessment are outlined in the following sections.

3.1 ASBESTOS

The common use of friable (materials which, when dry, can be easily crumbled or powdered by hand pressure) ACMs in construction generally ceased voluntarily in the mid-1970s but was only banned through legislation by the late 1980s. Friable asbestos was used in many building products, primarily high temperature insulations, spray-applied structural fireproofing, and a material known as vermiculite that was commonly used as block wall insulation and may be contaminated with asbestos fibres. Asbestos was also used in many non-friable manufactured products such as floor tiles, ceiling tiles, Transite cement products, and various other construction materials. Some cement products currently used in the construction of buildings may still contain asbestos.

The presence of asbestos in federal workplaces and pertaining to federally regulated workers is governed by the COHSR. According to the COHSR, ACM means:

- Any article that is manufactured and contains 1% or more asbestos (by weight) at the time of manufacture, or any material that contains 1% or more asbestos when tested in accordance with accepted methods.

The presence of asbestos in the workplace in British Columbia pertaining to provincially regulated workers is governed by BC Reg. 296/97. According to the current version of BC Reg. 296/97, ACM means:

- Any material containing at least 0.5% asbestos, or vermiculite insulation with any asbestos

As both federally regulated workers and provincially regulated workers (e.g., contractors) are expected to carry out work activities within the subject buildings, and as the provincial regulations have a more stringent definition of ACM, and generally include the requirements noted in the COHSR, this assessment was conducted to meet the requirements of BC Reg. 296/97.

Based on these criteria, a visual assessment of accessible areas was undertaken in order to check for the presence of materials suspected of containing asbestos. Locations to collect discrete bulk asbestos samples of suspect building materials were identified. Samples of representative materials were then collected at these locations.

Multiple samples were collected from each “homogenous application” of observed suspected ACMs (materials suspected to contain asbestos that are uniform in material type, colour, texture application and estimated installation date) and submitted to EMSL Canada Inc. (EMSL) in Burnaby, BC for analysis of asbestos content using polarized light microscopy (PLM) with dispersion staining, in accordance with the United States Environmental Protection Agency (EPA) 600/R-93/116 method. EMSL’s analytical laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

The 2017 WorkSafeBC publication *Safe Work Practices for Handling Asbestos* (Asbestos Guide), is used by Occupational Health and Safety officers as a guide when reviewing abatement work practices and employer codes of practice. The number of samples to be collected for each homogenous application of a suspected ACM was based on the recommendations provided in the Asbestos Guide along with accepted occupational hygiene standards and protocols and the assessor’s experience and understanding of the consistency of that building material’s application.

3.1.1 Sample Results Interpretation

When asbestos is detected in concentrations greater than 0.5% in one of the samples within a set that was collected to represent a “homogenous application” of a particular material (or detected in any concentration, in a set of samples collected for applications of vermiculite), the entire sample set and the entire application of that material was then considered to be an ACM.

In addition to the above, a “positive stop” option was used during the laboratory analysis of the building material samples submitted for asbestos analysis. The “positive stop” option is utilized by the laboratory when asbestos is detected at a concentration of greater than 0.5 percent in one of the samples within a set that was collected to represent a “homogenous application” of that material. At this point, further analysis of subsequent samples within the set is deemed to be unnecessary (as the entire set will be considered an ACM, per above), and the remainder of the samples within the set are not analyzed.

3.1.2 Potential Asbestos-Containing Vermiculite Insulation

As part of the assessment, Stantec assessed the subject buildings for locations where vermiculite insulation, a potential ACM, would likely be present. This included making note of and assessing attic spaces, floor cavities and masonry or brick walls, which are typical areas where vermiculite is found. Regarding this portion of the assessment, the following should be noted:

- Where masonry or brick walls were observed, destructive assessment (drilling) was conducted to assess the cavity for the presence of vermiculite
- Where non-vermiculite attic insulation (e.g., fiberglass) was observed, inspection for the presence of vermiculite under the other insulation was conducted only at the attic access point (not throughout the attic)

3.1.3 Asbestos Sampling Quality Assurance/Quality Control

Sampling activities pertaining to asbestos were conducted in accordance with Stantec's SWPs, which take into account current provincial regulations pertaining to such work (i.e., sampling procedures, required number of samples, and laboratory analytical procedures).

Representative bulk samples were collected of accessible suspect ACMs in sufficient quantities for laboratory analyses. Suspect ACM samples were sealed in polyethylene zip-lock bags labeled with the sample number, suspect material description, and sample location. As part of sampling procedures, sampling tools were cleaned between sample collection events to avoid the potential for cross-contamination of samples.

Sample bags were compiled in order and placed into a single container accompanied with a Chain of Custody form outlining the project information, date, building location, number of samples, and sample description. Samples were submitted to the analytical laboratory in a sealed container via courier.

3.2 LEAD

Lead may be used in its pure metallic form or combined chemically with other elements to form lead compounds. Metallic lead is used to make products such as electric storage batteries, ammunition, lead solder, radiation shields, pipes, and sheaths for electric cables. Metallic lead is sometimes combined with other metals such as copper, tin, and antimony as lead alloys for use in the manufacture of a variety of metal products. Lead is commonly found in buildings in the solder used on copper domestic pipes, in the caulking on bell fittings of cast iron drainage pipes and in electrical equipment.

A visual assessment of accessible areas was undertaken in order to check for the presence of materials that may contain lead. These materials included paint applications, wiring and plumbing, batteries, etc.

With respect to potential lead exposures associated with disturbance to surfaces coated with lead-containing products, the 2011 WorkSafeBC manual titled *Lead-Containing Paint and Coatings: Preventing Exposure in the Construction Industry*, indicates the following:

- Improper removal of lead paint containing 600 mg/kg lead results in airborne lead concentrations that exceed half of the exposure limit
  - This potential for exposure exceeding half of the occupational exposure limit would be the trigger for implementation of an exposure control plan
- Lead concentrations as low as 90 mg/kg may present a risk to pregnant women and children
  - Any risk assessment should include consideration for the presence of high risk individuals within the workplace

In addition to the above, the 2017 WorkSafeBC publication *Safe Work Practices for Handling Lead* (Lead Guideline) indicates the following:

> "Unlike for asbestos-containing material, WorkSafeBC does not numerically define what would be considered a lead-containing paint or coating. All suspected paints or coatings should be tested for lead because, depending on the nature of the work, even a small amount could pose a risk to workers. In order to determine which controls and personal protective equipment would be required for a particular job, a qualified person must consider this information as part of the risk assessment."

When reviewing the above, "high risk" individuals are not expected to be present in the workplace associated with this site during operations and maintenance or building material alteration activities (i.e., renovation) that would create significant disturbance to paint with such individuals present. As such, Stantec will reference a value of greater than 600 ppm in defining paints as "lead-containing" for the purpose of this report, such that appropriate risk assessments can be completed for ongoing operations and maintenance. However, information regarding the lead content of all paints tested is provided herein, for reference and risk assessment should the consideration of high risk individuals be necessary, based on the requirements of a particular situation.

Based on the above, samples of suspected LCPs were collected from major paint applications. Samples were collected to substrate, where possible, in sufficient quantity to conduct analysis for total lead content. Samples collected were placed into separate, sealed, and labeled polyethylene bags, and submitted to EMSL in Mississauga, Ontario for analyses of total lead content using Flame Atomic Absorption Spectrometry AAS (SW 846 3050B*/7000B).

EMSL's analytical laboratory is also accredited by the American Industrial Hygiene Association (AIHA) Environmental Lead Laboratory Approval Program.

3.2.1 Welding, Burning or Torch Cutting

Although a concentration of 600 ppm lead has been used to define paint coatings as LCPs, it should be noted that this is related to painted surfaces and the determination of appropriate provisions to protect occupants and employees from exposure to elevated concentrations of lead during typical operations and maintenance or simple renovation. This does not include painted metal surfaces that are to be welded, burned or torch-cut.

Using an arc welder or oxyacetylene torch on steel that is coated with lead-containing paint can create hazardous lead fumes and is prohibited by section 12.115 of the BC Reg. 296/97.

> Regulatory excerpt: **12.115 Coatings on metals**
>
> "A coating on metal which could emit harmful contaminants (such as lead, chromium, organic materials, or toxic combustion products) must be removed from the base metal, whenever practicable, before welding or cutting begins."

In addition, the following information is provided in the Lead Guideline:

- Welding or torch cutting of paints or coatings on metal can create very high concentrations of airborne lead fumes. Torch cutting structural steel, coated with paint containing as little as 130 mg/kg (equivalent to ppm) lead, can release airborne levels of lead as high as 0.8 mg/m^3 (16 times the exposure limit).

Given this information and that the analytical detection limit for lead paint analysis is approximately 80–90 ppm (not significantly different than 130 ppm, which, per above, may release airborne lead levels 16 times the exposure limit), any paint coating on a metal surface to be welded, burned or torch-cut must be removed prior to that action being undertaken, unless a project-specific or tasks-specific risk assessment and safe work practices are developed by a qualified person.

3.3 POLYCHLORINATED BIPHENYLS

PCBs were used widely as coolants and lubricants in transformers, capacitors, and other electrical equipment. In fluorescent fixtures, PCBs were usually found within the small capacitors inside the ballast that controls the lamp. The Federal Chlorobiphenyls Regulation, SOR/91-152, prohibited the use of PCBs in electrical equipment manufactured after July 1, 1980.

A visual review for the presence of PCBs in electrical equipment was completed visually. Equipment that is generally suspected of containing PCBs includes lamp ballasts, transformers, hydraulic systems, compressors, switchgear and capacitors. No sampling of dielectric fluids was undertaken as part of this assessment.

With respect to fluorescent lamp ballasts, due to the risk of electrical shock associated with dismantling operating fixtures, fluorescent lamp ballasts were not removed to view identification numbers/information.

Suspected PCB-containing electrical equipment can be visually inspected and compared to the Environment Canada reference guide entitled *Identification of Lamp Ballasts Containing PCBs, Report EPS 2/CC/2*, dated August 1991 (PCB Guide), or a similar reference.

For buildings constructed prior to 1985, limited amounts of PCBs may be present in non-electrical items (e.g., plastics, molded rubber parts, applied dried paints, coatings or sealants, caulking, adhesives, paper, sound deadening materials, insulation, or felt and fabric products such as gaskets). However, unless otherwise noted based on building construction type or suspect building material use, PCBs are not expected to be present in those materials in concentrations that would necessitate the requirement for PCB-specific handling procedures, separate removal and/or disposal considerations for ongoing operations and maintenance, or for renovation or demolition. As such, these items were not considered or sampled in our assessment.

3.4 MERCURY

Mercury is commonly found in buildings as mercury vapour lighting, thermostats/thermometers with mercury-containing glass ampoules, electrical switches and can also be found in minor amounts in fluorescent lamp tubes and vapour bulbs and may be present in stable forms in adhesives. Exposure to mercury in federal workplaces is governed by the COHSR, while provincially it is governed by BC Reg. 296/97.

An assessment for equipment that is likely to contain mercury was completed visually. Information on the type of equipment (i.e., gauges, switches, batteries, thermometers, etc.), model and serial numbers and quantities was recorded, where such information was available.

For buildings constructed prior to 2004, limited amounts of mercury may be present in paints and adhesives. However, unless otherwise noted based on building construction type or suspect building material use, mercury is not expected to be present in those materials in concentrations that would necessitate the requirement for mercury specific handling procedures, separate removal and/or disposal considerations for ongoing operations and maintenance, renovation or demolition. As such, these items were not considered or sampled in our assessment.

3.5 MOULD

Moist building materials may provide suitable conditions for mould growth, and the removal of building materials impacted by mould growth may require workers with specific training and experience using work procedures that have been developed to protect workers and work areas from exposure to elevated concentrations of airborne mould.

The presence of suspect visible mould was assessed through visual observations. Material observed with dark-colored staining and/or a textured and discolored appearance is described as “suspect mould”. Mould identified visually is defined as “suspect mould” unless it is confirmed as mould by laboratory analysis.

3.5.1 Mould Reference Guidelines

With respect to mould and/or moisture, the visual assessment procedures utilized during this project were based on the recommendations provided in the documents listed below:

- Standard Construction Document CCA 82 *Mould Guidelines for the Canadian Construction Industry*, Canadian Construction Association, 2004 (referred to as CCA 82)
- *Guidelines on Assessment and Remediation of Fungi in Indoor Environment*, New York City Department of Health, Bureau of Environmental and Occupational Disease Epidemiology, April 2000 (referred to as the NYC Guidelines)
- *Fungal Contamination in Public Buildings: Heath Effects and Investigation Methods*, Federal-Provincial Committee on Environmental and Occupational Health, 2004 (referred to as the Health Canada Guide)
- *Indoor Air Quality in Office Buildings: A Technical Guide*, report of the Federal-Provincial Advisory Committee on Environmental and Occupational Health, 1995 (referred to as the IAQ Guide)
- *Bioaerosols: Assessment and Control*, American Conference of Governmental Industrial Hygienists (ACGIH), 1999 (referred to as the ACGIH Report)

3.6 OZONE-DEPLETING SUBSTANCES

Chlorofluorocarbons (CFCs) and other ODSs are often found in refrigeration units associated with air-conditioning or other refrigeration equipment. In September 1987, 47 countries agreed to the Montreal Protocol on Substances that Deplete the Ozone Layer. ODSs are regulated in BC by the British Columbia *Waste Management Act*—Ozone Depleting Substances and Other Halocarbons Regulation (BC Reg. 387/99 as amended by BC Reg. 109/2002) and the Federal Halocarbon Regulations, 2003 (FHR 2003).

An assessment for equipment likely to contain ODSs was completed visually. Information on the type of equipment, manufacturer and type and quantity of refrigerants was recorded, where available.

3.7 SILICA

Silica, also referred to as free crystalline silica, is found in concrete, cement, mortar, ceramic wall and floor tiles, stucco finishes and acoustic ceiling tiles. Prolonged exposure to, and inhalation of free crystalline silica, may result in respiratory disease known as silicosis, which is characterized by progressive fibrosis of the inner lung tissue and marked shortness of breath or impaired lung function.

Exposure to silica dust is governed by the COHSR and BC Reg. 296/97 According to both legislative instruments; the time-weighted average exposure limit for airborne silica dust is 0.025 mg/m^3.

An assessment for the presence of silica was conducted visually. The presence of potential silica-containing building materials such as concrete, masonry, stone, terrazzo, refractory brick, ceramic tile, ceiling tile etc. was noted.

4.0 ASSESSMENT LIMITATIONS

This report has been prepared for general information purposes associated with continued operations and maintenance of the subject buildings. This report does not necessarily constitute a pre-renovation or pre-demolition assessment, which can involve destructive removal of building finishes to observed concealed conditions. Prior to any renovation or demolition work within the subject buildings, this report should be reviewed by an appropriately qualified professional (with education and experience associated with the management of hazardous building materials) to determine what, if any, additional assessment is necessary.

In preparation of this report, Stantec used professional judgment based on experience. The work was conducted in accordance with generally accepted professional standards. Stantec relied on information gathered during the site investigations and laboratory analytical reports.

This report reflects the observations made within accessed portions of the subject buildings and the results of analyses performed on specific materials sampled during the assessment. Analytical results reflect the sampled materials at the specific sample locations.

Sampling was conducted pertaining to suspected ACMs and suspected LCPs only. The assessment for the presence of other hazardous building materials was visual in nature, and was conducted pertaining to readily visible surfaces within accessible spaces only. Concealed spaces were inspected via existing access panels, where present.

4.1 ASBESTOS

Suspected ACMs that were not sampled included, but were not limited to, the following (where present, based on building construction or as otherwise noted):

- Concealed layers of roofing materials
- Interior components of mechanical equipment (e.g., inner linings or gaskets in boilers)
- Interior components of heating, ventilation and air conditioning (HVAC) units
- Heat protection materials inside mechanical installations (e.g., gaskets) and light fixtures (e.g., paper backing in sealed incandescent fixtures)
- Drywall and/or wall plaster and associated finish materials concealed behind new and/or additional walls or ceilings
- Woven tape inside duct connection joints or inner ducting insulation
- Materials within sealed/hard wall cavities or hard ceiling cavities without appropriate access points
- Insulation materials inside fire doors

If encountered during renovation, demolition or other activities, any suspected ACMs not identified within this report should be presumed to contain asbestos and handled as such until otherwise proven, through analytical testing.

4.2 LEAD

Assessment for the presence of lead or lead-containing materials was visual in nature, and was conducted pertaining to readily visible surfaces within accessible spaces of the subject buildings. The presence of lead or lead-containing materials in inaccessible areas not assessed included, but was not limited to, ceiling spaces and wall cavities.

With respect to paint, samples of suspected LCPs were collected within the subject buildings only from surfaces of major paint applications where visually different paint colours and/or types were identified. Although the surfaces where samples were collected may be covered with more than one coat of paint, the paint samples are described by the surface (visible) colour only.

Attempts were made to represent all layers of paint in the samples collected. As analytical results are referenced to the surface paint colour only, the lead content of all painted surfaces similar to that represented by the surface paint colour will be presumed to be the same, regardless of differing sub-surface paints, if any.

4.3 POLYCHLORINATED BIPHENYLS

Due to height restrictions and the risk of electrical shock in handling operational light fixtures, the ballasts present in the fixtures observed within the subject buildings were not removed for comparison to the PCB Guide. The visible labels of ballasts in several fixtures were inspected for comparison to the PCB Guide.

Conclusions and recommendations regarding the presence of PCBs within the subject buildings are based on Stantec's limited observations in combination with information provided by staff regarding lighting renovations (where requested by Stantec based on observations) and is presented to provide guidance regarding the likelihood that PCB-containing equipment is or is not present within the subject buildings. The exact extent and/or number of fluorescent lamp ballasts containing PCBs, if any, within the subject buildings will not be commented on.

4.4 MERCURY

Visual assessment for the presence of mercury-containing equipment within the subject buildings was conducted in accessible areas only. Additional mercury or mercury-containing equipment may be present in inaccessible areas including, but not limited to, ceiling spaces and wall cavities, or as internal parts of HVAC mechanisms.

4.5 MOULD

Visual assessment for the presence of suspected visible mould and/or suitable conditions for mould growth (e.g., moist and/or water-stained building materials) were conducted in accessed portions of the subject buildings only. The assessment was not intrusive in nature and included visual assessment of exposed surfaces and closer inspection of known problem areas.

The conclusions made in this report provide description(s) of the potential source(s) of moisture within the subject buildings that may have led to suitable conditions for mould growth, only in those cases where potential source(s) of moisture were identified. These conclusions will not necessarily identify all sources of moisture leading to suitable conditions for mould growth within the subject buildings or within the impacted area(s).

This assessment does not constitute a building envelope/building systems assessment for any of the subject buildings, which would include an intrusive investigation to assess the internal condition, potential moisture sources, and expected remaining service life of the various components and systems comprising the envelope of a building.

4.6 OZONE DEPLETING SUBSTANCES

Visual assessment for the presence of ODSs within the subject buildings was conducted in accessible areas only. Additional ODS-containing equipment may be present in inaccessible areas including, but not limited to, ceiling spaces and wall cavities. In addition, portable equipment that may contain ODSs (refrigerators, drink coolers, etc.) was not considered as part of this assessment.

4.7 SILICA

Visual assessment for the presence of silica-containing materials within the subject buildings was conducted in accessible areas only. Additional silica-containing materials may be present in inaccessible areas including, but not limited to, ceiling spaces and wall cavities.

5.0 FINDINGS

The results of our assessment are provided on a building-by-building basis in Appendix 5.1 through Appendix 5.43 Each Appendix contains the following (where applicable):

- Separate sections with written summaries of findings pertaining to each hazardous building material, including the following:
  - Listing of suspect materials observed
  - Tables that provide summaries of the sample types, locations, and analytical results
  - Interpretations of observations and/or sample analytical results
- Information pertaining to condition evaluation of identified hazardous building materials
- Recommendations for identified hazardous building materials found to be in “non-compliant” condition (e.g., damaged ACMs, mould-impacted materials, etc.), where applicable
- Floor plan drawings for the buildings/structures, which include locations of the samples collected during this assessment, and locations of identified hazardous building materials (where practical)
- Copies of the analytical certificates for suspected ACM samples collected/analyzed
- Copies of the analytical certificates for all suspected LCP samples collected/analyzed

5.1 MATERIAL CONDITION EVALUATION

In evaluating the condition of identified hazardous building materials, Stantec followed the protocols outlined in the Hazardous Building Materials Management Plan developed for the CSC Kent Institution. The condition evaluation criteria for the various hazardous building materials considered are summarized below.

5.1.1 Asbestos-Containing Materials

The criteria are generally based on the June 5, 2017 PSPC Asbestos Management Standard and industry standards of practice for asbestos.

5.1.1.1 Friable ACMs other than Mechanical Insulation

In evaluating the condition of ACM spray friable ACMs other than mechanical insulation (e.g., spray-applied as fireproofing, texture, decorative or acoustic finishes), the following criteria apply:

Good

Surface of material shows no significant signs of damage, deterioration, or delamination. Up to one percent visible damage to surface is allowed within range of **GOOD**. Evaluation of sprayed fireproofing requires the assessor to be familiar with the irregular surface texture typical of sprayed asbestos products. **GOOD** condition includes un-encapsulated or unpainted fireproofing or texture finishes, where no delamination or damage is observed, and encapsulated fireproofing or texture finishes where the encapsulation has been applied after the damage or fallout occurred.

Fair

FAIR condition is not utilized or considered as a valid criterion in the evaluation of sprayed fireproofing, sprayed insulation, or texture coat finishes.

Poor

Sprayed materials show signs of damage, delamination, or deterioration. More than 1% damage to surface of hazardous building material spray.

In observation areas, where damage exists in isolated locations, both **GOOD** and **POOR** condition may be reported. The extent or percentage of each condition will be recorded on the assessor's reassessment form.

The evaluation of ACM spray applied as fireproofing, non-mechanical thermal insulation, or texture, decorative or acoustic finishes that are present above ceilings, may be limited by the number of observations made, and by building components such as ducts or full height walls that obstruct the above ceiling observations. BC Reg. 296/97 requires Moderate Risk operations for the removal of all or part of a false ceiling to obtain access to a work area, if asbestos-containing material is likely to be lying on the surface of the false ceiling.

5.1.1.2 Mechanical Insulation

In evaluating the condition of ACM mechanical insulation (on boilers, breeching, ductwork, piping, tanks, equipment etc.) the following criteria are used:

Good

Insulation is completely covered in jacketing and exhibits no evidence of damage or deterioration. No insulation is exposed. Includes conditions where the jacketing has minor surface damage (i.e., scuffs or stains), but the jacketing is not penetrated.

Fair

Minor penetration damage to jacketed insulation (cuts, tears, nicks, deterioration or delamination) or undamaged insulation that has never been jacketed. Insulation is exposed but not showing surface disintegration. The extent of missing insulation ranges should be minor to none.

Poor

Original insulation jacket is missing, damaged, deteriorated or delaminated. Insulation is exposed and significant areas have been dislodged. Damage cannot be readily repaired.

The evaluation of ACM mechanical insulation may be limited by the number of observations made and building components such as ducts or full height walls that obstruct observations. In these circumstances, it is not possible to observe each foot of mechanical insulation from all angles.

5.1.1.3 Non-Friable Materials

Non-friable ACMs generally have little potential to release airborne fibres, even when damaged by mechanical breakage. However, some non-friable materials, i.e., exterior asbestos cement products, may have deteriorated so that the binder no longer effectively contains the asbestos fibres. In such cases of significantly deteriorated non-friable material, the material will be treated as a friable product, and evaluated per the above criteria.

5.1.2 Lead

For general lead-containing materials (e.g., solder used on copper domestic pipes; caulking on bell fittings of cast iron drainage pipes; electrical equipment/wiring; batteries [e.g., emergency exit signage batteries]; lead sheeting [e.g., x-ray rooms; vent and pipe flashings), condition evaluation is based on function. If the function is compromised, the material would be considered in “poor” condition, and would likely require replacement. Given that the exposure hazards associated with such replacements are typically low and/or simplistic to control, condition evaluation pertaining to such materials is not conducted or discussed herein.

5.1.2.1 Lead-Containing Paint

The criteria for condition evaluation pertaining to LCPs described herein are generally based on the United States Housing and Urban Development (HUD) 2012 *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*.

When evaluating the condition of LCPs, an attempt should be made to determine whether the deterioration is due to a moisture problem or some other existing building deficiency.

“Poor” surfaces are considered to be a hazard and should be corrected. “**Fair”** surfaces should be repaired, but are not yet considered to be a hazard; if not repaired, they should be monitored frequently. “**Good/intact”** surfaces should be monitored to ensure that they remain in a nonhazardous condition.

In addition, the presence of paint debris must be considered in evaluating condition. Given the variety of paint uses, there are many applications that can have a tendency for the paint to “wear” from the surface slowly, over an extended period of time. Conditions where paint has worn from a surface are worth noting for maintenance discussions (i.e., related to re-coating the surface should, for example, the coating provide weather protection), however, in the absence of loose paint chip debris/dust, such conditions would not represent a potential exposure situation related to lead.

The condition evaluation criteria for LCPs are summarized in Table 5-1, below.

Table 5-1 Lead-Containing Paint Condition Categories

Type of Building Component[1]	Total Area of Deteriorated Paint on Each Component		
	Good/Intact	Fair[2]	Poor[3]
Exterior components with large surface areas	Entire surface is intact	Less than or equal to 10 ft^2	More than 10 ft^2
Interior components with large surface areas (walls, ceilings, floors, doors	Entire surface is intact	Less than or equal to 2 ft^2	More than 2 ft^2
Interior and exterior components with small surface areas (window sills, baseboards, soffits, trim)	Entire surface is intact	Less than or equal to 10% of the total surface area of the component	More than 10% of the total surface area of the component

NOTES:

1 Building component in this table refers to each individual component or side of building, not the combined surface area of all similar components in a room (e.g., a wall with 1 square foot of deteriorated paint is in "fair" condition, even if the other three walls in a room are intact).

2 Surfaces in "fair" condition should be repaired and/or monitored, but are not considered to be "lead-containing paint hazards".

3 Surfaces in "poor" condition are considered to be "lead-containing paint hazards" and should be addressed through abatement or interim controls.

5.1.3 Mould and Moisture-Impacted Building Materials

The condition of building materials impacted by moisture or mould is typically considered "**poor**" or "**requiring action**". Additional details are provided below:

- Non-porous building materials (e.g., glass, metal) that can be cleaned and dried without losing function would be considered to be in "**fair condition**" if wet, and "**poor condition**" only if visible mould growth is present on surfaces (typically indicating the surfaces are covered with a layer of dirt, as mould will not grow on non-porous, inorganic materials)
- Semi-porous and porous materials (e.g., wood framing, gypsum board, carpets, furniture) that are impacted by moisture (without mould contamination) are considered to be in "**fair**" condition—representative of a situation that requires moisture intrusion correction and drying of affected surfaces only.
  - Depending on the building material, the water impacts may have degraded the material itself to a point where replacement is required (e.g., gypsum, insulation)
- Semi-porous and porous materials that are impacted by moisture (current or previous) and have evidence of mould contamination are considered to be in "**poor**" condition.

5.1.4 Other Hazardous Building Materials

For other hazardous building materials (e.g., equipment with PCBs, equipment with mercury, equipment with ODSs, materials containing silica), condition evaluation is based on function. If the function is compromised, the material would be considered in "**poor**" condition, and would likely require replacement. Given that the exposure hazards associated with such replacements are typically low, simplistic to control and/or paramount to the removal process (e.g., review of ballasts for PCBs as they are decommissioned; in-tact removal of mercury-containing items; recovery of ODSs; implementation of dust control when disturbing/removing silica-containing materials), condition evaluation pertaining to such materials is not conducted or discussed herein.

6.0 GENERAL RECOMMENDATIONS

Building-specific recommendations pertaining to the identified hazardous building materials that require action are provided in Appendix 5.1 through Appendix 5.43. General recommendations pertaining to management of identified hazardous building materials in good condition are provided below.

6.1 ASBESTOS

For buildings with identified ACMs, Stantec recommends the following with regards to meeting the requirements of the COHSR and BC Reg. 296/97 as they pertain to managing asbestos in the workplace:

- Identified ACMs in good condition can be managed in place in accordance with the Hazardous Building Materials Management Plan developed for the CSC Kent Institution.

- Suspected ACMs deemed visually similar to the ACMs identified in this report (on a building-by-building basis) should be considered asbestos-containing and handled as such, unless proven otherwise, through analytical testing.
- Asbestos-containing materials that may be impacted during renovation or demolition work activities should be removed by appropriately trained personnel (e.g., asbestos abatement contractor personnel), in accordance with the requirements of BC Reg. 296/97 and the Asbestos Guide, and prior to the initiation of project work that will disturb them.
- Should a material suspected to contain asbestos fibres become uncovered during renovation and/or demolition activities, all work in the areas that may disturb the material should be stopped. Samples of the suspect material should be submitted for laboratory analysis to determine if asbestos fibres are present. Confirmed asbestos materials should be handled in accordance with applicable guidelines and regulations.
- If masonry block walls are to be impacted by renovation or demolition work, and these walls have not been checked for the presence of vermiculite insulation, intrusive assessments for vermiculite should be undertaken prior to renovation/or demolition work. If vermiculite insulation is suspected to be present, this material should be treated as an ACM until testing can show otherwise.
- Asbestos-containing cement pipe may be present below ground–caution should be used at any time when excavation is required
- Ensure asbestos containing waste is handled, stored, and disposed of in accordance with the requirements of the Federal Transportation of Dangerous Goods Regulation and the British Columbia Hazardous Waste Regulation (BC Reg. 63/88).

6.2 LEAD

Lead-containing materials, including paints, in good condition can be managed in place in accordance with the Hazardous Building Materials Management Plan developed for the CSC Kent Institution.

If LCPs or other lead-containing equipment/materials within the subject buildings are to be disturbed and/or removed, including for work associated with debris removal or preparing surfaces with LCPs for re-painting, ensure compliance with the following:

- Exposure protection requirements of BC Reg. 296/97, including the provisions of the Lead Guideline
- Transportation and disposal requirements of BC Reg. 63/88
- Transportation requirements of the Federal Transportation of Dangerous Goods Regulation

Corrective action or remedial work on paint applications containing any concentration of lead should be undertaken in a manner so as to avoid generating fine particulate matter or dust (i.e., avoid sanding). Airborne lead dust or fumes should not exceed the COHSR and BC Reg. 296/97 8-hour Occupational Exposure Limit (OEL) of 0.05 milligram per cubic metre (mg/m^3) during the removal of paints and products containing any concentration of lead. The use of personal protective equipment is recommended to reduce the potential for over-exposure to lead dust. This can be achieved by:

- Providing workers with protective clothing and PPE or devices as necessary to protect the worker against the hazards to which the worker may be exposed
- Providing workers with adequate and training in the care and use of clothing, equipment or device before wearing or using it
- Wetting the surface of the materials to prevent dust emissions
- Providing workers with washing facilities with clean water, soap and individual towels to properly wash prior to exiting the work area

To avoid the inhalation of lead, it is essential to have the following control methods in place:

- Engineering controls
- Work practices and hygiene practices
- Respirators and personal protective equipment
- Training

The work tasks required and the ways in which lead-containing materials (including paints) will be impacted will determine the appropriate respirators, measures and procedures that should be followed to protect workers from lead exposure.

6.2.1 Welding, Burning or Torch Cutting

Any paint coating on a metal surface to be welded, burned or torch-cut must be removed prior to that action is undertaken, unless a project-specific or tasks-specific risk assessment and safe work practices are developed by a qualified person. Development of such risk assessments and work practices will involve consideration of information including, but not limited to, the following:

- Composition of the material to be disturbed
- Lead content of the paint coating
- Methods and tools to be used, including exhaust ventilation
- Duration of the work/work shift
- Training of the personnel conducting the task
- Respiratory protection program in effect

6.3 POLYCHLORINATED BIPHENYLS

Fluorescent lamp ballasts that may contain PCBs can be managed in place in accordance with the Hazardous Building Materials Management Plan developed for the CSC Kent Institution, where these items are operating and in good condition. No further action is currently required until such time that renovation or demolition activities are to be conducted, or until 2025, when PCB-containing ballasts will require removal and disposal.

When fluorescent fixtures are decommissioned, verify the PCB content of fluorescent lamp ballasts as per the PCB Guide, or equivalent reference.

Should a material suspected to contain PCBs become uncovered during renovation activities (i.e., dielectric fluids, hydraulic fluids), all work in the areas that may disturb the material should be stopped. Samples of the suspect material should be submitted for laboratory analysis to determine if PCBs are present.

If PCB-containing items are identified for removal and disposal, these should be handled, transported, stored and disposed of in accordance with the following:

- Transportation and disposal requirements of BC Reg. 63/88
- Transportation requirements of the Federal Transportation of Dangerous Goods Regulation
- Requirements of the Federal PCB Regulations (SOR/2008-273)

6.4 MERCURY

Identified mercury-containing items can be managed in place in accordance with the Hazardous Building Materials Management Plan developed for the CSC Kent Institution. Mercury vapour within light tubes poses no risk to workers or occupants provided the mercury containers remain intact and undisturbed.

Complete removal of mercury-containing equipment is required prior to renovation or demolition activities that may disturb the equipment. When mercury-containing items (e.g., fluorescent light bulbs/tubes, thermostats) are removed, ensure all mercury waste is handled, stored and disposed of in accordance with the requirements the following:

- Transportation and disposal requirements of BC Reg. 63/88
- Transportation requirements of the Federal Transportation of Dangerous Goods Regulation

Precautions should be taken if workers may potentially be exposed to mercury or mercury vapours to ensure that workers exposure levels do not exceed the occupational exposure limit of 0.025 mg/m^3 as per the COHSR and BC Reg. 296/97. This can be achieved by providing respiratory and skin protection applicable to the hazard and task to be completed.

6.5 MOULD

Documents published by Health Canada, Ontario Ministry of Health, American Industrial Hygiene Association (AIHA), American Conference of Governmental Industrial Hygienists (ACGIH) and others, provide guidance for interpreting the results of mold investigations. The Health Canada Guide states that:

> "...current knowledge supports the need to prevent damp conditions and mold growth and to remediate any fungal contamination in buildings."

In general, mould-impacted building materials will require action (e.g., abatement/removal or cleaning). Recommendations pertaining to mould are provided in the building-by-building information included in Appendix 5.1 through Appendix 5.43.

6.6 OZONE DEPLETING SUBSTANCES

ODS-containing equipment can be managed in place in accordance with the Hazardous Building Materials Management Plan developed for the CSC Kent Institution, and must be serviced by licensed refrigeration technicians (as defined in the *Federal Halocarbon Regulations*).

If ODS-containing equipment is to be removed for renovation or demolition activities, ODSs must be recovered, handled, recycled, stored, and/or disposed of in accordance with the requirements of the following:

- British Columbia *Waste Management Act*—Ozone Depleting Substances and Other Halocarbons Regulation (BC Reg. 387/99 as amended by BC Reg. 109/2002)
- Transportation requirements of the Federal Transportation of Dangerous Goods Regulation
- Federal Halocarbons Regulations

6.7 SILICA

Silica-containing materials can be managed in place in accordance with the Hazardous Building Materials Management Plan developed for the CSC Kent Institution.

If silica-containing materials are to be removed or destructively altered (drilled, chipped, abraded, etc.), ensure dust control measures are employed such that airborne silica dust concentrations do not exceed the exposure limit as stipulated by the COHSR and BC Reg. 296/97 (0.025 mg/m^3). This would include, but not be limited to, the following:

- Providing workers with respiratory protection
- Wetting the surface of the materials to prevent dust emissions
- Providing workers with facilities to properly wash prior to exiting the work area
- Providing dust control to mitigate the potential for demolition dust to escape from the work area into public and/or adjacent areas

7.0 CLOSURE

This report has been prepared by Stantec Consulting Ltd. for the sole benefit of Public Services and Procurement Canada and Correctional Services Canada. Any use that a third party makes of this report, or any reliance on decisions to be made based on it, is the responsibility of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The information and conclusions contained in this report are based upon work undertaken by trained professionals and technical staff in accordance with generally accepted engineering, scientific and occupational health and safety practices current at the time the work was performed. Conclusions presented in this report should not be construed as legal advice.

The conclusions presented represent the best judgment of the assessors based on current environmental, health and safety standards and the site conditions observed on the dates cited within this report. This report is based on, and limited by, circumstances and conditions stated herein, and on information available at the time of preparation of the report. Due to the limited nature of the investigation and the limited data available, Stantec Consulting Ltd. cannot warrant against undiscovered environmental, health and/or safety liabilities. It is possible that additional, concealed hazardous materials may become evident during renovation and/or demolition activities within the subject buildings.

If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

We trust that the report meets your current requirements. Should you have any questions or concerns regarding the above, please do not hesitate to contact the undersigned.

Respectfully submitted,

Stantec Consulting Ltd.

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APPENDIX 1

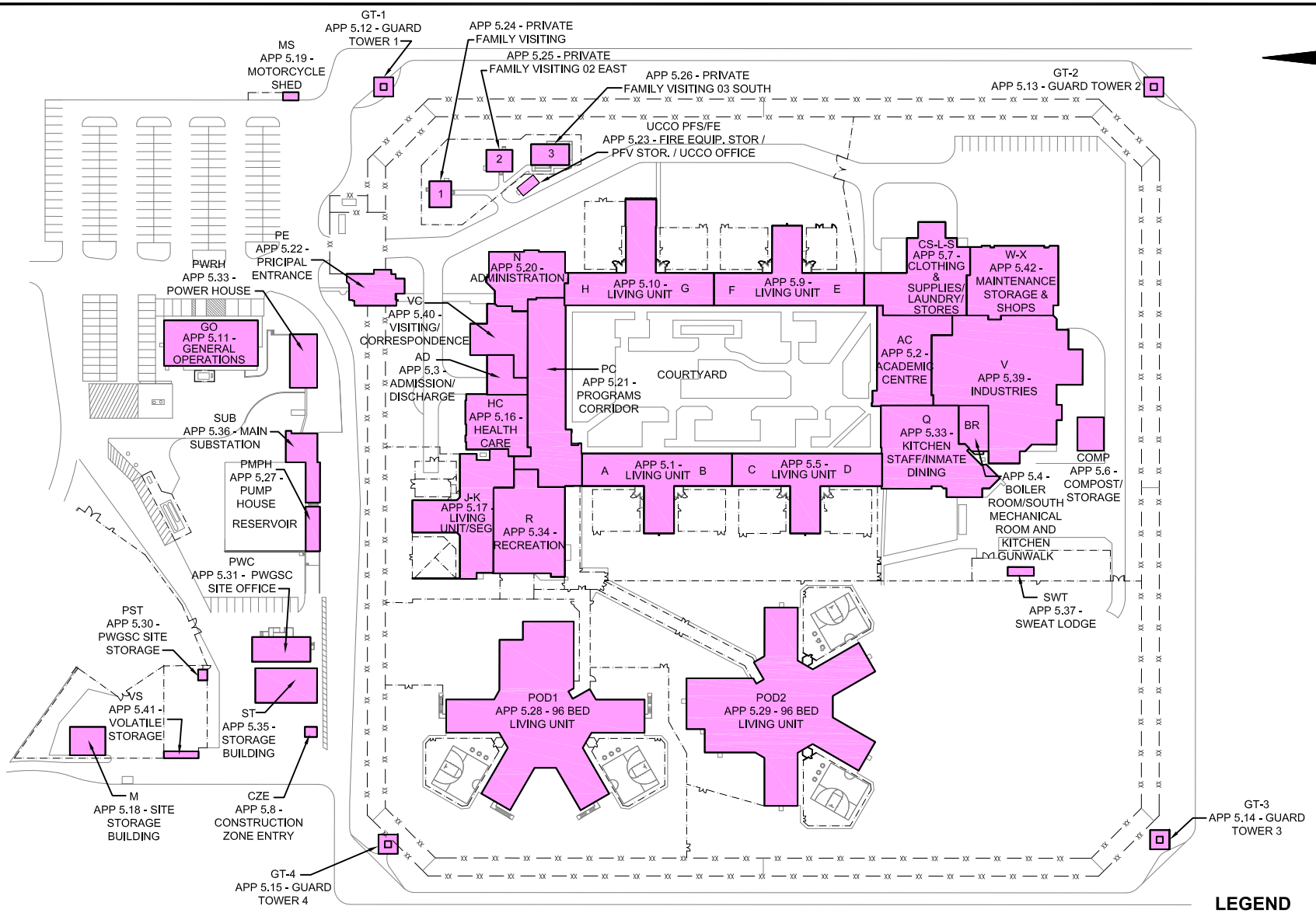
BUILDING LIST

Appendix 1 BUILDING LIST

Appendix	Tag #	Building #	Building Name	Real Property ID	Year of Construction	Area (m^2)
5.1	836-08-RP	A&B	Living Unit A&B	1795	1979	1449
5.2	836-08-RP	AC	Academic Centre	1796	1979	1114
5.3	836-08-RP	AD	Admission/Discharge	1797	1979	159
5.4	836-08-RP	BR	Boiler Room/South Mechanical Room	1798	1979	347
5.5	836-08-RP	C&D	Living Unit C&D	1799	1979	1400
5.6	836-00-RP	COMP	Composter & Storage	1800	Unknown	0
5.7	836-08-RP	CS/L/S	Clothing & Supplies, Laundry and Storage	1801	1979	243
5.8	836-00-RP	CZE	Construction Zone Entry Building	1802	2005	15
5.9	836-08-RP	E&F	Living Unit E&F	1803	1979	1449
5.10	836-08-RP	G&H	Living Unit G&H	1807	1979	1399
5.11	836-19-RP	GO	General Operations/ G.O. Building	2301	2013	929
5.12	836-03-RP	GT01	Guard Tower	1808	1979	26
5.13	836-03-RP	GT02	Guard Tower	1809	1979	26
5.14	836-03-RP	GT03	Guard Tower	1810	1979	26
5.15	836-03-RP	GT04	Guard Tower	1811	1979	26
5.16	836-08-RP	HC	Health Care	1812	1979	439
5.17	836-08-RP	J&K	Living Unit K/Segregation Unit J	1813	1984	1485
5.18	836-00-RP	M	Site Storage Building	1815	Unknown	0
5.19	836-00-RP	MS	Motorcycle Shed	1816	Unknown	0
5.20	836-08-RP	N	Administration	1817	1979	1050
5.21	836-08-RP	PC	Programs Corridor	1819	1979	1181
5.22	836-04-RP	PE	Principal Entrance	60	1979	407
5.23	836-11-RP	PFS	PF Storage/UCCO Office	1820	1981	26
5.24	836-05-RP	PFV1	Private Family Visiting	1804	1981	70
5.25	836-06-RP	PFV2	Private Family Visiting 02 East	1805	1981	70
5.26	836-07-RP	PFV3	Private Family Visiting 03 South	1806	1994	98
5.27	836-17-RP	PMPH	Pump House	2127	2011	94
5.28	836-15-RP	POD1	POD1—96-Man Living Unit	2051	2009	3709

Appendix 1 Building List
February 2019

Appendix	Tag #	Building #	Building Name	Real Property ID	Year of Construction	Area (m^2)
5.29	836-18-RP	POD2	POD2—96-Man Living Unit	2189	2012	3709
5.30	836-13-RP	PST	Public Works Storage Trailer	1821	1992	12
5.31	836-09-RP	PWC	Public Works Site Office	1822	1983	178
5.32	836-16-RP	PWRH	Power House	2126	2011	180
5.33	836-08-RP	Q	Kitchen Staff/Inmate Dining	1823	1979	1309
5.34	836-08-RP	R	Recreation	1824	1979	1021
5.35	836-14-RP	ST	Storage Building	1826	1998	263
5.36	836-02-RP	SUB	Main Substation	1827	1979	185
5.37	836-00-RP	SWT	Sweat Lodge	1828	2005	28
5.38	836-08-RP	TU	Tunnels	1829	1979	2211
5.39	836-08-RP	V	Industries	1830	1979	1945
5.40	836-08-RP	VC	Visiting & Correspondence	1831	1979	315
5.41	836-12-RP	VS	Volatile Storage	1832	1995	30
5.42	836-08-RP	W-X	Maintenance Shops & Storage	1833	1979	498
5.43	836-08-RP	Main Building	Roof	1834	1979	N/A



LEGEND

BUILDINGS ASSESSED

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

SITE PLAN

CSC KENT INSTITUTION

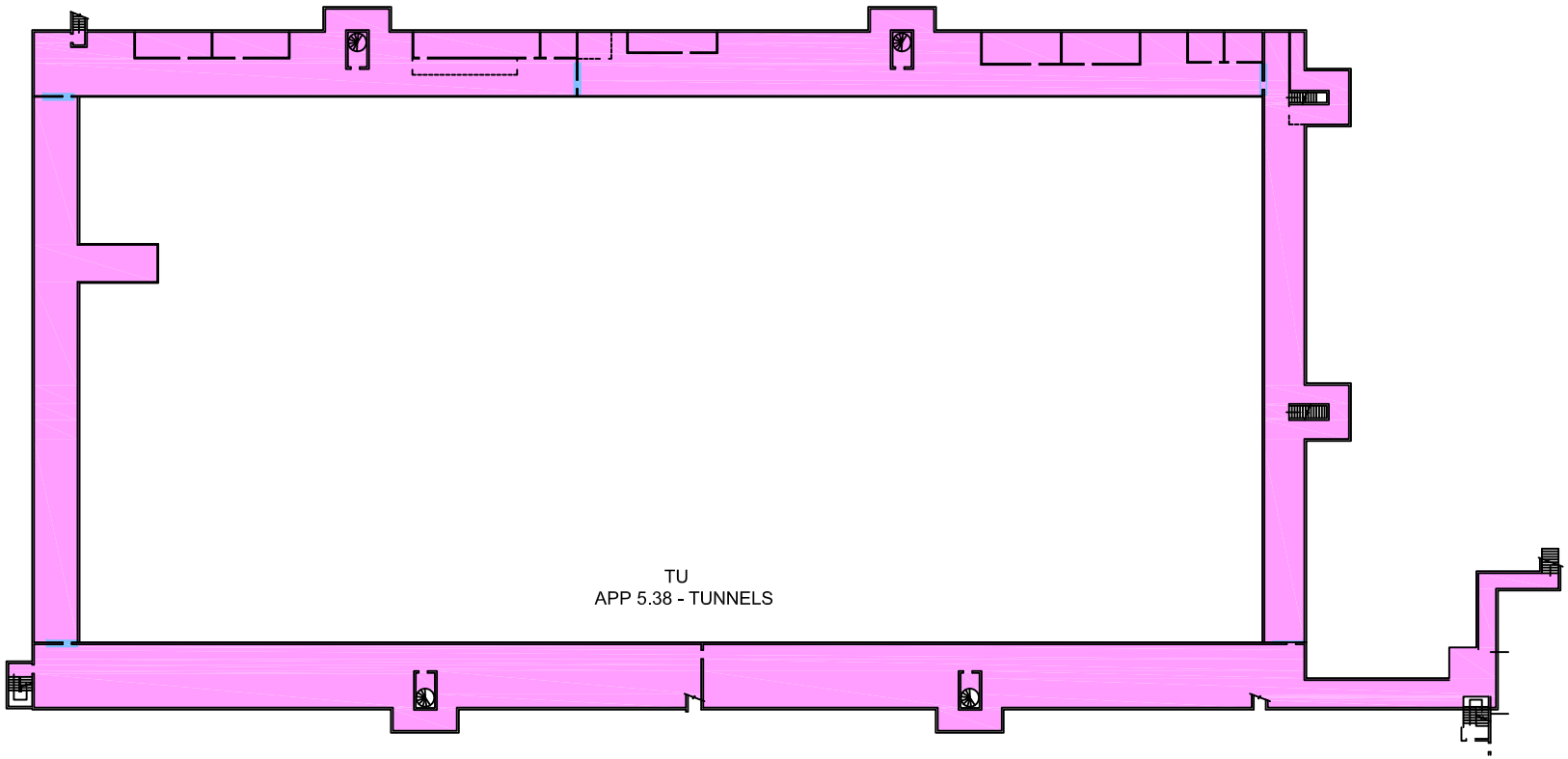
4732 CEMETERY ROAD, AGASSIZ, BC

Client: PUBLIC SERVICES AND PROCUREMENT CANADA

Project No.:	123221164
Scale:	N.T.S.
Date:	18/09/11
Dwn. By:	CD SL2018090082 VM/DM
App'd By:	TW

Dwg. No.: 1

Stantec



LEGEND

BUILDINGS ASSESSED

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

SITE PLAN

CSC KENT INSTITUTION

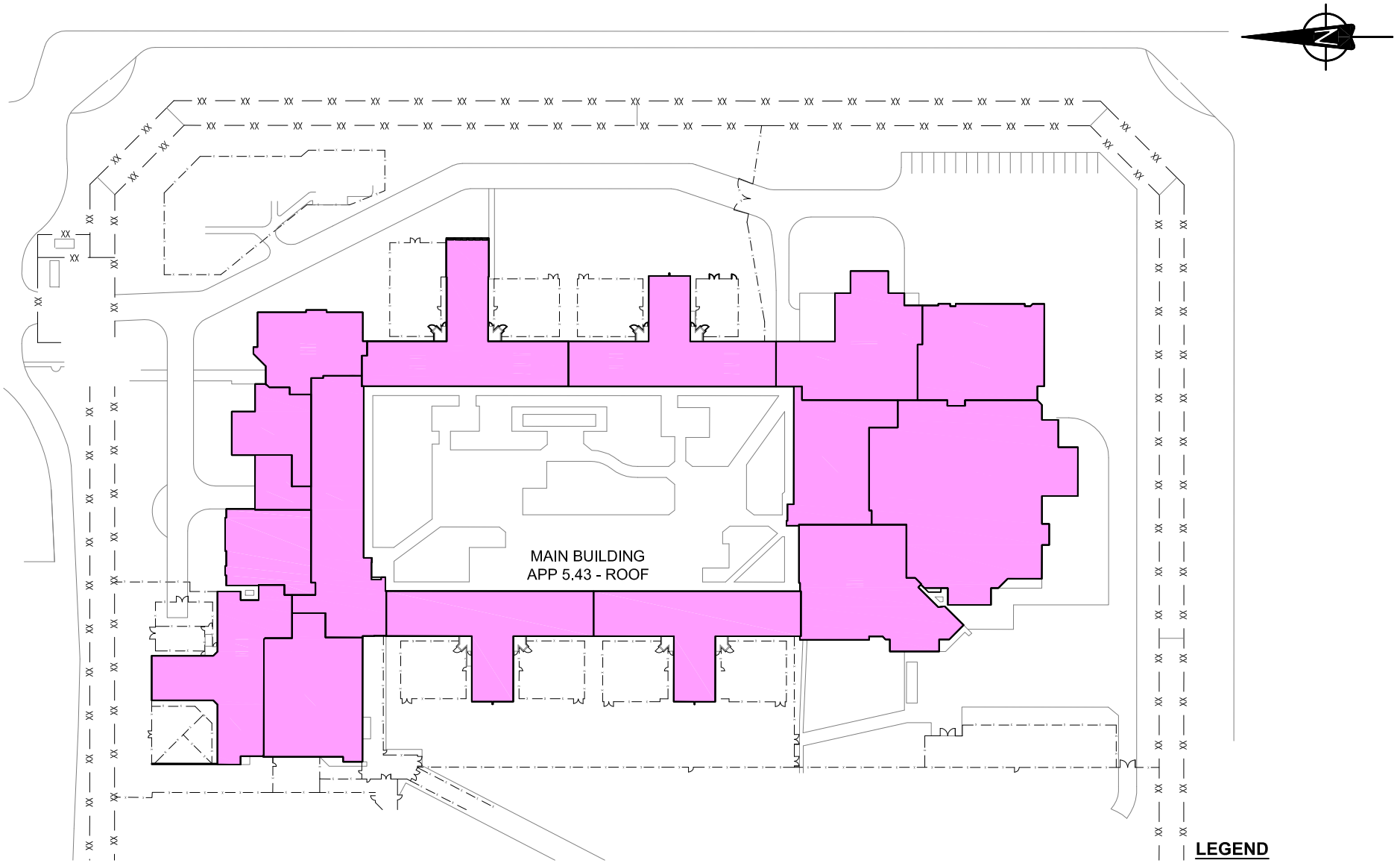
4732 CEMETERY ROAD, AGASSIZ, BC

Client: PUBLIC SERVICES AND PROCUREMENT CANADA

Project No.:	123221164
Scale:	N.T.S.
Date:	18/09/11
Dwn. By:	CD SL2018090082 VM/DM
App'd By:	TW

Dwg. No.: 2

Stantec



NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

SITE PLAN

CSC KENT INSTITUTION

4732 CEMETERY ROAD, AGASSIZ, BC

Client: PUBLIC SERVICES AND PROCUREMENT CANADA

Project No.:	123221164
Scale:	N.T.S.
Date:	18/09/11
Dwn. By:	CD SL2018090082 VM/DM
App'd By:	TW

Dwg. No.: 3

Stantec

APPENDIX 5.20

FINDINGS AND RECOMMENDATIONS—BUILDING N—ADMINISTRATION (836-08-RP)

Appendix 5.20 FINDINGS AND RECOMMENDATIONS—BUILDING N—ADMINISTRATION (836-08-RP)

Building N—Administration (subject building) was reportedly constructed in 1979 and has been assigned Real Property ID #1817. It is part of the main complex of adjoined buildings within Kent Institution and may share mechanical/electrical systems with adjacent units Building VC (Visiting Correspondence), Building PC (Programs Corridor) and Building G&H (Living Unit G&H). The typical structural components and finishes associated with this building consist of exterior corrugated metal and masonry block walls; suspended ceiling tiles, metal, and open ceilings; drywall, ceramic tile and masonry block interior walls; concrete and vinyl tile floors; and a flat built up asphalt roof.

The results of the assessment for each of the considered hazardous materials within the subject building are provided in the following sub-sections.

Floor plan drawings, which include locations of the samples collected during this assessment and locations of identified hazardous building materials (where practical), are attached to this Appendix.

5.20-1. ASBESTOS

The Previous Reports indicated the presence of the following ACMs, with notes regarding condition or other changes noted during the current assessment:

- Red HVAC duct mastic (PGL, ACM Survey Report 2004)
  - Additional samples were collected by Stantec during the current assessment
- 12”x12” red floor tiles (PHH Pre-Reno MCCP and CER Upgrade, 2013)
  - Additional samples were collected by Stantec during the current assessment
- 12”x12” grey floor tile with brown streaks (SNC Admin Report 2017)
  - Additional samples were collected by Stantec during the current assessment
- Drywall joint compound in rooms N113 and N112 (SNC Admin Report 2017)
  - Additional samples were collected by Stantec during the current assessment
- Brown under sink coating in room N112 (SNC Admin Report 2017)
  - Not observed by Stantec but presumed to be present
- White vinyl floor tile (PHH Pre-Reno MCCP Upgrade, 2013)
  - Presumed to be the same as the 12”x12” grey tile above
- Ceiling texture coat in the lobby (PHH Pre-Reno MCCP Upgrade, 2013)
  - Not observed by Stantec but presumed to be present
- Grey or black fibrous gasket material inside plumbing fixtures (Wes-Har Analytical Results for RJ dated Aug 17th, 2009).
  - Not observed during the current assessment but presumed to remain in various flanges and fixtures

- Vermiculite insulation (Wes-Har analytical records provided by PSPC, 2009)
  - Based on analytical records provided by PSPC subsequent to our site work, this was identified in one wall within Building N—Administration, which is part of the overall complex of buildings within which the subject building resides.
  - Although not identified through assessment completed by Stantec, this material is potentially present in sporadic locations that have not been destructively assessed

In addition to the above, Stantec identified and sampled various additional suspected ACMs and/or collected confirmatory samples of previously identified ACMs. The samples collected were submitted to EMSL for analysis of asbestos content and nature.

A summary of the materials sampled as part of the current assessment, along with the sample locations and analytical results is presented in Table 5.20-1, below. A copy of the certificate of analysis provided by EMSL for the suspected ACM samples submitted as part of this assessment is attached at the end of this Appendix.

Table 5.20-1 Suspected ACM Sample Collection and Analysis Summary Building N—Administration

Material/Homogenous Application Description	Sample Number	Sample Location	Result (%/type asbestos)
Red duct mastic applied to seams of HVAC ducting throughout	**N-DM-01A**	**Room N112, staff lounge, ceiling space**	**2% Chrysotile**
	N-DM-01B	**Room N118, mechanical room, ceiling space**	**Positive Stop (Not Analyzed)**
	N-DM-01C	**Room N205, boardroom/ERT tactical room, ceiling space**	**Positive Stop (Not Analyzed)**
Grey duct mastic applied to seams of HVAC ducting throughout	N-DM-02A	Room N108, corridor, ceiling space	None Detected
	N-DM-02B	Room N217, telephone room	None Detected
	N-DM-02C	Room N217, telephone room	None Detected
2'x4' ceiling tile with small and large pinholes	N-CT-01A	Room N110, corridor	None Detected
	N-CT-01B	Room N108, corridor	None Detected
	N-CT-01C	Room N100, D.W.	None Detected
2'x4' ceiling tile with standard fissure and pinhole	N-CT-02A	Room N112, staff lounge	None Detected
	N-CT-02B	Room N108, corridor	None Detected
	N-CT-02C	Room N109, contraband room	None Detected
Black window pane caulking applied to windows throughout	**N-WPC-01A**	**Room N112, staff lounge**	**None Detected (see 5.20.1.1)**
	N-WPC-01B	**Room N112, staff lounge**	**None Detected (see 5.20.1.1)**
	N-WPC-01C	**Room N103, S.I.O.**	**<1% Chrysotile (see 5.20.1.1)**

Table 5.20-1 Suspected ACM Sample Collection and Analysis Summary Building N—Administration

Material/Homogenous Application Description	Sample Number	Sample Location	Result (%/type asbestos)
Black window pane caulking applied to windows in room N 205, boardroom/ERT tactical room	**N-WPC-02A**	**Room N205, boardroom/ERT tactical room**	**1.3% Chrysotile**
	N-WPC-02B	**Room N205, boardroom/ERT tactical room**	**Positive Stop (Not Analyzed)**
	N-WPC-02C	**Room N205, boardroom/ERT tactical room**	**Positive Stop (Not Analyzed)**
White Fireproofing applied to metal ceiling	N-FP-01A	Room N108, corridor, ceiling space	None Detected
	N-FP-01B	Room N118, mechanical room, ceiling space	None Detected
	N-FP-01C	Room N109, contraband room, ceiling space	None Detected
	N-FP-01D	Room N205, boardroom/ERT tactical room, ceiling space	None Detected
	N-FP-01E	Room N217, telephone room, ceiling	None Detected
Red electrical penetration sealant	N-EPS-01A	Room N216, UPS room, wall penetration	None Detected
	N-EPS-01B	Room N216, UPS room, wall penetration	None Detected
	N-EPS-01C	Room N216, UPS room, wall penetration	None Detected
Drywall joint compound applied to drywall walls and ceilings throughout the first floor	**N-DJC-01A**	**Room N110, corridor, wall**	**2% Chrysotile**
	N-DJC-01B	**Room N112, staff lounge, wall**	**2% Chrysotile**
	N-DJC-01C	**Room N116, janitor room, ceiling**	**None Detected**
	N-DJC-01D	**Room N152, storage/mechanical room**	**None Detected**
	N-DJC-01E	**Room N104, B.F. male staff locker room, wall**	**None Detected**
Drywall joint compound applied to drywall walls and ceilings throughout the second floor	N-DJC-02A	Room N200, general office area, wall	None Detected
	N-DJC-02B	Room N200, general office area, wall	None Detected
	N-DJC-02C	Room N205, boardroom/ERT tactical room, wall	None Detected
	N-DJC-02D	Room N200, general office area, wall	None Detected
	N-DJC-02E	Room N200, general office area, wall	None Detected
Grey pipe sealant applied to threads of sprinkler line throughout	**N-PS-01A**	**Room N112, staff lounge, ceiling space**	**0.59% Chrysotile**
	N-PS-01B	**Room N152, storage/mechanical room,**	**Positive Stop (Not Analyzed)**
	N-PS-01C	**Room N152, storage/mechanical room**	**Positive Stop (Not Analyzed)**
12”x12” red floor tile with cream streaks	**N-FT-01**	**Room N110, corridor**	**1.3% Chrysotile**
12”x12” grey floor tile with brown streaks	**N-FT-02**	**Room N108, corridor**	**1.0% Chrysotile**
12”x12” cream floor tile with brown streaks	N-FT-03	Room N108, corridor, patch	None Detected
12”x12” beige floor tile with brown speckles	N-FT-04	Room N115, M.C.C.P.	None Detected

Table 5.20-1 Suspected ACM Sample Collection and Analysis Summary Building N—Administration

Material/Homogenous Application Description	Sample Number	Sample Location	Result (%/type asbestos)
Pink/salmon pebble pattern sheet flooring	N-SF-01	Room N150, B.F. female staff locker room	None Detected
NOTE: Bold, highlighted text indicates confirmed ACM			

Based on our observations of building construction (estimated vintage of interior finishes and uniformity of building material use) and on our interpretations of suspected ACM sample analytical results, the materials presented in Table 5.20-2, below were identified as ACMs.

Table 5.20-2 Summary of Identified ACMs Building N—Administration

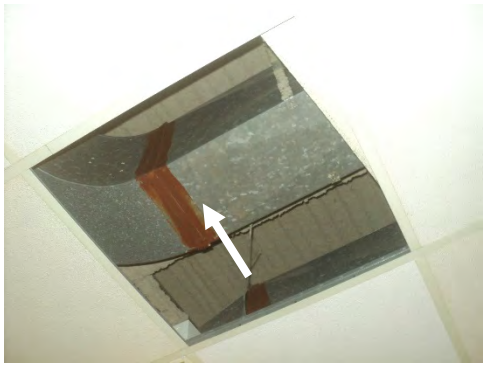
Identified ACM Description and Condition Information		Photo
Red HVAC duct mastic on seams of ducting throughout.		
Friability	Non-friable	
Condition	Good	
Total Quantity	Throughout	
Content	2% Chrysotile (Stantec current assessment) 40% Chrysotile (PGL, ACM Survey Report 2004)	
Black window pane caulking applied to windows throughout (See 5.20-1.1)		
Friability	Non-friable	
Condition	Good	
Total Quantity	Approximately 120 windows	
Content	<1% Chrysotile	

Table 5.20-2 Summary of Identified ACMs
Building N—Administration

Identified ACM Description and Condition Information		Photo
Black window pane caulking applied to window in room N205.		
Friability	Non-friable	
Condition	Good	
Total Quantity	Approximately one window	
Content	1.3% Chrysotile	
Drywall joint compound on walls and ceilings throughout the first floor.		
Friability	Non-friable	
Condition	Good	
Total Quantity	Approximately 475 m^2	
Content	2% Chrysotile (Stantec current assessment) 1.3–1.4% Chrysotile (SNC Admin Report 2017)	
Grey pipe sealant on threads of sprinkler lines.		
Friability	Non-friable	
Condition	Good	
Total Quantity	Throughout	
Content	0.59% Chrysotile	
12”x12” red floor tile with cream streaks in rooms: C100, N101 (under laminate), N102 (under laminate), N103 (under laminate), N107 (under laminate), N108 (under laminate), N109 (under laminate), N110, N112 (under laminate), N151 and N152		
Friability	Non-friable	
Condition	Good	

Table 5.20-2 Summary of Identified ACMs
Building N—Administration

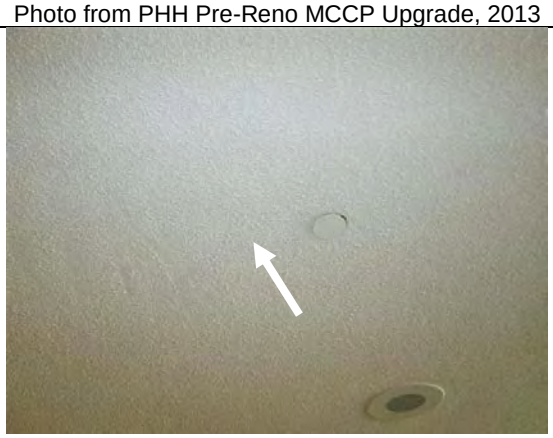
Identified ACM Description and Condition Information		Photo
Total Quantity	Approximately 180 m^2	
Content	1.3% Chrysotile (Stantec current assessment) 3% Chrysotile (PHH Pre-Reno MCCP and CER Upgrade, 2013)	
12”x12” grey floor tile with brown streaks in room N108, N116, and N215A.		
Friability	Non-friable	
Condition	Good	
Total Quantity	Approximately 30 m^2	
Content	1.0% Chrysotile (Stantec current assessment) 1.6% Chrysotile (SNC Admin Report 2017)	
White vinyl floor tile in the lobby concealed under laminate.		 Photo from PHH Pre-Reno MCCP Upgrade, 2013
Friability	Non-friable	
Condition	Good	
Total Quantity	Approximately 46 m^2	
Content	3% Chrysotile (PHH Pre-Reno MCCP Upgrade, 2013)	
Ceiling texture coat in the lobby.		 Photo from PHH Pre-Reno MCCP Upgrade, 2013
Friability	Friable	
Condition	Good	
Total Quantity	Approximately 46 m^2	
Content	3% Chrysotile (PHH Pre-Reno MCCP Upgrade, 2013)	

Table 5.20-2 Summary of Identified ACMs
Building N—Administration

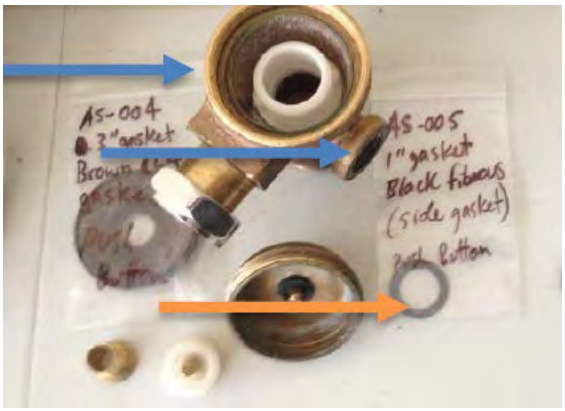
Identified ACM Description and Condition Information		Photo
Brown under sink coating in room N112, staff lounge. Not observed by Stantec but presumed to be present (no records provided to confirm removal).		 Photo from SNC Admin Report, 2017
Friability	Non-friable	
Condition	N/A	
Total Quantity	N/A	
Content	3.7% Chrysotile (SNC Admin Report 2017)	
Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures. See Section 5.20.1.3		 Photo from DST Gasket Report, 2013
Friability	Friable	
Condition	Good—presumed concealed within pipe flanges	
Total Quantity	Unknown	
Content	85-90% chrysotile (Wes-Har Analytical Results for RJ dated Aug 17th, 2009)	

**Table 5.20-2 Summary of Identified ACMs
Building N—Administration**

Identified ACM Description and Condition Information		Photo
Vermiculite insulation within block walls in sporadic locations (confirmed by others as present in the block wall between rooms N102 and N103 SIO offices). Not observed by Stantec in discrete locations assessed. See 5.20.1.2		No photo
Friability	Friable	
Condition	N/A	
Total Quantity	N/A	
Content	0.02% Asbestiform Amphibole (Wes-Har analytical records provided by PSPC, 2009)	

5.20.1.1. Window Pane Caulking

Less than one percent chrysotile asbestos was detected in one sample of window pane caulking with no asbestos detected in the other two samples. There was insufficient material for additional analysis to determine whether the asbestos content is greater or less than 0.5%. As such, this material should be considered asbestos-containing until proven otherwise.

5.20.1.2. Potential Asbestos-Containing Vermiculite Insulation

As part of the assessment, Stantec assessed the subject building for areas where vermiculite insulation, a potential ACM, would likely be present. This included making note of attic spaces, floor cavities and masonry block or brick walls, which are typical areas where vermiculite is found. The following observations we made regarding areas where vermiculite is potentially present:

- Walls of the subject building are comprised of brick and masonry blocks. To assess for the presence of vermiculite insulation the block wall cavities were drilled in two locations. Additional drilling was conducted in multiple locations in the complex of adjoining buildings. No vermiculite was observed in the locations where drilling was conducted.
- No other locations that may potentially contain vermiculite (that could not otherwise be assessed) were observed by Stantec

Subsequent to our assessment, suspected asbestos-containing vermiculite insulation material was reportedly released from the cavity of the block wall between rooms N102 and N103 SIO offices. Additionally, visually similar material had reportedly been previously identified as an ACM through laboratory analysis (analytical records provided by PSPC for the vermiculite are attached to this document, for reference).

Based on the above, asbestos-containing vermiculite insulation should be presumed to be present in masonry wall cavities sporadically throughout the subject building.

5.20.1.3. Fibrous Gasket Material

As indicated by the Wes-Har Analytical Results for RJ dated Aug 17th, 2009, grey or black fibrous gasket material inside plumbing fixtures within Building A&B—Living Unit A&B was sampled and found to contain 85–90% chrysotile asbestos. As Building A&B—Living Unit A&B is part of the overall complex of buildings where the subject building resides, it is likely that similar gaskets are present in plumbing flanges and fixtures in other locations within the complex, including the subject building. As such, grey or black fibrous gaskets in plumbing fixtures or flanges throughout the subject building should be considered ACM unless gasket-specific sampling and laboratory analysis proves otherwise.

5.20-2. LEAD

Lead is expected to be present in the following within the subject building:

- Lead-acid batteries used in emergency lighting
- Older electrical wiring materials and sheathing
- Solder used on domestic water lines
- Solder used in bell fittings for cast iron pipes and in electrical equipment
- Vent and pipe flashings
- Ceramic tile glaze

With respect to paint, the following paint was considered LCP through the Previous Reports based on an LCP definition criterion of 600 ppm lead (or greater), with notes regarding condition or other changes noted during the current assessment.

- Red on sprinkler lines (SNC Admin Report 2017)
  - Paint remains and was observed to be in good condition
- Brown on bars over windows (SNC Admin Report 2017)
  - Paint remains and was observed to be in good condition

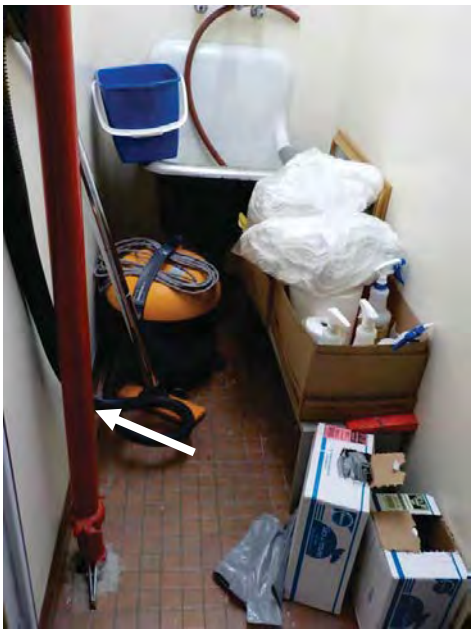
In addition to above, chip samples were obtained from the predominant suspected LCP applications within the subject building. A summary of the sample types, locations and analytical results is presented in Table 5.20-3, below. A copy of the certificate of analysis provided by EMSL for the suspected LCP samples submitted is attached to this Appendix.

Table 5.20-3 Suspected LCP Sample Collection and Analysis Summary Building N—Administration

Sample No.	Sample Colour/Substrate	Sample Location	Lab Result (ppm)
N-P-01	White—drywall and concrete	Room N108, corridor, walls	<83
N-P-02	Cream—drywall and concrete	Room N110, corridor, walls	<81
N-P-03	Red—metal	Room N152, storage/mechanical room	<81

Based on our observations and on our interpretations of suspected LCP sample analytical results, the paint presented in Table 5.20-4, below was identified as an LCP:

Table 5.20-4 Summary of Identified LCPs
Building N—Administration

Identified LCP Description		Photo
Paint colour	Red	 Photo from SNC Admin Report, 2017
Substrate	Cast iron	
Location/approx. extent	Sprinkler lines	
Lead content	61,200 ppm (SNC Admin Report 2017)	
Condition	Good	
Paint colour	Brown	 Photo from SNC Admin Report, 2017
Substrate	Metal	
Location/approx. extent	Bars over windows	
Lead content	2,480 ppm (SNC Admin Report 2017)	
Condition	Good	

5.20-3. POLYCHLORINATED BIPHENYLS

PCBs may be present in the fluorescent light ballasts of the approximately 50 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons.

5.20-4. MERCURY

Mercury vapour is present in the light tubes within the approximately 50 fluorescent light fixtures observed.

5.20-5. MOULD

The observations pertaining to mould and/or moisture that were made during this assessment are summarized in Table 5.20-5, below.

Table 5.20-5 Mould/Moisture Observations Summary—July 18 2018
Building N—Administration

Building Area	Observation	Suspected Source of Moisture	Photo
Various locations throughout	Moisture stained ceiling tiles	Pipe leaks, roof leaks, condensation tray overflow	
Room N116 sink	Suspect mould impacted drywall, approximately 1 m^2	Sink and associated janitorial supply storage	

5.20-6. OZONE-DEPLETING SUBSTANCES

Building related cooling, refrigeration or fire suppression equipment suspected to be ODS-containing was not observed within the interior of the subject building.

5.20-7. SILICA

Silica is expected to be present in the following, which were observed in various locations throughout:

- Cement products such as:
  - Concrete—foundations, floors, blocks
  - Brick/masonry units and associated grout and mortar
  - Stone/ceramic floor tiles and associated grouts and mortars
- Gypsum and associated wall/ceiling finish materials
- Suspended ceiling tiles
- Asphalt and asphalt products containing rock or stone (e.g., roof membrane)

6.20 RECOMMENDATIONS

In general, identified hazardous building materials were observed to be in good condition and do not appear to require specific action to maintain compliance with applicable regulations for continued operations and maintenance. Refer to Section 6.0 of the main body of this report for applicable material-by-material general recommendations.

Additional building-specific recommendations to be considered are provided below.

6.20-1. ASBESTOS

Asbestos-containing vermiculite insulation may be present in masonry block walls. If suspect material is released from walls, it should be presumed ACM, and the reports and records for this building should be updated to indicate vermiculite location(s).

If masonry block walls are to be impacted by renovation and/or demolition work, and if these walls have not been checked for the presence of vermiculite insulation, intrusive assessments for vermiculite should be undertaken prior to renovation/or demolition work. If vermiculite insulation is identified to be present, this material should be treated as an ACM until testing can show otherwise.

6.20-5. MOULD

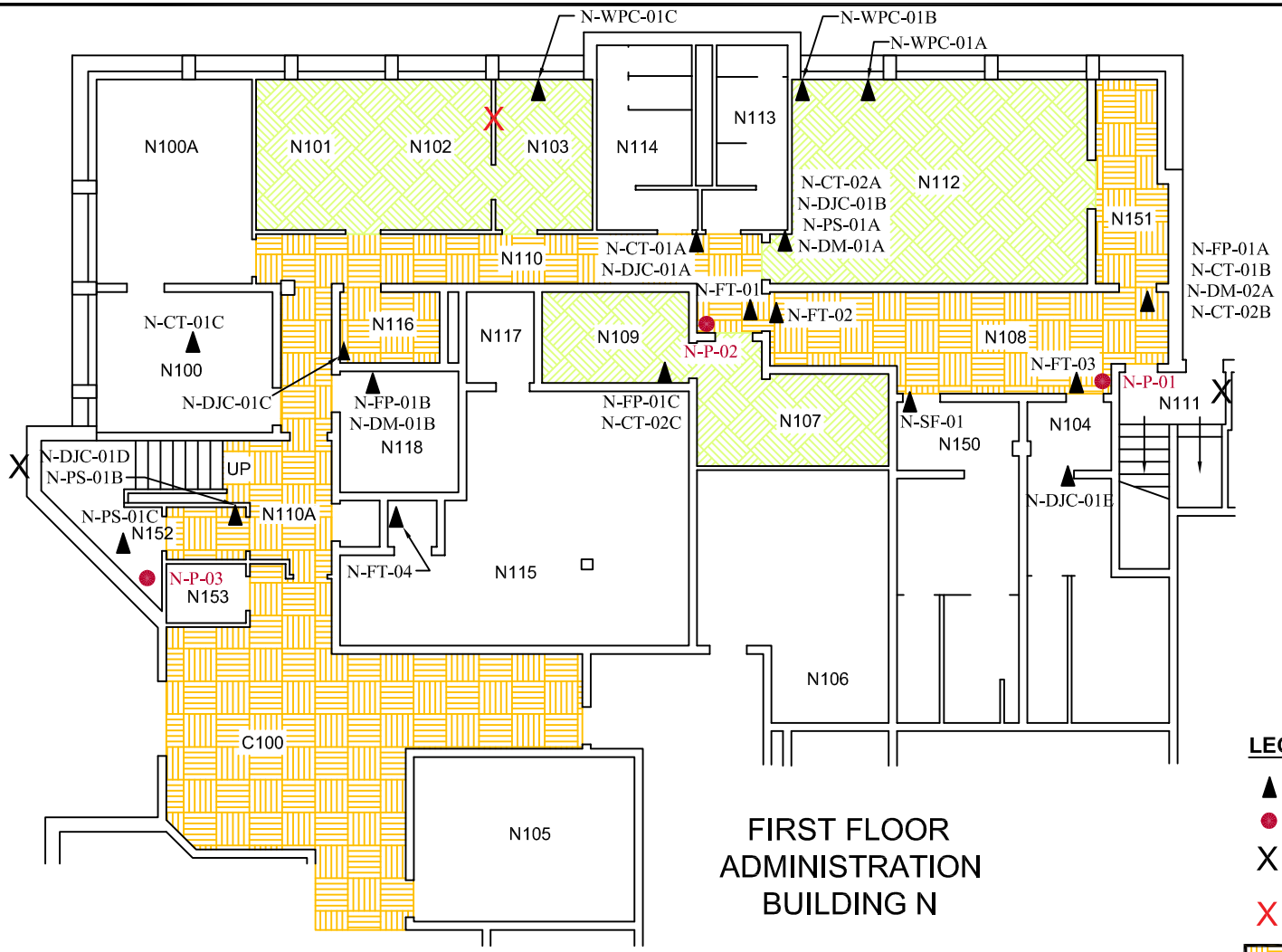
Documents published by Health Canada, Ontario Ministry of Health, American Industrial Hygiene Association (AIHA), American Conference of Governmental Industrial Hygienists (ACGIH) and others, provide guidance for interpreting the results of mold investigations. The Health Canada Guide states that:

> "…current knowledge supports the need to prevent damp conditions and mold growth and to remediate any fungal contamination in buildings."

To this end, Stantec recommends the following course of action within the subject building:

- Remove and dispose of moisture impacted ceiling tiles (and impacted attic insulation, if present) from the building throughout and assess conditions of concealed materials for additional mould-impacted materials that may require removal or cleaning.
  - This work can be conducted by regular facility maintenance staff, if conducted prior to the onset of mould growth
- Room N116—remove and dispose of the lower one meter of suspect mould impacted drywall (and impacted underlying vapour retarder and insulation, if present) from walls around the sink (2 m^2 total).
  - As the drywall joint compound on the first floor is asbestos-containing this work (and any associated reinstatement work that will involve contact with remaining drywall with ACM joint compound) should be conducted by appropriately trained personnel (e.g., asbestos abatement contractor personnel), in accordance with the requirements of the COHSR, BC Reg. 296/97 and the Asbestos Guide.

An assessment to determine the likely source(s) of water staining/moisture intrusion should be undertaken. Issues leading to moisture impacts and/or mould growth should be identified and addressed prior to reinstating building materials to areas where mould abatement is conducted, to avoid the potential for re-wetting of new materials, and repeated mould growth.



FIRST FLOOR
ADMINISTRATION
BUILDING N

LEGEND

- ASBESTOS BULK SAMPLE
- LEAD PAINT SAMPLE
- X — INTRUSIVE INVESTIGATION FOR VERMICULITE - NO VERMICULITE OBSERVED
- X — LOCATION OF REPORTED VERMICULITE INSULATION
- ASBESTOS-CONTAINING FLOOR TILE
- CONCEALED ASBESTOS-CONTAINING FLOOR TILE

NOTES:

1. RED HVAC DUCT MASTIC THROUGHOUT IS ASBESTOS-CONTAINING.
2. BLACK WINDOW PANE CAULKING APPLIED TO WINDOWS THROUGHOUT IS ASBESTOS-CONTAINING.
3. GREY PIPE SEALANT ON THREADS OF SPRINKLER LINES THROUGHOUT IS ASBESTOS-CONTAINING.
4. DRYWALL JOINT COMPOUND IS ASBESTOS-CONTAINING.
5. GREY OR BLACK MECHANICAL GASKETS PRESUMED TO REMAIN IN VARIOUS FLANGES AND FIXTURES ARE ASBESTOS-CONTAINING.
6. ACM VERMICULITE INSULATION MAY BE PRESENT IN MASONRY BLOCK WALLS IN SPORADIC LOCATIONS.
7. CEILING TEXTURE COAT IN THE LOBBY IS ASBESTOS-CONTAINING.
8. MULTIPLE STAINED CEILING TILES OBSERVED IN VARIOUS LOCATIONS THROUGHOUT.
9. THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

KENT INSTITUTION
4732 CEMETERY ROAD, AGASSIZ, BC

Client: PUBLIC SERVICES AND PROCUREMENT CANADA

Project No.:	123221164
Scale:	N.T.S.
Date:	19/01/25
Dwn. By:	CD SL2019010488 DM/VM
App'd By:	TW

Dwg. No.: 20.1

Stantec

Unit N		
Administration - First Floor		
Rm#	Name	Area m2
N100A	D.W.	17.71
N100	D.W. Secretary	24.24
N101	S.I.O.	13.79
N102	S.I.O.	10.18
N103	S.I.O.	10.11
N104	B. F. Male Staff Locker Room	22.98
N105	IT Office	22.61
N106	C.E.R.	26.33
N107	Contraband Room	12.77
N108	Corridor	23.28
N109	Contraband Room	8.96
N110A	Corridor	
N111	Stairwell	11.19
N112	Staff Lounge	41.24
N113	Men's Washroom	10.02
N114	Ladies' Washroom	12.76
N115	M.C.C.P.	46.12
N116	Janitor Room	5.75
N117	Washroom	4.31
N118	Mechanical Room	9.45
N150	B.F. Female Staff Locker Room	24.43
N151	Staff Canteen	11.93
N152	Storage / Mechanical Room	11.79
N153	B.F. Lift	3.05
C100	Corridor	55.17

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

KENT INSTITUTION

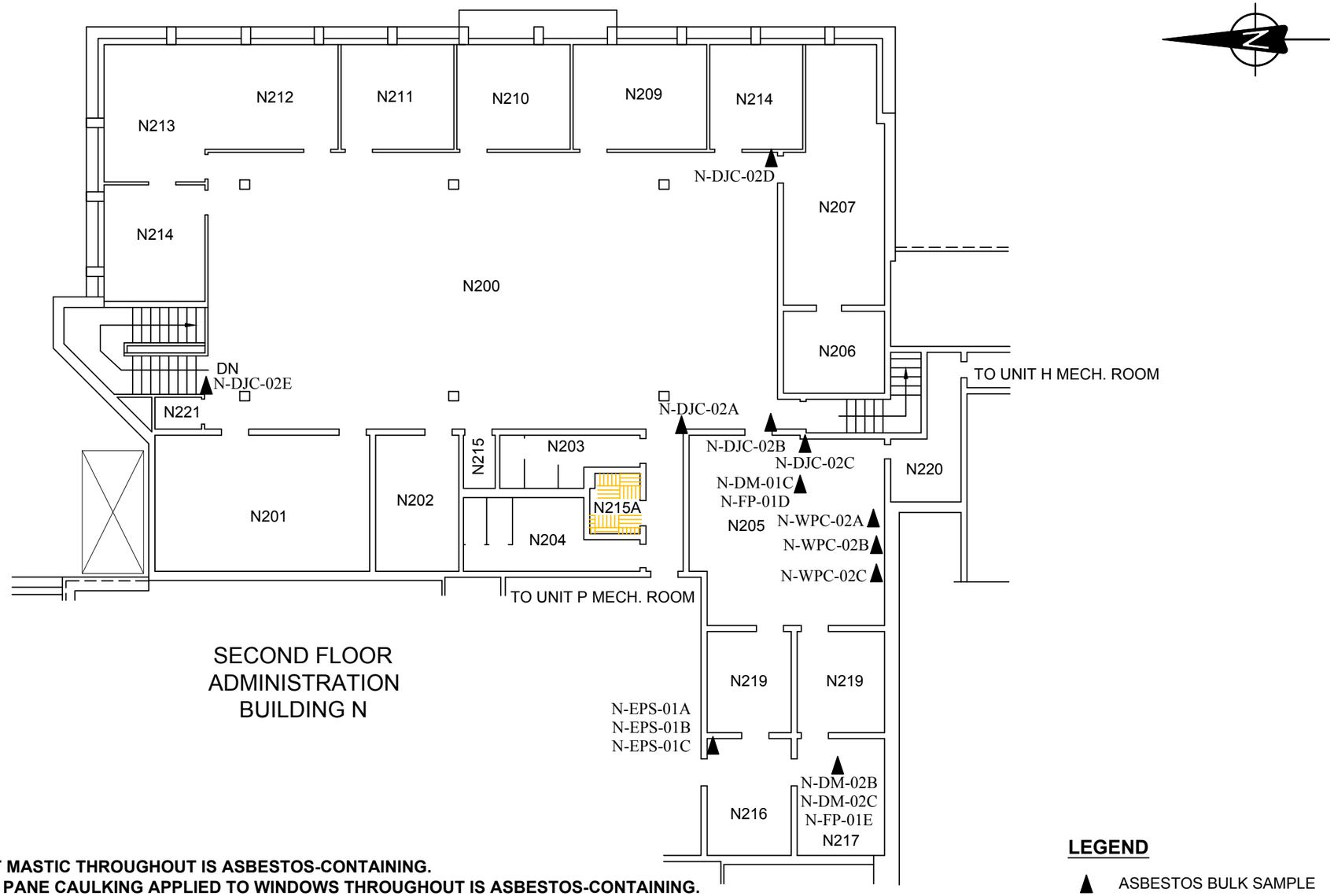
4732 CEMETERY ROAD, AGASSIZ, BC

Client: PUBLIC SERVICES AND PROCUREMENT CANADA

Project No.:	123221164
Scale:	N.T.S.
Date:	19/01/25
Dwn. By:	CD VM SL2019010489
App'd By:	TW

Dwg. No.: 20.2

Stantec



SECOND FLOOR
ADMINISTRATION
BUILDING N

NOTES:

1. **RED HVAC DUCT MASTIC THROUGHOUT IS ASBESTOS-CONTAINING.**
2. **BLACK WINDOW PANE CAULKING APPLIED TO WINDOWS THROUGHOUT IS ASBESTOS-CONTAINING.**
3. **GREY PIPE SEALANT ON THREADS OF SPRINKLER LINES THROUGHOUT IS ASBESTOS-CONTAINING.**
4. **GREY OR BLACK MECHANICAL GASKETS PRESUMED TO REMAIN IN VARIOUS FLANGED AND FIXTURES ARE ASBESTOS-CONTAINING.**
5. **ACM VERMICULITE INSULATION MAY BE PRESENT IN MASONRY BLOCK WALLS IN SPORADIC LOCATIONS.**
6. **MULTIPLE STAINED CEILING TILES OBSERVED IN VARIOUS LOCATIONS THROUGHOUT.**
7. THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

LEGEND

- ASBESTOS BULK SAMPLE
- ASBESTOS-CONTAINING FLOOR TILE

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

KENT INSTITUTION
4732 CEMETERY ROAD, AGASSIZ, BC

Client: PUBLIC SERVICES AND PROCUREMENT CANADA

Project No.:	123221164
Scale:	N.T.S.
Date:	19/01/25
Dwn. By:	CD VM SL2019010490
App'd By:	TW

Dwg. No.: 20.3

Stantec

Unit N		
Administration - Second Floor		
Rm#	Name	Area m2
N200	General Office Area	185.44
N201	Records Vault, Mail & Switchboard	36.15
N202	Office	14.74
N203	Men's Washroom	8.03
N204	Ladies' Washroom	13.26
N205	Boardroom / ERT Tactical Room	43.38
N206	Vault	10.78
N207	Office	16.07
N208	Office	20.57
N209	Office	19.22
N210	Office	17.75
N211	Office	15.43
N212	Warden's Secretary	17.71
N213	Warden's Office	31.43
N214	Personnel	12.71
N215	Janitors Room	2.29
N215A	B.F. Washroom	4.15
N216	UPS Room	12.68
N217	Telephone Room	14.99
N218	Fire Enunciation Equipment Room	13.68
N219	Radio Room	11.70
N220	H3001A Mechanical Room	10.90
N221	Elevatior	3.93

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

KENT INSTITUTION

4732 CEMETERY ROAD, AGASSIZ, BC

Client: PUBLIC SERVICES AND PROCUREMENT CANADA

Project No.:	123221164
Scale:	N.T.S.
Date:	19/01/25
Dwn. By:	CD VM SL2019010491
App'd By:	TW

Dwg. No.: 20.4

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EMSL Canada Order 691802022
Customer ID: 55JACQ30L
Customer PO: 123221164
Project ID:

Attn: Kim Wiese
Stantec Consulting Ltd.
500 - 4730 Kingsway
Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Collected:
Received: 7/27/2018
Analyzed: 8/03/2018

Proj: 123221164 / N - KENT INSTITUTION

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: N-DM-01A **Lab Sample ID:** **691802022-0001**
Sample Description: ROOM N112, STAFF LOUNGE, CEILING SPACE/RED DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Red	0%	98%	2% Chrysotile	

Client Sample ID: N-DM-01B **Lab Sample ID:** **691802022-0002**
Sample Description: ROOM N118, MECHANICAL ROOM, CEILING SPACE/RED DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018				Positive Stop (Not Analyzed)	

Client Sample ID: N-DM-01C **Lab Sample ID:** **691802022-0003**
Sample Description: ROOM N205, BOARDROOM/ERT TACTICAL ROOM, CEILING SPACE/RED DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018				Positive Stop (Not Analyzed)	

Client Sample ID: N-DM-02A **Lab Sample ID:** **691802022-0004**
Sample Description: ROOM N108, CORRIDOR, CEILING SPACE/GREY DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: N-DM-02B **Lab Sample ID:** **691802022-0005**
Sample Description: ROOM N217, TELEPHONE ROOM/GREY DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: N-DM-02C **Lab Sample ID:** **691802022-0006**
Sample Description: ROOM N217, TELEPHONE ROOM/GREY DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: N-CT-01A **Lab Sample ID:** **691802022-0007**
Sample Description: ROOM N110, CORRIDOR/2'X4' CEILING TILE WITH SMALL AND LARGE PINHOLES

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	80%	20%	None Detected	

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EMSL Canada Order 691802022
Customer ID: 55JACQ30L
Customer PO: 123221164
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: N-CT-01B **Lab Sample ID:** **691802022-0008**

Sample Description: ROOM N108, CORRIDOR/2'X4' CEILING TILE WITH SMALL AND LARGE PINHOLES

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	80%	20%	None Detected	

Client Sample ID: N-CT-01C **Lab Sample ID:** **691802022-0009**

Sample Description: ROOM N100, D.W. /2'X4' CEILING TILE WITH SMALL AND LARGE PINHOLES

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	80%	20%	None Detected	

Client Sample ID: N-CT-02A **Lab Sample ID:** **691802022-0010**

Sample Description: ROOM N112, STAFF LOUNGER/2'X4' STANDARD FISSURE AND PINHOLE CEILING TILE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	80%	20%	None Detected	

Client Sample ID: N-CT-02B **Lab Sample ID:** **691802022-0011**

Sample Description: ROOM N108, CORRIDOR/2'X4' STANDARD FISSURE AND PINHOLE CEILING TILE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	80%	20%	None Detected	

Client Sample ID: N-CT-02C **Lab Sample ID:** **691802022-0012**

Sample Description: ROOM N109, CONTRABAND ROOM/2'X4' STANDARD FISSURE AND PINHOLE CEILING TILE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	80%	20%	None Detected	

Client Sample ID: N-WPC-01A **Lab Sample ID:** **691802022-0013**

Sample Description: ROOM N112, STAFF LOUNGE/BLACK WINDOW PANE CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Black	0.0%	100%	None Detected	

Client Sample ID: N-WPC-01B **Lab Sample ID:** **691802022-0014**

Sample Description: ROOM N112, STAFF LOUNGE/BLACK WINDOW PANE CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Black	0.0%	100%	None Detected	

Client Sample ID: N-WPC-01C **Lab Sample ID:** **691802022-0015**

Sample Description: ROOM N103, S.I.O./BLACK WINDOW PANE CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Black	0%	100%	**<1% Chrysotile**	Insufficient sample for additonal analysis

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EMSL Canada Order 691802022
Customer ID: 55JACQ30L
Customer PO: 123221164
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: N-WPC-02A ***Lab Sample ID:*** **691802022-0016**

Sample Description: ROOM N205, BOARDROOM/ERT TACTICAL ROOM/BLACK WINDOW PANE CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Black	0.0%	98.7%	**1.3% Chrysotile**	

Client Sample ID: N-WPC-02B ***Lab Sample ID:*** **691802022-0017**

Sample Description: ROOM N205, BOARDROOM/ERT TACTICAL ROOM/BLACK WINDOW PANE CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018				Positive Stop (Not Analyzed)	

Client Sample ID: N-WPC-02C ***Lab Sample ID:*** **691802022-0018**

Sample Description: ROOM N205, BOARDROOM/ERT TACTICAL ROOM/BLACK WINDOW PANE CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018				Positive Stop (Not Analyzed)	

Client Sample ID: N-FP-01A ***Lab Sample ID:*** **691802022-0019**

Sample Description: ROOM N108, CORRIDOR, CEILING SPACE/FIREPROOFING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	25%	75%	None Detected	

Client Sample ID: N-FP-01B ***Lab Sample ID:*** **691802022-0020**

Sample Description: ROOM 118, MECHANICAL ROOM, CEILING SPACE/FIREPROOFING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	25%	75%	None Detected	

Client Sample ID: N-FP-01C ***Lab Sample ID:*** **691802022-0021**

Sample Description: ROOM N109, CONTRABAND ROOM, CEILING SPACE/FIREPROOFING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	25%	75%	None Detected	

Client Sample ID: N-FP-01D ***Lab Sample ID:*** **691802022-0022**

Sample Description: ROOM N205, BOARDROOM/ERT TACTICAL ROOM, CEILING SPACE/FIREPROOFING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	30%	70%	None Detected	

Client Sample ID: N-FP-01E ***Lab Sample ID:*** **691802022-0023**

Sample Description: ROOM N217, TELEPHONE ROOM, CEILING/FIREPROOFING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	30%	70%	None Detected	

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EMSL Canada Order 691802022
Customer ID: 55JACQ30L
Customer PO: 123221164
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: N-EPS-01A ***Lab Sample ID:*** **691802022-0024**

Sample Description: ROOM N216, UPS ROOM, WALL PENETRATION/RED ELECTRICAL PENETRATION SEALANT

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Red	0%	100%	None Detected	

Client Sample ID: N-EPS-01B ***Lab Sample ID:*** **691802022-0025**

Sample Description: ROOM N216, UPS ROOM, WALL PENETRATION/RED ELECTRICAL PENETRATION SEALANT

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Red	0%	100%	None Detected	

Client Sample ID: N-EPS-01C ***Lab Sample ID:*** **691802022-0026**

Sample Description: ROOM N216, UPS ROOM, WALL PENETRATION/RED ELECTRICAL PENETRATION SEALANT

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Red	0%	100%	None Detected	

Client Sample ID: N-DJC-01A ***Lab Sample ID:*** **691802022-0027**

Sample Description: ROOM N110, CORRIDOR, WALL/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	0%	98%	**2% Chrysotile**	

Client Sample ID: N-DJC-01B ***Lab Sample ID:*** **691802022-0028**

Sample Description: ROOM N112, STAFF LOUNGE, WALL/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	0%	98%	**2% Chrysotile**	

Client Sample ID: N-DJC-01C ***Lab Sample ID:*** **691802022-0029**

Sample Description: ROOM N116, JANITOR ROOM, CEILING/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	White	0%	100%	None Detected	

Client Sample ID: N-DJC-01D ***Lab Sample ID:*** **691802022-0030**

Sample Description: ROOM N152, STORAGE/MECHANICAL ROOM/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	White	0%	100%	None Detected	

Client Sample ID: N-DJC-01E ***Lab Sample ID:*** **691802022-0031**

Sample Description: ROOM N104, B.F. MALE STAFF LOCKER ROOM, WALL/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	White	0%	100%	None Detected	

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EMSL Canada Order 691802022
Customer ID: 55JACQ30L
Customer PO: 123221164
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: N-DJC-02A **Lab Sample ID:** **691802022-0032**

Sample Description: ROOM N200, GENERAL OFFICE AREA, WALL/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	White	0%	100%	None Detected	

Client Sample ID: N-DJC-02B **Lab Sample ID:** **691802022-0033**

Sample Description: ROOM N200, GENERAL OFFICE AREA, WALL/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	White	0%	100%	None Detected	

Client Sample ID: N-DJC-02C **Lab Sample ID:** **691802022-0034**

Sample Description: ROOM N205, BOARDROOM/ERT TACTICAL ROOM, WALL/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	White	0%	100%	None Detected	

Client Sample ID: N-DJC-02D **Lab Sample ID:** **691802022-0035**

Sample Description: ROOM N200, GENERAL OFFICE AREA, WALL/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	White	0%	100%	None Detected	

Client Sample ID: N-DJC-02E **Lab Sample ID:** **691802022-0036**

Sample Description: ROOM N200, GENERAL OFFICE AREA, WALL/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	White	0%	100%	None Detected	

Client Sample ID: N-PS-01A **Lab Sample ID:** **691802022-0037**

Sample Description: ROOM N152, STORAGE/MECHANICAL ROOM, THREADS OF SPRINKLER PIPES/GREY PIPE SEALANT

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Blue	0.0%	99.4%	**0.59% Chrysotile**	

Client Sample ID: N-PS-01B **Lab Sample ID:** **691802022-0038**

Sample Description: ROOM N152, STORAGE/MECHANICAL ROOM, THREADS OF SPRINKLER PIPES/GREY PIPE SEALANT

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018				Positive Stop (Not Analyzed)	

Client Sample ID: N-PS-01C **Lab Sample ID:** **691802022-0039**

Sample Description: ROOM N152, STORAGE/MECHANICAL ROOM, THREADS OF SPRINKLER PIPES/GREY PIPE SEALANT

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018				Positive Stop (Not Analyzed)	

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Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: N-FT-01 ***Lab Sample ID:*** **691802022-0040**

Sample Description: ROOM N110, CORRIDOR/12"X12" RED FLOOR TILE WITH CREAM STREAKS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Red	0.0%	98.7%	**1.3% Chrysotile**	

Client Sample ID: N-FT-02 ***Lab Sample ID:*** **691802022-0041**

Sample Description: ROOM N108, CORRIDOR/12"X12" GREY FLOOR TILE WITH BROWN STREAKS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Gray	0.0%	99.0%	**1.0% Chrysotile**	

Client Sample ID: N-FT-03 ***Lab Sample ID:*** **691802022-0042**

Sample Description: ROOM N108, CORRIDOR, PATCH/12"X12" CREAM FLOOR TILE WITH BROWN STREAKS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: N-FT-04 ***Lab Sample ID:*** **691802022-0043**

Sample Description: ROOM N115, M.C.C.P./12"X12" BEIGE FLOOR TILE WITH BROWN SPECKLES

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: N-SF-01 ***Lab Sample ID:*** **691802022-0044**

Sample Description: ROOM N150, B.F. FEMALE STAFF LOCKER ROOM/PINK/SALMON PEBBLE PATTERN SHEET FLOORING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Beige	0.0%	100%	None Detected	

Analyst(s):

Kathleen Cruz PLM (10)
PLM Grav. Reduction (1)

Nicole Yeo PLM (16)
PLM Grav. Reduction (11)

Reviewed and approved by:

Nicole Yeo, Laboratory Manager
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Burnaby, BC

Initial report from: 08/03/201815:08:14

Wes-Har Asbestos Analysis & Consulting Ltd.

Bulk Asbestos in Vermiculite Report

For R.J. & Associates
Environmental Consulting Inc.
2049 Waterloo Street Vancouver BC Canada V6R 3G8

Location : Kent Institution - Partition Wall

Project : 090729-01AM

9134	Kent	Sample Location / Description	Result(s)	Analyzed	Analyst	ACM
1	KENT01	Brown / Grey Granular Insulation Material	0.02% [wt/wt] Asbestiform Amphibole DNQ Vermiculite DNQ Non-fibrous	Aug 10 2009	GN	.T.

Comments

Fibrous / Mineral Components Analyzed In Accordance With The NIOSH ASBESTOS (bulk) by PLM Method 9002 [15 August 1994]
Research Method for Sampling and Analysis of Fibrous Amphibole in Vermiculite Attic Insulation EPA/600/R-04/004 January 2004
Detection Limit for Asbestiform Amphibole 'Rapid Screening' is less than 0.01 % (by weight) , Dependant on Original Sample Size
ACM Means - Asbestos Containing Material; T - Present
LP Means - Precent : Layer or Phase of Whole Sample.
DNQ Means - Detected Not Quantitated
Samples Submitted Will Be Retained For 30 Days After Receipt And Will Be Disposed Of Thereafter Unless Otherwise Notified In Writing
Sample Submitted By R.J. & Associates

August 10, 2009 [Facsimile]

G. Nawrocki
Analyst

G. Nawrocki
Reviewed By

RICON Kent.KENT01 9134. 1

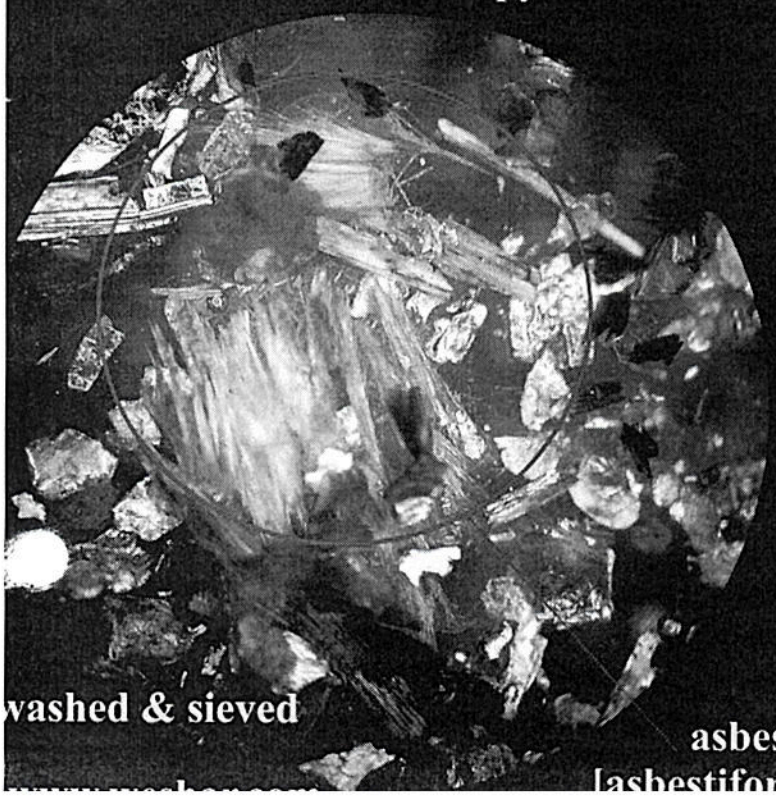
08/06/2009

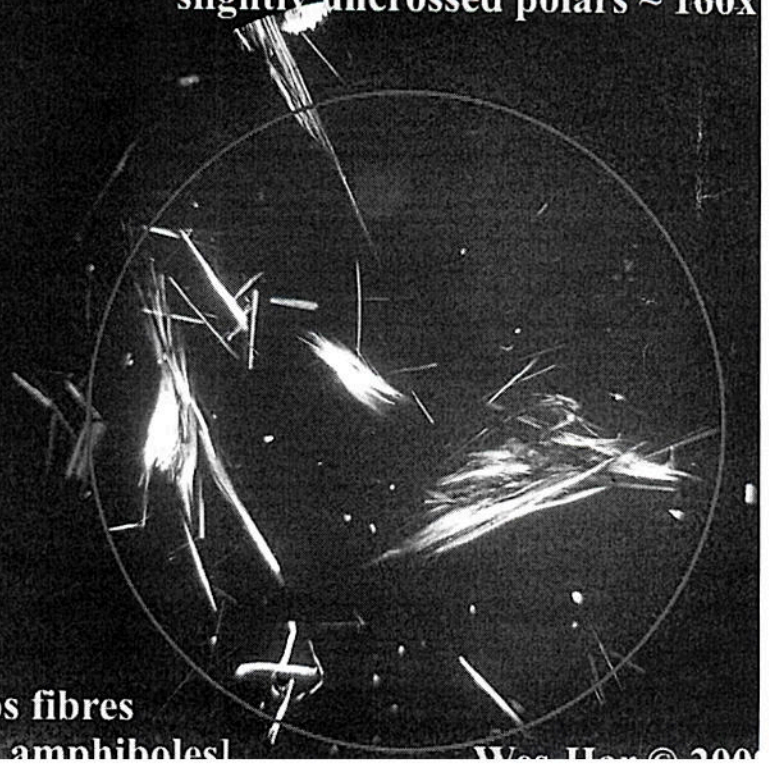
Brown / Grey Granular Insulation Material

submitted sample

stereo binocular microscopy ~ 40x

polarized light microscopy
slightly uncrossed polars ~ 160x





washed & sieved

asbestos fibres
[asbestiform amphiboles]

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EMSL Canada Or	551808879
CustomerID:	55JACQ30L
CustomerPO:	123221164
ProjectID:	

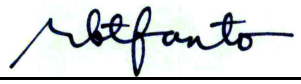
Attn: **Kim Wiese**
Stantec Consulting Ltd.
500 - 4730 Kingsway
Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Received: 07/30/18 11:47 AM
Collected:

Project: **123221164**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client SampleDescription	*Collected*	*Analyzed*	*Weight*	*RDL*	*Lead Concentration*
N-P-01		8/1/2018	0.2414 g	83 ppm	<83 ppm
551808879-0009	Site: N - Kent Institution / Room N108, Corridor, Walls Desc: White - Drywall and Concete				
N-P-02		8/1/2018	0.2458 g	81 ppm	<81 ppm
551808879-0010	Site: N - Kent Institution / Room N110, Corridor, Walls Desc: Cream - Drywall and Concrete				
N-P-03		8/1/2018	0.2477 g	81 ppm	<81 ppm
551808879-0011	Site: N - Kent Institution / Room N152, Storage/Mechanical Room Desc: Red - Metal				



Rowena Fanto, Lead Supervisor
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 08/07/2018 08:20:47

APPENDIX 5.21

FINDINGS AND RECOMMENDATIONS—BUILDING PC—PROGRAMS CORRIDOR (836-08-RP)

Appendix 5.21 FINDINGS AND RECOMMENDATIONS—BUILDING PC—PROGRAMS CORRIDOR (836-08-RP)

Building PC—Programs Corridor (subject building) was reportedly constructed in 1979 and has been assigned Real Property ID #1819. It is part of the main complex of adjoined buildings within Kent Institution and may share mechanical/electrical systems with adjacent units: Living Unit G&H (Building G&H), Administration (Building N), Visiting and Correspondence (Building VC), Admission and Discharge (Building AD), Health Care (Building HC), Living Unit J&K/Segregation (Building J&K), Recreation (Building R), and Living Unit A&B (Building A&B). The typical structural components and finishes associated with this building consist of exterior brick walls; suspended ceiling tiles, and concrete ceilings; drywall, ceramic tile and masonry block interior walls; concrete, vinyl floor tile flooring; and a flat asphalt shingle roof.

The results of the assessment for each of the considered hazardous materials within the subject building are provided in the following sub-sections.

Floor plan drawings, which include locations of the samples collected during this assessment and locations of identified hazardous building materials (where practical), are attached to this Appendix.

5.21-1. ASBESTOS

The Previous Reports indicated the presence of the following ACMs, with notes regarding condition or other changes noted during the current assessment:

- Red mastic on both outer and inner seams of HVAC ducts (PGL, ACM Survey Report 2004)
  - Additional samples were collected by Stantec during the current assessment
- Ash coloured floor tile in room 141 (PGL, ACM Survey Report 2004)
  - Additional samples were collected by Stantec during the current assessment
- Grey or black fibrous gasket material inside plumbing fixtures (Wes-Har Analytical Results for RJ dated August 17, 2009).
  - Not observed during the current assessment but presumed to remain in various flanges and fixtures
- Vermiculite insulation
  - Based on analytical records provided by PSPC subsequent to our site work, this was identified in one wall within Building N—Administration, which is part of the overall complex of buildings within which the subject building resides.
  - Although not identified through assessment completed by Stantec, this material is potentially present in sporadic locations that have not been destructively assessed

In addition to the above, Stantec identified and sampled various additional suspected ACMs and/or collected confirmatory samples of previously identified ACMs. The samples collected were submitted to EMSL for analysis of asbestos content and nature.

A summary of the materials sampled as part of the current assessment, along with the sample locations and analytical results is presented in Table 5.21-1, below. A copy of the certificate of analysis provided by EMSL for the suspected ACM samples submitted as part of this assessment is attached at the end of this Appendix.

Table 5.21-1 Suspected ACM Sample Collection and Analysis Summary Building PC—Programs Corridor

Material/Homogenous Application Description	Sample Number	Sample Location	Result (%/type asbestos)
Drywall joint compound applied to walls and ceilings	PC-DJC-01A	Room PC141, common room, wall	None Detected
	PC-DJC-01B	Room PC140, library, wall	None Detected
	PC-DJC-01C	Room PC128, law library, wall	None Detected
	PC-DJC-01D	Room PC125, NPB room, wall	None Detected
	PC-DJC-01E	Room PC122, deliberation room, wall	None Detected
	PC-DJC-01F	Room PC122, deliberation room, wall	None Detected
	PC-DJC-01G	Room PC116a, office, pillar	None Detected
2'x4' pinhole and fissure ceiling tile	PC-CT-01A	Room PC112, office	None Detected
	PC-CT-01B	Room PC112, office	None Detected
	PC-CT-01C	Room PC112, office	None Detected
Pipe insulation on elbows of domestic water pipes	PC-PI-01A	Room MR203, mechanical room, domestic water elbows	None Detected
	PC-PI-01B	Room MR203, mechanical room, domestic water elbows	None Detected
	PC-PI-01C	Room MR203, mechanical room, domestic water elbows	None Detected
Pipe insulation on elbows of cold-water pipes	PC-PI-02A	Room MR203, mechanical room, cold water elbows	None Detected
	PC-PI-02B	Room MR203, mechanical room, cold water elbows	None Detected
	PC-PI-02C	Room MR203, mechanical room, cold water elbows	None Detected
Pipe insulation on elbows of hot water pipes	PC-PI-03A	Room MR203, mechanical room, hot water elbows	None Detected
	PC-PI-03B	Room MR203, mechanical room, hot water elbows	None Detected
	PC-PI-03C	Room MR203, mechanical room, hot water elbows	None Detected

Table 5.21-1 Suspected ACM Sample Collection and Analysis Summary Building PC—Programs Corridor

Material/Homogenous Application Description	Sample Number	Sample Location	Result (%/type asbestos)
Fire proofing applied to ceilings	PC-FP-01A	Room MR203, mechanical room, ceiling	None Detected
	PC-FP-01B	Room MR203, mechanical room, ceiling	None Detected
	PC-FP-01C	Room MR203, mechanical room, ceiling	None Detected
Black window pane caulking	PC-WPC-01A	Room PC127, librarian office, partition windows	None Detected
	PC-WPC-01B	Room PC140, library, partition windows	None Detected
	PC-WPC-01C	Room PC140, library, partition windows	None Detected
Red duct mastic on ducting	**PC-DM-01A**	**Room MR203, mechanical room, ducting**	**<0.25% Chrysotile**
	PC-DM-01B	**Room MR203, mechanical room, ducting**	**2% Chrysotile**
	PC-DM-01C	**Room MR203, mechanical room, ducting**	**Positive Stop (Not Analyzed)**
Grey pipe sealant on threads of hot water pipes	PC-PS-01A	Room MR203, mechanical room, threads of hot water pipes	None Detected
	PC-PS-01B	Room MR203, mechanical room, threads of hot water pipes	None Detected
	PC-PS-01C	Room MR203, mechanical room, threads of hot water pipes	None Detected
Blue pipe sealant on threads of sprinkler pipes	**PC-PS-02A**	**Room MR203, mechanical room, threads of sprinkler pipes**	**0.94% Chrysotile**
	PC-PS-02B	**Room MR203, mechanical room, threads of sprinkler pipes**	**Positive Stop (Not Analyzed)**
	PC-PS-02C	**Room MR203, mechanical room, threads of sprinkler pipes**	**Positive Stop (Not Analyzed)**
Black mechanical gasket on sprinkler pipe flanges	PC-MG-01	Room MR203, mechanical room, sprinkler pipe flanges	None Detected
Green mechanical gasket on sprinkler pipe flanges	PC-MG-02	Room MR203, mechanical room, sprinkler pipe flanges	None Detected
12”x12” cream floor tile with brown smears	**PC-FT-01**	**Room PC141, common room**	**1.5% Chrysotile**
12”x12” off-white floor tile with blue and pink streaks	PC-FT-02	Room PC123, inmate waiting	None Detected
12”x12” cream floor tile with brown smears	PC-FT-03	Room PC117, barber shop	None Detected
Off-white sheet flooring with grey and cream smudges	PC-SF-01	Room PC137, inmate contraband room	None Detected
NOTE: Bold, highlighted text indicates confirmed ACM			

Based on our observations of building construction (estimated vintage of interior finishes and uniformity of building material use) and on our interpretations of suspected ACM sample analytical results, the materials presented in Table 5.21-2, below is identified as ACMs.

Table 5.21-2 Summary of Identified ACMs
Building PC—Programs Corridor

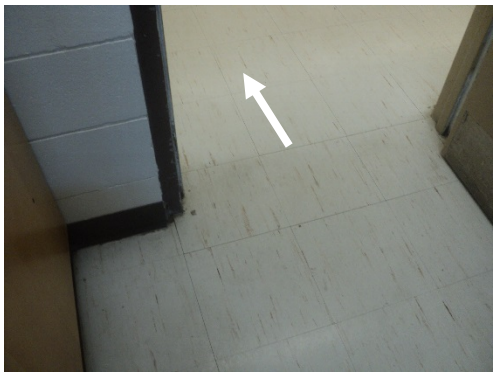
Identified ACM Description and Condition Information		Photo
Red HVAC duct mastic on ducting throughout.		
Friability	Non-friable	
Condition	Good	
Total Quantity	Ducting throughout	
Content	<0.25–2% Chrysotile	
Blue pipe sealant on threads of sprinkler lines throughout.		No photo.
Friability	Non-friable	
Condition	Good	
Total Quantity	Sprinkler lines throughout	
Content	0.94% Chrysotile	
12”x12” cream floor tile with brown smears in rooms PC141 common room, PC130 chapel, PC131 chaplain office (under laminate), PC138 day keepers office (under laminate) and PC113 office storage (under laminate).		
Friability	Non-friable	
Condition	Good	
Total Quantity	Approximately 185 square metres	
Content	1.5% Chrysotile (previous assessment) 0.5% Chrysotile (PGL, ACM Survey Report 2004)	

**Table 5.21-2 Summary of Identified ACMs
Building PC—Programs Corridor**

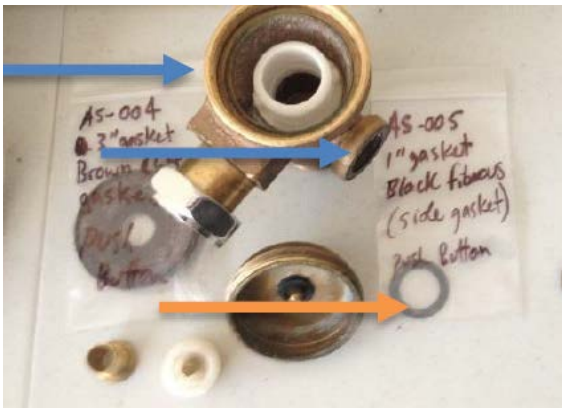
<table>
<tr><th colspan="2">Identified ACM Description and Condition Information</th><th>Photo</th></tr>
<tr><td colspan="2">Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures. See Section 5.21.1.1</td><td rowspan="5"> 

Photo from DST Gasket Report, 2013</td></tr>
<tr><td>Friability</td><td>Friable</td></tr>
<tr><td>Condition</td><td>Good—presumed concealed within pipe flanges</td></tr>
<tr><td>Total Quantity</td><td>Unknown</td></tr>
<tr><td>Content</td><td>85–90% chrysotile (Wes-Har Analytical Results for RJ dated August 17, 2009)</td></tr>
<tr><td colspan="2">Although unlikely based on assessment conducted to date, ACM vermiculite insulation may be present in masonry block walls in sporadic locations that have not previously been destructively assessed.
See Section 5.21.1.2</td><td rowspan="5">No Photo.</td></tr>
<tr><td>Friability</td><td>Friable</td></tr>
<tr><td>Condition</td><td>Good—concealed within wall cavity, if present</td></tr>
<tr><td>Total Quantity</td><td>Unknown</td></tr>
<tr><td>Content</td><td>0.02% asbestiform amphibole (previous analytical records provided by PSPC)</td></tr>
</table>

5.21.1.1 Fibrous Gasket Material

As indicated by the Wes-Har Analytical Results for RJ dated Aug 17th, 2009, grey or black fibrous gasket material inside plumbing fixtures within Building A&B—Living Unit A&B was sampled and found to contain 85–90% chrysotile asbestos. As Building A&B—Living Unit A&B is part of the overall complex of buildings where the subject building resides, it is likely that similar gaskets are present in plumbing flanges and fixtures in other locations within the complex, including the subject building. As such, grey or black fibrous gaskets in plumbing fixtures or flanges throughout the subject building should be considered ACM unless gasket-specific sampling and laboratory analysis proves otherwise.

5.21.1.2 Potential Asbestos-Containing Vermiculite Insulation

As part of the assessment, Stantec assessed the subject building for areas where vermiculite insulation, a potential ACM, would likely be present. This included making note of attic spaces, floor cavities and masonry block or brick walls, which are typical areas where vermiculite is found. The following observations we made regarding areas where vermiculite is potentially present:

- Walls of the subject building are comprised of masonry blocks. To assess for the presence of vermiculite insulation the block wall cavities were drilled in one location. No vermiculite was observed in the location where drilling was conducted.
- According to analytical reports and reported information provided by PSPC subsequent to the completion of our site work, ACM vermiculite insulation has been found in one masonry block wall cavity within Building N—Administration, which is part of the overall complex of "buildings" where the subject building resides. Although unlikely based on the findings of our assessment and the destructive assessment (drilling) completed, it is possible that additional ACM vermiculite is present in sporadic locations within this building.

5.21-2. LEAD

Lead is expected to be present in the following within the subject building:

- Lead-acid batteries used in emergency lighting
- Older electrical wiring materials and sheathing
- Solder used on domestic water lines
- Solder used in bell fittings for cast iron pipes and in electrical equipment
- Ceramic tile glaze
- Vent and pipe flashings

With respect to paint, LCPs were not identified through the Previous Reports. As such, chip samples were obtained from the predominant suspected LCP applications within the subject building. A summary of the sample types, locations and analytical results is presented in Table 5.21-3, below. A copy of the certificate of analysis provided by EMSL for the suspected LCP samples submitted is attached to this Appendix.

Table 5.21-3 Suspected LCP Sample Collection and Analysis Summary Building PC—Programs Corridor

Sample No.	Sample Colour/Substrate	Sample Location	Lab Result (ppm)
PC-P-01	Cream—metal	Room PC140, library, trim and doors	<83
PC-P-02	Off-white—drywall and concrete	Room PC140, library, walls	<83
PC-P-03	Purple—metal	Room PC122, deliberation room, trim	<93
PC-P-04	Light blue—metal	Room PC126, storage/media, trim and doors	<83

Table 5.21-3 Suspected LCP Sample Collection and Analysis Summary Building PC—Programs Corridor

Sample No.	Sample Colour/Substrate	Sample Location	Lab Result (ppm)
PC-P-05	Light blue—drywall	Room PC125, NPB room, walls	<82
PC-P-06	Cream—concrete	Room COR102, corridor, walls	<81
PC-P-07	White—concrete	Room MR203, mechanical room, walls	<80
PC-P-08	**Brown—metal**	**Room MR203, mechanical room, trim and doors**	**2,300**

NOTE:
Bold, highlighted text indicates confirmed LCP

Based on our observations and on our interpretations of suspected LCP sample analytical results along with information provided in the previous reports, the paint presented in Table 5.21-4, below was identified as an LCP:

Table 5.21-4 Summary of Identified LCPs Building PC—Programs Corridor

Identified LCP Description		Photo
Paint colour	Brown	
Substrate	Metal	
Location/approx. extent	Trim and doors	
Lead content	2,300 ppm	
Condition	Good	

5.21-3. POLYCHLORINATED BIPHENYLS

PCBs may be present in the fluorescent light ballasts of the approximately 100 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons.

5.21-4. MERCURY

Mercury vapour is present in the light tubes within the approximately 100 fluorescent light fixtures observed.

5.21-5. MOULD

The observations pertaining to mould and/or moisture that were made during this assessment are summarized in Table 5.21-5, below.

Table 5.21-5 Mould/Moisture Observations Summary—July 25, 2018
Building PC—Programs Corridor

Building Area	Observation	Suspected Source of Moisture	Photo
Rooms PC122 (deliberation room) and PC112 (office)	Moisture stained ceiling tiles	Pipe leaks, condensation tray overflow	

5.21-6. OZONE-DEPLETING SUBSTANCES

Building related cooling, refrigeration or fire suppression equipment suspected to be ODS-containing was not observed within the interior of the subject building.

5.21-7. SILICA

Silica is expected to be present in the following, which were observed in various locations throughout:

- Cement products such as:
  - Concrete—foundations, floors, walls, blocks
  - Brick/masonry units and associated grout and mortar
  - Stone/ceramic floor tiles and associated grouts and mortars
- Gypsum and associated wall/ceiling finish materials
- Suspended ceiling tiles
- Asphalt and asphalt products containing rock or stone (e.g., roof membrane)

6.21 RECOMMENDATIONS

In general, identified hazardous building materials were observed to be in good condition and do not appear to require specific action to maintain compliance with applicable regulations for continued operations and maintenance. Refer to Section 6.0 of the main body of this report for applicable material-by-material general recommendations.

Additional building-specific recommendations to be considered are provided below.

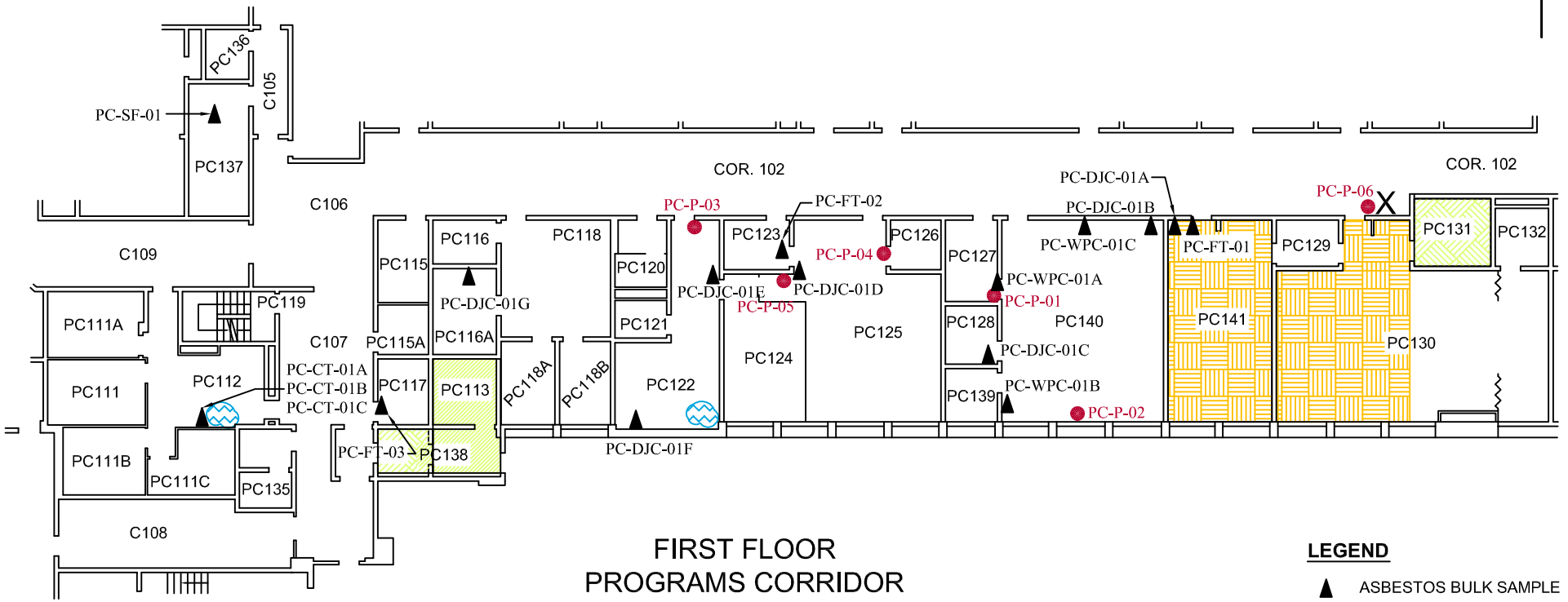
6.21-5. MOULD

Documents published by Health Canada, Ontario Ministry of Health, American Industrial Hygiene Association (AIHA), American Conference of Governmental Industrial Hygienists (ACGIH) and others, provide guidance for interpreting the results of mold investigations. The Health Canada Guide states that:

> "…current knowledge supports the need to prevent damp conditions and mold growth and to remediate any fungal contamination in buildings."

To this end, Stantec recommends the following course of action within the subject building:

- Remove and dispose of moisture impacted ceiling tiles with new tiles. If staining re-appears on the new tiles, the source of moisture should be identified and corrected.
  - This work can be conducted by regular facility maintenance staff, if conducted prior to the onset of mould growth



FIRST FLOOR
PROGRAMS CORRIDOR
BUILDING PC

LEGEND

- ASBESTOS BULK SAMPLE
- LEAD PAINT SAMPLE
- MOISTURE STAINED CEILING TILE
- X — INTRUSIVE INVESTIGATION FOR VERMICULITE
- ASBESTOS-CONTAINING FLOOR TILE
- CONCEALED ASBESTOS-CONTAINING FLOOR TILE

NOTES:

1. **RED HVAC DUCT MASTIC THROUGHOUT IS ASBESTOS-CONTAINING.**
2. **BLUE PIPE SEALANT ON SPRINKLER LINES THROUGHOUT IS ASBESTOS-CONTAINING.**
3. **GREY OR BLACK MECHANICAL GASKETS PRESUMED TO REMAIN IN VARIOUS FLANGES AND FIXTURES ARE ASBESTOS-CONTAINING.**
4. **ACM VERMICULITE INSULATION MAY BE PRESENT IN MASONRY BLOCK WALLS IN SPORADIC LOCATIONS.**

3. THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

KENT INSTITUTION

4732 CEMETERY ROAD, AGASSIZ, BC

Client: PUBLIC SERVICES AND PROCUREMENT CANADA

Project No.:	123221164
Scale:	N.T.S.
Date:	19/01/28
Dwn. By:	CD VM SL2019010492
App'd By:	TW

Dwg. No.: 21.1

Stantec

Unit PC		
Programs Corridor - First Floor		
Rm#	Name	Area m2
PC111	Office	13.31
PC111A	Office	13.29
PC111B	Office	12.82
PC111C	Office	10.37
PC112	Office	26.12
PC113	Office Storage	9.31
PC115	Native Liaison Officer	9.32
PC115A	Interview Office	5.70
PC116	File Room	6.57
PC116A	Office	11.84
PC117	Barber Shop	7.59
PC118	Psychology Reception	26.99
PC118A	Psychologist Office	10.88
PC118B	Psychologist Office	10.76
PC119	Stairwell	10.33
PC120	Inmate Washroom	8.46
PC121	Public Washroom	5.15
PC122	Deliberation Room	33.44
PC123	Inmate Waiting	7.58
PC124	Non Inmate Viewing	23.66
PC125	NPB Room	57.17
PC126	Storage / Media	6.06
PC127	Librarian Office	9.65
PC128	Law Library	6.66
PC129	Chaplain Office	7.60
PC130	Chapel	94.33
PC131	Chaplain Office	10.92
PC132	Storage (Chapel)	7.54
PC135	Inmate Telephone Room	9.05
PC136	Washroom	7.03
PC137	Inmate Contraband Room	17.46
PC138	Day Keeper's Office	14.27
PC139	Library Storage	7.31
PC140	Library	70.87
PC141	Common Room	47.24
C102	Corridor 102	169.10
C105	Corridor 105	8.29
C106	Corridor 106	48.74
C107	Corridor 107	50.18
C108	Corridor 108	32.00
C109	Corridor 109	28.19

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

KENT INSTITUTION

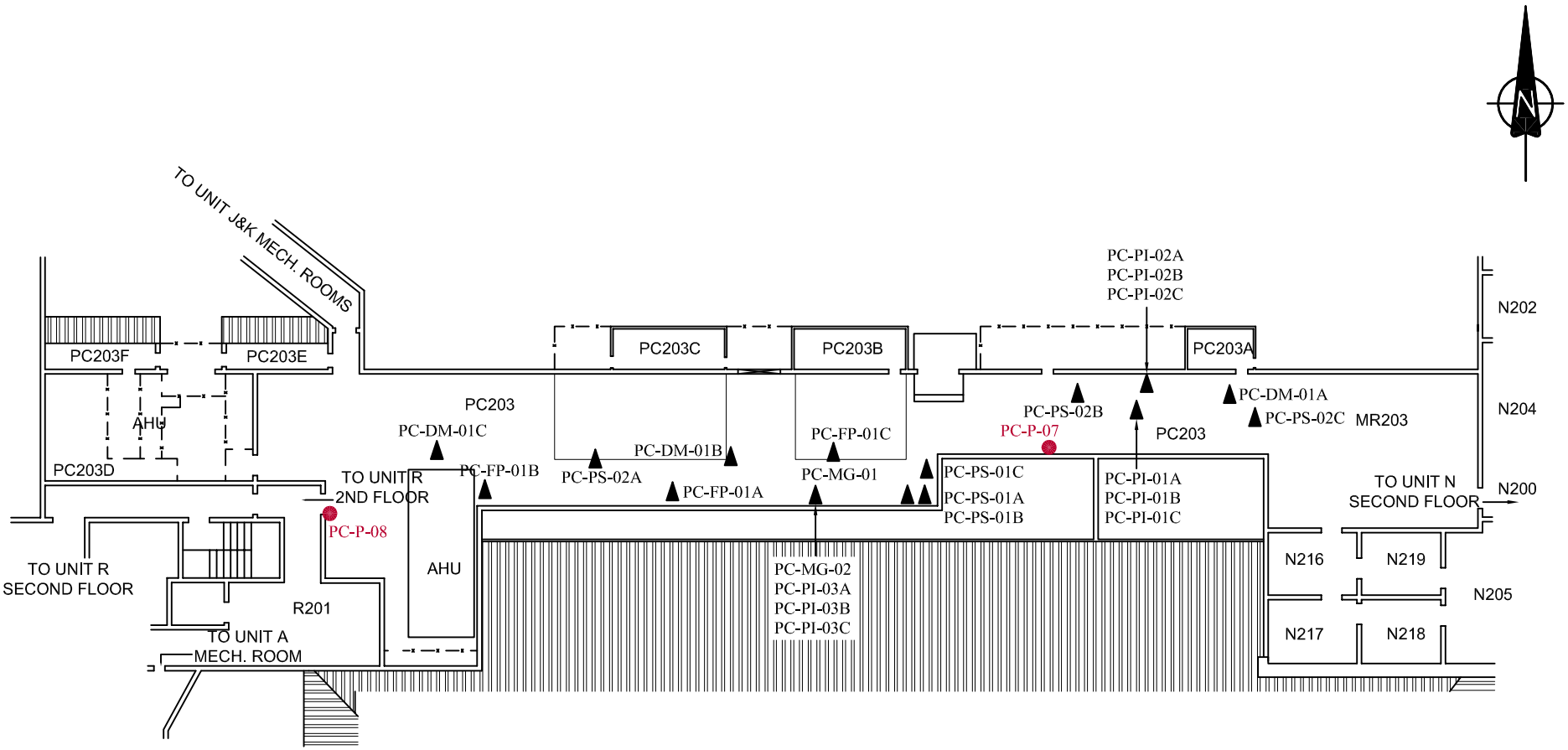
4732 CEMETERY ROAD, AGASSIZ, BC

Client: PUBLIC SERVICES AND PROCUREMENT CANADA

Project No.:	123221164
Scale:	N.T.S.
Date:	19/01/28
Dwn. By:	CD VM SL2019010493
App'd By:	TW

Dwg. No.: 21.2

Stantec



SECOND FLOOR
PROGRAMS CORRIDOR
BUILDING PC

LEGEND

- ▲ ASBESTOS BULK SAMPLE
- ● LEAD PAINT SAMPLE

NOTES:
1. **RED HVAC DUCT MASTIC THROUGHOUT IS ASBESTOS-CONTAINING.**
2. **BLUE PIPE SEALANT ON SPRINKLER LINES THROUGHOUT IS ASBESTOS-CONTAINING.**
3. **GREY OR BLACK MECHANICAL GASKETS PRESUMED TO REMAIN IN VARIOUS FLANGES AND FIXTURES ARE ASBESTOS-CONTAINING.**
4. **ACM VERMICULITE INSULATION MAY BE PRESENT IN MASONRY BLOCK WALLS IN SPORADIC LOCATIONS.**

3. THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

KENT INSTITUTION
4732 CEMETERY ROAD, AGASSIZ, BC

Client: PUBLIC SERVICES AND PROCUREMENT CANADA

Project No.:	123221164
Scale:	N.T.S.
Date:	19/01/28
Dwn. By:	CD VM SL2019010494
App'd By:	TW

Dwg. No.: 21.3

Stantec

Unit PC		
Programs Corridor Mechanical Room - Second Floor		
Rm#	Name	Area m2
MG203	Mechanical Room	354.09

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

KENT INSTITUTION

4732 CEMETERY ROAD, AGASSIZ, BC

Client: PUBLIC SERVICES AND PROCUREMENT CANADA

Project No.:	123221164
Scale:	N.T.S.
Date:	19/01/28
Dwn. By:	CD VM SL2019010495
App'd By:	TW

Dwg. No.: 21.4

Stantec

EMSL Canada Inc.

4506 Dawson Street Burnaby, BC V5C 4C1
Phone/Fax: (604) 757-3158 / (604) 757-4731
http://www.EMSL.com / vancouverlab@EMSL.com

EMSL Canada Order 691802019
Customer ID: 55JACQ30L
Customer PO: 123221164
Project ID:

Attn: Kim Wiese
Stantec Consulting Ltd.
500 - 4730 Kingsway
Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Collected:
Received: 7/27/2018
Analyzed: 8/03/2018

Proj: 123221164 / PC - KENT INSTITUTION

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: PC-DJC-01A **Lab Sample ID:** 691802019-0001
Sample Description: ROOM PC141, COMMON ROOM, WALL/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	White	0%	100%	None Detected	

Client Sample ID: PC-DJC-01B **Lab Sample ID:** 691802019-0002
Sample Description: ROOM PC140, LIBRARY, WALL/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	White	0%	100%	None Detected	

Client Sample ID: PC-DJC-01C **Lab Sample ID:** 691802019-0003
Sample Description: ROOM PC128, LAW LIBRARY, WALL/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	White	0%	100%	None Detected	

Client Sample ID: PC-DJC-01D **Lab Sample ID:** 691802019-0004
Sample Description: ROOM PC125, NPB ROOM, WALL/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	White	0%	100%	None Detected	

Client Sample ID: PC-DJC-01E **Lab Sample ID:** 691802019-0005
Sample Description: ROOM PC122, DELIBERATION ROOM, WALL/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	White	0%	100%	None Detected	

Client Sample ID: PC-DJC-01F **Lab Sample ID:** 691802019-0006
Sample Description: ROOM PC122, DELIBERATION ROOM, WALL/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	White	0%	100%	None Detected	

Client Sample ID: PC-DJC-01G **Lab Sample ID:** 691802019-0007
Sample Description: ROOM PC116A, OFFICE, PILLAR/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	White	0%	100%	None Detected	

EMSL Canada Inc.

4506 Dawson Street Burnaby, BC V5C 4C1
Phone/Fax: (604) 757-3158 / (604) 757-4731
http://www.EMSL.com / vancouverlab@EMSL.com

EMSL Canada Order 691802019
Customer ID: 55JACQ30L
Customer PO: 123221164
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: PC-CT-01A ***Lab Sample ID:*** **691802019-0008**

Sample Description: ROOM PC112, OFFICE/2'X4' PINHOLE AND FISSURE CEILING TILE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	80%	20%	None Detected	

Client Sample ID: PC-CT-01B ***Lab Sample ID:*** **691802019-0009**

Sample Description: ROOM PC112, OFFICE/2'X4' PINHOLE AND FISSURE CEILING TILE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	80%	20%	None Detected	

Client Sample ID: PC-CT-01C ***Lab Sample ID:*** **691802019-0010**

Sample Description: ROOM PC112, OFFICE/2'X4' PINHOLE AND FISSURE CEILING TILE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	80%	20%	None Detected	

Client Sample ID: PC-PI-01A ***Lab Sample ID:*** **691802019-0011**

Sample Description: ROOM MR203, MECHANICAL ROOM, DOMESTIC WATER ELBOWS/PIPE INSULATION

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	15%	85%	None Detected	

Client Sample ID: PC-PI-01B ***Lab Sample ID:*** **691802019-0012**

Sample Description: ROOM MR203, MECHANICAL ROOM, DOMESTIC WATER ELBOWS/PIPE INSULATION

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	15%	85%	None Detected	

Client Sample ID: PC-PI-01C ***Lab Sample ID:*** **691802019-0013**

Sample Description: ROOM MR203, MECHANICAL ROOM, DOMESTIC WATER ELBOWS/PIPE INSULATION

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	35%	65%	None Detected	

Client Sample ID: PC-PI-02A ***Lab Sample ID:*** **691802019-0014**

Sample Description: ROOM MR203, MECHANICAL ROOM, COLD WATER ELBOWS/PIPE INSULATION

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	20%	80%	None Detected	

Client Sample ID: PC-PI-02B ***Lab Sample ID:*** **691802019-0015**

Sample Description: ROOM MR203, MECHANICAL ROOM, COLD WATER ELBOWS/PIPE INSULATION

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	25%	75%	None Detected	

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EMSL Canada Order 691802019
Customer ID: 55JACQ30L
Customer PO: 123221164
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: PC-PI-02C ***Lab Sample ID:*** **691802019-0016**

Sample Description: ROOM MR203, MECHANICAL ROOM, COLD WATER ELBOWS/PIPE INSULATION

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	30%	70%	None Detected	

Client Sample ID: PC-PI-03A ***Lab Sample ID:*** **691802019-0017**

Sample Description: ROOM MR203, MECHANICAL ROOM, HOT WATER ELBOWS/PIPE INSULATION

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	40%	60%	None Detected	

Client Sample ID: PC-PI-03B ***Lab Sample ID:*** **691802019-0018**

Sample Description: ROOM MR203, MECHANICAL ROOM, HOT WATER ELBOWS/PIPE INSULATION

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	15%	85%	None Detected	

Client Sample ID: PC-PI-03C ***Lab Sample ID:*** **691802019-0019**

Sample Description: ROOM MR203, MECHANICAL ROOM, HOT WATER ELBOWS/PIPE INSULATION

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	35%	65%	None Detected	

Client Sample ID: PC-FP-01A ***Lab Sample ID:*** **691802019-0020**

Sample Description: ROOM MR203, MECHANICAL ROOM, CEILING/FIRE PROOFING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	70%	30%	None Detected	

Client Sample ID: PC-FP-01B ***Lab Sample ID:*** **691802019-0021**

Sample Description: ROOM MR203, MECHANICAL ROOM, CEILING/FIRE PROOFING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	70%	30%	None Detected	

Client Sample ID: PC-FP-01C ***Lab Sample ID:*** **691802019-0022**

Sample Description: ROOM MR203, MECHANICAL ROOM, CEILING/FIRE PROOFING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Gray	60%	40%	None Detected	

Client Sample ID: PC-WPC-01A ***Lab Sample ID:*** **691802019-0023**

Sample Description: ROOM PC127, LIBRARIAN OFFICE, PARTITION WINDOWS/BLACK WINDOW PANE CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Black	0.0%	100%	None Detected	

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Customer ID: 55JACQ30L
Customer PO: 123221164
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: PC-WPC-01B ***Lab Sample ID:*** **691802019-0024**

Sample Description: ROOM PC140, LIBRARY, PARTITION WINDOWS/BLACK WINDOW PANE CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Black	0.0%	100%	None Detected	

Client Sample ID: PC-WPC-01C ***Lab Sample ID:*** **691802019-0025**

Sample Description: ROOM PC140, LIBRARY, PARTITION WINDOWS/BLACK WINDOW PANE CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Black	0.0%	100%	None Detected	

Client Sample ID: PC-DM-01A ***Lab Sample ID:*** **691802019-0026**

Sample Description: ROOM MR203, MECHANICAL ROOM, DUCTING/RED DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Red	0.0%	100%	**<0.25% Chrysotile**	

Client Sample ID: PC-DM-01B ***Lab Sample ID:*** **691802019-0027**

Sample Description: ROOM MR203, MECHANICAL ROOM, DUCTING/RED DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Brown	0%	98%	**2% Chrysotile**	

Client Sample ID: PC-DM-01C ***Lab Sample ID:*** **691802019-0028**

Sample Description: ROOM MR203, MECHANICAL ROOM, DUCTING/RED DUCT MASTIC

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018				Positive Stop (Not Analyzed)	

Client Sample ID: PC-PS-01A ***Lab Sample ID:*** **691802019-0029**

Sample Description: ROOM MR203, MECHANICAL ROOM, THREADS OF HOT WATER PIPES/GREY PIPE SEALANT

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Gray	1.3%	98.7%	None Detected	

Client Sample ID: PC-PS-01B ***Lab Sample ID:*** **691802019-0030**

Sample Description: ROOM MR203, MECHANICAL ROOM, THREADS OF HOT WATER PIPES/GREY PIPE SEALANT

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/03/2018	Brown	0%	100%	None Detected	

Client Sample ID: PC-PS-01C ***Lab Sample ID:*** **691802019-0031**

Sample Description: ROOM MR203, MECHANICAL ROOM, THREADS OF HOT WATER PIPES/GREY PIPE SEALANT

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Gray	0.72%	99.3%	None Detected	

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Customer ID: 55JACQ30L
Customer PO: 123221164
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: PC-PS-02A ***Lab Sample ID:*** **691802019-0032**

Sample Description: ROOM MR203, MECHANICAL ROOM, THREADS OF SPRINKLER PIPES/BLUE PIPE SEALANT

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Blue	0.0%	99.1%	**0.94% Chrysotile**	

Client Sample ID: PC-PS-02B ***Lab Sample ID:*** **691802019-0033**

Sample Description: ROOM MR203, MECHANICAL ROOM, THREADS OF SPRINKLER PIPES/BLUE PIPE SEALANT

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018			Positive Stop (Not Analyzed)		

Client Sample ID: PC-PS-02C ***Lab Sample ID:*** **691802019-0034**

Sample Description: ROOM MR203, MECHANICAL ROOM, THREADS OF SPRINKLER PIPES/BLUE PIPE SEALANT

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018			Positive Stop (Not Analyzed)		

Client Sample ID: PC-MG-01 ***Lab Sample ID:*** **691802019-0035**

Sample Description: ROOM MR203, MECHANICAL ROOM, SPRINKLER PIPE FLANGES/BLACK MECHANICAL GASKET

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Black	0.0%	100%	None Detected	

Client Sample ID: PC-MG-02 ***Lab Sample ID:*** **691802019-0036**

Sample Description: ROOM MR203, MECHANICAL ROOM, SPRINKLER PIPE FLANGES/GREEN MECHANICAL GASKET

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Green	0.0%	100%	None Detected	

Client Sample ID: PC-FT-01 ***Lab Sample ID:*** **691802019-0037**

Sample Description: ROOM PC141, COMMON ROOM/12"X12" CREAM FLOOR TILE WITH BROWN SMEARS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Gray	0.0%	98.5%	**1.5% Chrysotile**	

Client Sample ID: PC-FT-02 ***Lab Sample ID:*** **691802019-0038**

Sample Description: ROOM PC123, INMATE WAITING/12"X12" OFF-WHITE FLOOR TILE WITH BLUE AND PINK STREAKS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	White	0.0%	100%	None Detected	

Client Sample ID: PC-FT-03 ***Lab Sample ID:*** **691802019-0039**

Sample Description: ROOM PC117, BARBER SHOP/12"X12" CREAM FLOOR TILE WITH BROWN SMEARS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Gray	0.0%	100%	None Detected	

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Customer ID: 55JACQ30L
Customer PO: 123221164
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: PC-SF-01 ***Lab Sample ID:*** **691802019-0040**

Sample Description: ROOM PC137, INMATE CONTRABAND ROOM/OFF-WHITE SHEET FLOORING WITH GREY AND CREAM SMUDGES

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/03/2018	Gray	0.0%	100%	None Detected	

Analyst(s):

Kathleen Cruz	PLM (8) PLM Grav. Reduction (2)
Nicole Yeo	PLM (16) PLM Grav. Reduction (11)

Reviewed and approved by:

Nicole Yeo, Laboratory Manager
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Burnaby, BC

Initial report from: 08/03/201816:42:15

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CustomerID:	55JACQ30L
CustomerPO:	123221164
ProjectID:	

Attn: **Kim Wiese**
Stantec Consulting Ltd.
500 - 4730 Kingsway
Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Received: 07/30/18 11:47 AM
Collected:

Project: **123221164**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client SampleDescription	*Collected*	*Analyzed*	*Weight*	*RDL*	*Lead Concentration*
PC-P-01		8/1/2018	0.2400 g	83 ppm	<83 ppm
551808879-0062	Site: PC - Kent Institution / Room PC140, Library, Trim and Doors Desc: Cream - Metal				
PC-P-02		8/1/2018	0.2404 g	83 ppm	<83 ppm
551808879-0063	Site: PC - Kent Institution / Room PC140, Library, Walls Desc: Off-White - Drywall and Concrete				
PC-P-03		8/1/2018	0.2155 g	93 ppm	<93 ppm
551808879-0064	Site: PC - Kent Institution / Room PC122, Deliberation Room, Trim Desc: Purple - Metal Insufficient sample to reach reporting limit.				
PC-P-04		8/1/2018	0.2415 g	83 ppm	<83 ppm
551808879-0065	Site: PC - Kent Institution / Room PC126, Storage/Media, Trim and Doors Desc: Light Blue - Metal				
PC-P-05		8/1/2018	0.2446 g	82 ppm	<82 ppm
551808879-0066	Site: PC - Kent Institution / Room PC125, NPB Room, Walls Desc: Light Blue - Drywall				
PC-P-06		8/1/2018	0.24666 g	81 ppm	<81 ppm
551808879-0067	Site: PC - Kent Institution / Room COR102, Corridor, Walls Desc: Cream - Concrete				
PC-P-07		8/1/2018	0.2500 g	80 ppm	<80 ppm
551808879-0068	Site: PC - Kent Institution / Room MR203, Mechanical Room, Walls Desc: White - Concrete				
PC-P-08		8/1/2018	0.2413 g	83 ppm	2300 ppm
551808879-0069	Site: PC - Kent Institution / Room MR203, Mechanical Room, Trim and Doors Desc: Brown - Metal				

Rowena Fanto, Lead Supervisor
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Cert #2845.08; AIHA-LAP, LLC - ELLAP #196142

Report Amended: 02/25/2019 16:40:50 Replaces Report Amended: 01/04/2019 08:08:42. Reason Code: Client-Change to Location

APPENDIX 5.38

FINDINGS AND RECOMMENDATIONS—BUILDING TU—TUNNELS (836-08-RP)

Appendix 5.38 FINDINGS AND RECOMMENDATIONS—BUILDING TU—TUNNELS (836-08-RP)

Building TU—Tunnels (subject building) was reportedly constructed in 1979 and has been assigned Real Property ID #1829. It is part of the main complex of adjoined buildings within Kent Institution and may share mechanical/electrical systems with above units. The typical structural components and finishes associated with this building consist of concrete walls; concrete and drywall ceilings; and concrete flooring.

The results of the assessment for each of the considered hazardous materials within the subject building are provided in the following sub-sections.

Floor plan drawings, which include locations of the samples collected during this assessment and locations of identified hazardous building materials (where practical), are attached to this Appendix.

5.38-1. ASBESTOS

The Previous Reports indicated the presence of the following ACMs, with notes regarding condition or other changes noted during the current assessment:

- Asbestos cement ("Transite") board used as fire barrier where mechanical system penetrates wall (PGL, ACM Survey Report 2004)
  - Additional samples were collected by Stantec during the current assessment
- Drywall joint compound in TU2 office (DST DDC Upgrade Report 2013)
  - Designation as ACM was based on 0.25% chrysotile asbestos being detected in one of three samples, with no asbestos having been detected in the other two samples
  - Although not considered to be an ACM strictly according to the WorkSafe BC definition (ACM includes material with >0.5% asbestos), material such as drywall joint compound are often conservatively considered ACM with any detection of asbestos because the asbestos content of such finishing materials may be inconsistent (the application of drywall joint compound was often conducted by hand-mixing the components), and asbestos may be present in higher concentrations in areas not sampled
  - Additional samples were collected by Stantec during the current assessment, to supplement the information from the DST DDC Upgrade Report 2013, given the limited overall area of drywall in this building (less than 2,000 square feet), and it's apparent consistent application.
    - As no asbestos was detected in the five supplemental samples collected by Stantec (see Table 5.38-1, below), this material should not be considered ACM, and has not been considered ACM for this report.
- Brown/red HVAC duct mastic (DST DDC Upgrade Report 2013)
  - Additional samples were collected by Stantec during the current assessment

- Grey or black fibrous gasket material inside plumbing fixtures (Wes-Har Analytical Results for RJ dated August 17, 2009)
  - Not observed during the current assessment but presumed to remain in various flanges and fixtures

In addition to the above, Stantec identified and sampled various additional suspected ACMs and/or collected confirmatory samples of previously identified ACMs. The samples collected were submitted to EMSL for analysis of asbestos content and nature.

A summary of the materials sampled as part of the current assessment, along with the sample locations and analytical results is presented in Table 5.38-1, below. A copy of the certificate of analysis provided by EMSL for the suspected ACM samples submitted as part of this assessment is attached at the end of this Appendix.

Table 5.38-1 Suspected ACM Sample Collection and Analysis Summary Building TU—Tunnels

Material/Homogenous Application Description	Sample Number	Sample Location	Result (%/type asbestos)
Concrete hatch	TU-C-01	EF-Corridor, ceiling	None Detected
Cement panel	**TU-CP-01**	**EF-Corridor, electrical penetrations above doors**	**15% Chrysotile**
Red/brown duct mastic on ducting	**TU-DM-01A**	**South corridor, ducting**	**3% Chrysotile**
	TU-DM-01B	**South corridor, ducting**	**Positive Stop (Not Analyzed)**
	TU-DM-01C	**South corridor, ducting**	**Positive Stop (Not Analyzed)**
Drywall joint compound—applied to walls and ceilings	TU-DJC-01A	TU1 Administration storage, walls	None Detected
	TU-DJC-01B	TU2 Administration storage, walls	None Detected
	TU-DJC-01C	TU3 ERT storage, walls	None Detected
	TU-DJC-01D	EF Corridor, walls	None Detected
	TU-DJC-01E	EF Corridor, walls	None Detected
White pipe insulation on elbows of chilled water pipes	TU-FI-01A	GH Corridor, elbows of chilled water pipes	None Detected
	TU-FI-01B	GH Corridor, elbows of chilled water pipes	None Detected
	TU-FI-01C	GH Corridor, elbows of chilled water pipes	None Detected
White pipe insulation on elbows of domestic water pipes	TU-FI-02A	GH Corridor, elbows of domestic water pipes	None Detected
	TU-FI-02B	GH Corridor, elbows of domestic water pipes	None Detected
	TU-FI-02C	GH Corridor, elbows of domestic water pipes	None Detected
Grey pipe sealant applied to threads of sprinkler lines	TU-PS-01A	TU3 ERT storage, threads of sprinkler lines	None Detected
	TU-PS-01B	GH Corridor, threads of sprinkler lines	None Detected
	TU-PS-01C	EF Corridor, threads of sprinkler lines	None Detected

Table 5.38-1 Suspected ACM Sample Collection and Analysis Summary Building TU—Tunnels

Material/Homogenous Application Description	Sample Number	Sample Location	Result (%/type asbestos)
Blue pipe sealant applied to threads of hot water lines	TU-PS-02A	GH Corridor, threads of hot water lines	None Detected
	TU-PS-02B	GH Corridor, threads of hot water lines	None Detected
	TU-PS-02C	GH Corridor, threads of hot water lines	None Detected
Tan pipe sealant applied to threads of sprinkler lines	TU-PS-03A	GH Corridor, threads of sprinkler lines	None Detected
	TU-PS-03B	GH Corridor, threads of sprinkler lines	None Detected
	TU-PS-03C	GH Corridor, threads of sprinkler lines	None Detected
NOTE: Bold, highlighted text indicates confirmed ACM			

Based on our observations of building construction (estimated vintage of interior finishes and uniformity of building material use) and on our interpretations of suspected ACM sample analytical results, the materials presented in Table 5.38-2, below are identified as ACMs.

Table 5.38-2 Summary of Identified ACMs Building TU—Tunnels

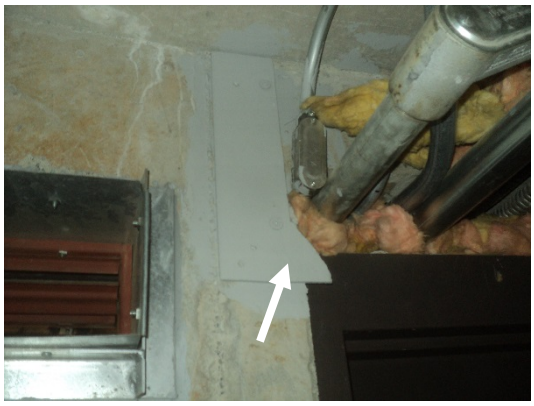
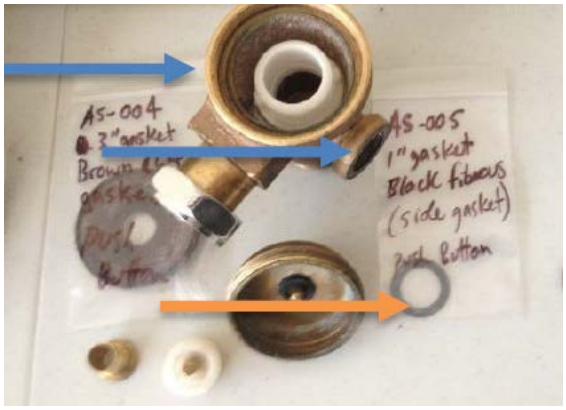
Identified ACM Description and Condition Information		Photo
Cement panels on electrical penetrations above doors.		
Friability	Non-friable	
Condition	Good	
Total Quantity	Approximately 10 m^2	
Content	15% Chrysotile	

**Table 5.38-2 Summary of Identified ACMs
Building TU—Tunnels**

<table>
<tr><th colspan="2">Identified ACM Description and Condition Information</th><th>Photo</th></tr>
<tr><td colspan="2">Red/brown duct mastic on ducting throughout.</td><td rowspan="5">  </td></tr>
<tr><td>Friability</td><td>Non-friable</td></tr>
<tr><td>Condition</td><td>Good</td></tr>
<tr><td>Total Quantity</td><td>Approximately 200 linear metres</td></tr>
<tr><td>Content</td><td>3% Chrysotile
8% Chrysotile
(DST DDC Upgrade Report 2013)</td></tr>
<tr><td colspan="2">Grey or black fibrous gasket material inside plumbing fixtures. Not observed during the current assessment but presumed to remain in various flanges and fixtures. See Section 5.38.1.1</td><td rowspan="5"> 
Photo from DST Gasket Report, 2013</td></tr>
<tr><td>Friability</td><td>Friable</td></tr>
<tr><td>Condition</td><td>Good—presumed concealed within pipe flanges</td></tr>
<tr><td>Total Quantity</td><td>Unknown</td></tr>
<tr><td>Content</td><td>85-90% chrysotile (Wes-Har Analytical Results for RJ dated Aug 17th, 2009)</td></tr>
</table>

5.38.1.1. Fibrous Gasket Material

As indicated by the Wes-Har Analytical Results for RJ dated August 17, 2009, grey or black fibrous gasket material inside plumbing fixtures within Building A&B—Living Unit A&B was sampled and found to contain 85–90% chrysotile asbestos. As Building A&B—Living Unit A&B is part of the overall complex of buildings where the subject building resides, it is likely that similar gaskets are present in plumbing flanges and fixtures in other locations within the complex, including the subject building. As such, grey or black fibrous gaskets in plumbing fixtures or flanges throughout the subject building should be considered ACM unless gasket-specific sampling and laboratory analysis proves otherwise.

5.38.1.2. Potential Asbestos-Containing Vermiculite Insulation

As part of the assessment, Stantec assessed the subject building for areas where vermiculite insulation, a potential ACM, would likely be present. This included making note of attic spaces, floor cavities and masonry block or brick walls, which are typical areas where vermiculite is found. No locations that may potentially contain vermiculite (that could not otherwise be assessed) were observed.

5.38-2. LEAD

Lead is expected to be present in the following within the subject building:

- Lead-acid batteries used in emergency lighting
- Older electrical wiring materials and sheathing
- Solder used on domestic water lines
- Solder used in bell fittings for cast iron pipes and in electrical equipment

With respect to paint, the following paint was considered LCP through the Previous Reports based on an LCP definition criterion of 600 ppm lead (or greater), with notes regarding condition or other changes noted during the current assessment.

- Orange on cast iron pipe flanges (DST DDC Upgrade Report 2013)
  - Paint remains and was observed to be in good condition
- Red paint on electrical conduits (DST DDC Upgrade Report 2013)
  - Paint remains and was observed to be in good condition

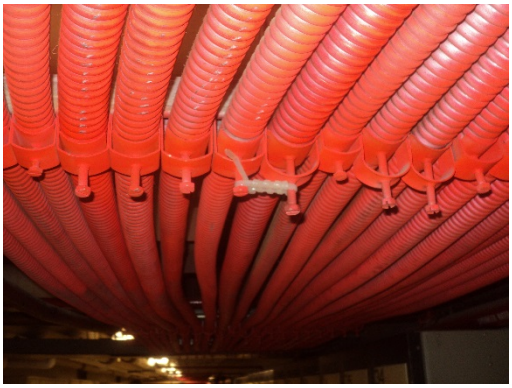
In addition to above, chip samples were obtained from the predominant suspected LCP applications within the subject building. A summary of the sample types, locations and analytical results is presented in Table 5.38-3, below. A copy of the certificate of analysis provided by EMSL for the suspected LCP samples submitted is attached to this Appendix.

Table 5.38-3 Suspected LCP Sample Collection and Analysis Summary Building TU—Tunnels

Sample No.	Sample Colour/Substrate	Sample Location	Lab Result (ppm)
TU-P-01	Yellow—Drywall/concrete	Room GH, Corridor	<82
TU-P-02	Light green—Concrete	TU7, Storage, floors	<80

Based on our observations and on our interpretations of suspected LCP sample analytical results along with information provided in the Previous Reports, the paints presented in Table 5.38-4, below were identified as LCPs.

**Table 5.38-4 Summary of Identified LCPs
Building TU—Tunnels**

Identified LCP Description		Photo
Paint colour	Orange	No photo
Substrate	Cast iron	
Location/approx. extent	Pipe flanges	
Lead content	1.0 mg/cm^2 (approximately 15,000 ppm[1], DST DDC Upgrade Report 2013)	
Condition	Good	
Paint colour	Red	
Substrate	Metal	
Location/approx. extent	Electrical conduits	
Lead content	1.0 mg/cm^2 (approximately 15,000 ppm[1], DST DDC Upgrade Report 2013)	
Condition	Good	

5.38-3. POLYCHLORINATED BIPHENYLS

PCBs may be present in the fluorescent light ballasts of the approximately 60 light fixtures observed. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons.

5.38-4. MERCURY

Mercury vapour is present in the light tubes within the approximately 60 fluorescent light fixtures observed.

5.38-5. MOULD

Suspect mould or moisture-impacted building materials were not observed at the time of the assessment.

[1] According to the 2011 publication "*Lead-Containing Paints and Coatings – Preventing Exposure in the Construction industry*, "Recent data collected in B.C. suggest that 0.04 mg/cm2 is equivalent to about 600 µg/g or 0.06% by weight; however, factors such as paint thickness may affect the results". This conversion factor has been utilized by Stantec to convert data from the referenced DST report into ppm for this report.

5.38-6. OZONE-DEPLETING SUBSTANCES

Building related cooling, refrigeration or fire suppression equipment suspected to be ODS-containing was not observed within the interior of the subject building.

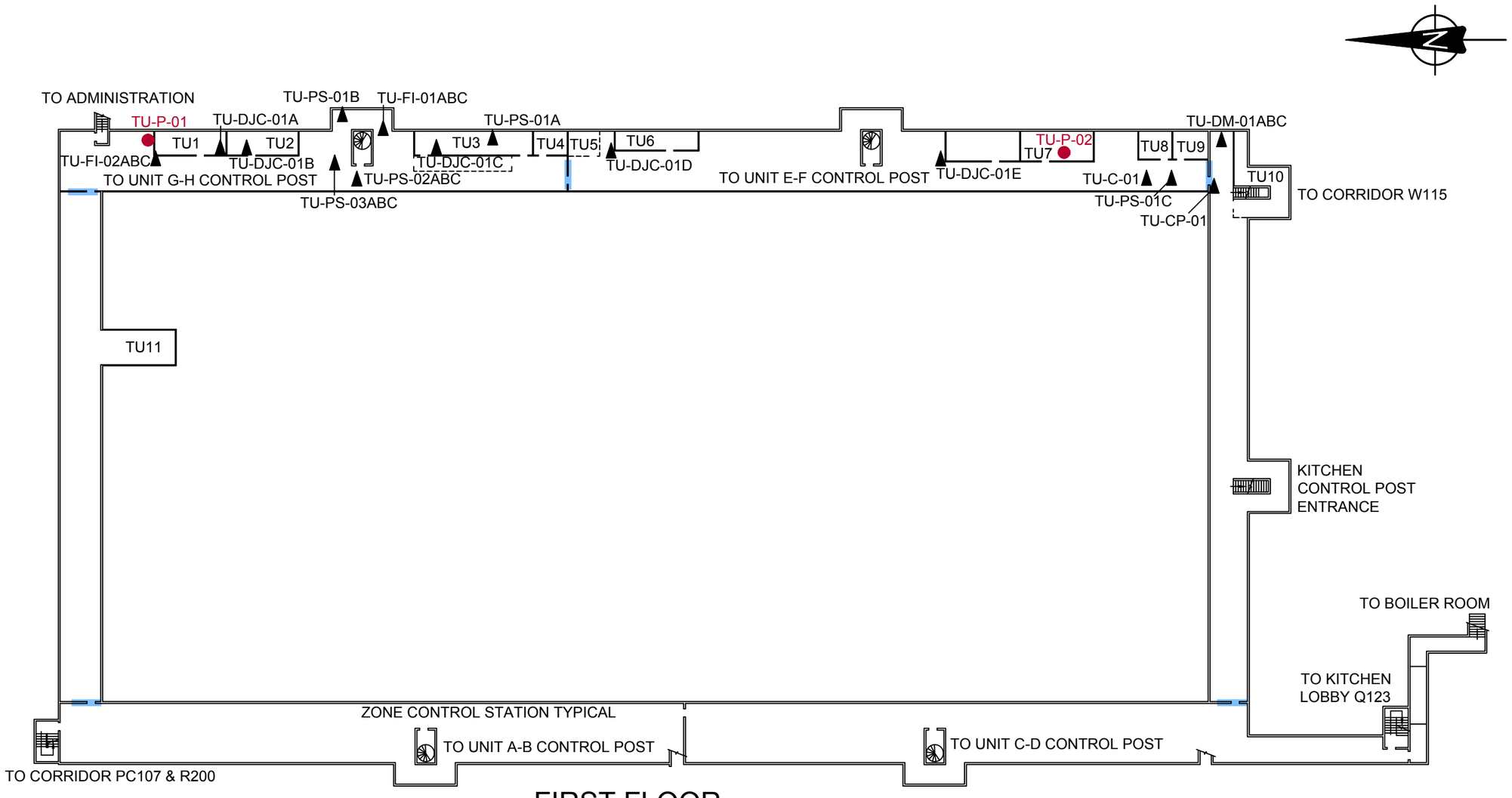
5.38-7. SILICA

Silica is expected to be present in the following, which were observed in various locations throughout:

- Cement products such as:
  - Concrete—foundations, floors, walls, blocks
  - Brick/masonry units and associated grout and mortar
- Gypsum and associated wall/ceiling finish materials

6.38 RECOMMENDATIONS

In general, identified hazardous building materials were observed to be in good condition and do not appear to require specific action to maintain compliance with applicable regulations for continued operations and maintenance. Refer to Section 6.0 of the main body of this report for applicable material-by-material general recommendations.



FIRST FLOOR TUNNELS BUILDING TU

LEGEND

- ASBESTOS BULK SAMPLE
- LEAD PAINT SAMPLE
- ASBESTOS-CONTAINING CEMENT PANEL

NOTES:
1. **RED HVAC DUCT MASTIC (PAINTED GREY IN AREAS) THROUGHOUT IS ASBESTOS-CONTAINING.**
2. **GREY OR BLACK MECHANICAL GASKETS PRESUMED TO REMAIN IN VARIOUS FLANGES AND FIXTURES ARE ASBESTOS-CONTAINING.**
3. THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

KENT INSTITUTION
4732 CEMETERY ROAD, AGASSIZ, BC

Client: PUBLIC SERVICES AND PROCUREMENT CANADA

Project No.:	123221164
Scale:	N.T.S.
Date:	18/09/19
Dwn. By:	CD DM SL2018090112
App'd By:	TW

Dwg. No.: 38.1

Stantec

TUNNELS - FIRST FLOOR	
Rm#	Name
TU1	Administration Storage
TU2	Administration Storage
TU3	ERT Storage
TU4	Storage
TU5	ERT ROOM
TU6	Storage
TU7	Storage
TU8	Storage
TU9	Storage
TU10	Maintenance Storage
TU11	Sewage Lift Station

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

KENT INSTITUTION

4732 CEMETERY ROAD, AGASSIZ, BC

Client: PUBLIC SERVICES AND PROCUREMENT CANADA

Project No.:	123221164
Scale:	N.T.S.
Date:	18/09/19
Dwn. By:	CD DM SL2018090113
App'd By:	TW

Dwg. No.: 38.2

Stantec

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EMSL Canada Order 691802075
Customer ID: 55JACQ30L
Customer PO: 123221164
Project ID:

Attn: Luke Sweet
Stantec Consulting Ltd.
500 - 4730 Kingsway
Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Collected:
Received: 8/01/2018
Analyzed: 8/15/2018

Proj: 123221164.200 / TUNNELS, KENT INSTITUTION

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: TU-C-01 ***Lab Sample ID:*** **691802075-0001**
Sample Description: ef-Corridor, Ceiling/Concrete Hatch

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/14/2018	Gray	0%	100%	None Detected	

Client Sample ID: TU-CP-01 ***Lab Sample ID:*** **691802075-0002**
Sample Description: EF-Corridor, Electrical Penetrations Above Doors/Cement Panel

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/14/2018	Gray	0%	85%	**15% Chrysotile**	

Client Sample ID: TU-DM-01A ***Lab Sample ID:*** **691802075-0003**
Sample Description: South Corridor, Ducting/Duct Mastic - Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/14/2018	Red	0%	97%	**3% Chrysotile**	

Client Sample ID: TU-DM-01B ***Lab Sample ID:*** **691802075-0004**
Sample Description: South Corridor, Ducting/Duct Mastic - Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/14/2018				Positive Stop (Not Analyzed)	

Client Sample ID: TU-DM-01C ***Lab Sample ID:*** **691802075-0005**
Sample Description: South Corridor, Ducting/Duct Mastic - Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/14/2018				Positive Stop (Not Analyzed)	

Client Sample ID: TU-DJC-01A ***Lab Sample ID:*** **691802075-0006**
Sample Description: TU1 Administration Storage, Walls/Drywall Joint Compound - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/14/2018	White	0%	100%	None Detected	

Client Sample ID: TU-DJC-01B ***Lab Sample ID:*** **691802075-0007**
Sample Description: TU2 Administration Storage, Walls/Drywall Joint Compound - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/14/2018	White	0%	100%	None Detected	

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Customer ID: 55JACQ30L
Customer PO: 123221164
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: TU-DJC-01C ***Lab Sample ID:*** **691802075-0008**

Sample Description: TU3 ERT Storage, Walls/Drywall Joint Compound - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2018	White	0%	100%	None Detected	

Client Sample ID: TU-DJC-01D ***Lab Sample ID:*** **691802075-0009**

Sample Description: EF Corridor, Walls/Drywall Joint Compound - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2018	White	0%	100%	None Detected	

Client Sample ID: TU-DJC-01E ***Lab Sample ID:*** **691802075-0010**

Sample Description: EF Corridor, Walls/Drywall Joint Compound - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2018	White	0%	100%	None Detected	

Client Sample ID: TU-FI-01A ***Lab Sample ID:*** **691802075-0011**

Sample Description: GH Corridor, Elbows Of Chilled Water Pipes/Pipe Insulation - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2018	Gray	35%	65%	None Detected	

Client Sample ID: TU-FI-01B ***Lab Sample ID:*** **691802075-0012**

Sample Description: GH Corridor, Elbows Of Chilled Water Pipes/Pipe Insulation - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2018	Gray	50%	50%	None Detected	

Client Sample ID: TU-FI-01C ***Lab Sample ID:*** **691802075-0013**

Sample Description: GH Corridor, Elbows Of Chilled Water Pipes/Pipe Insulation - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2018	Gray	35%	65%	None Detected	

Client Sample ID: TU-FI-02A ***Lab Sample ID:*** **691802075-0014**

Sample Description: GH Corridor, Elbows Of Domestic Water Pipes/Pipe Insulation - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2018	Gray	40%	60%	None Detected	

Client Sample ID: TU-FI-02B ***Lab Sample ID:*** **691802075-0015**

Sample Description: GH Corridor, Elbows Of Domestic Water Pipes/Pipe Insulation - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2018	Gray	50%	50%	None Detected	

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EMSL Canada Order 691802075
Customer ID: 55JACQ30L
Customer PO: 123221164
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: TU-FI-02C ***Lab Sample ID:*** **691802075-0016**

Sample Description: GH Corridor, Elbows Of Domestic Water Pipes/Pipe Insulation - White

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2018	Gray	40%	60%	None Detected	

Client Sample ID: TU-PS-01A ***Lab Sample ID:*** **691802075-0017**

Sample Description: TU3 ERT Stroage, Threads Of Sprinkler Lines/Pipe Sealant - Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/15/2018	Gray	1.7%	98.3%	None Detected	

Client Sample ID: TU-PS-01B ***Lab Sample ID:*** **691802075-0018**

Sample Description: GH Corridor, Threads Of Sprinkler Lines/Pipe Sealant - Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/15/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: TU-PS-01C ***Lab Sample ID:*** **691802075-0019**

Sample Description: EF Corridor, Threads Of Sprinkler Lines/Pipe Sealant - Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/15/2018	Gray	<0.25%	100%	None Detected	

Client Sample ID: TU-PS-02A ***Lab Sample ID:*** **691802075-0020**

Sample Description: GH Corridor, Threads Of Hot Water Lines/Pipe Sealant - Blue

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/15/2018	Blue	0.0%	100%	None Detected	

Client Sample ID: TU-PS-02B ***Lab Sample ID:*** **691802075-0021**

Sample Description: GH Corridor, Threads Of Hot Water Lines/Pipe Sealant - Blue

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/15/2018	Blue	0.0%	100%	None Detected	

Client Sample ID: TU-PS-02C ***Lab Sample ID:*** **691802075-0022**

Sample Description: GH Corridor, Threads Of Hot Water Lines/Pipe Sealant - Blue

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/15/2018	Blue	0.0%	100%	None Detected	

Client Sample ID: TU-PS-03A ***Lab Sample ID:*** **691802075-0023**

Sample Description: GH Corridor, Threads Of Sprinkler Lines/Pipe Sealant - Tan

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/15/2018	Gray	0.84%	99.2%	None Detected	

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Customer ID: 55JACQ30L
Customer PO: 123221164
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: TU-PS-03B ***Lab Sample ID:*** **691802075-0024**

Sample Description: GH Corridor, Threads Of Sprinkler Lines/Pipe Sealant - Tan

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/15/2018	Gray	1.3%	98.7%	None Detected	

Client Sample ID: TU-PS-03C ***Lab Sample ID:*** **691802075-0025**

Sample Description: GH Corridor, Threads Of Sprinkler Lines/Pipe Sealant - Tan

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/15/2018	Gray	4.1%	95.9%	None Detected	

Analyst(s):

Chloe Huang	PLM (10) PLM Grav. Reduction (6)
Kathleen Cruz	PLM (4) PLM Grav. Reduction (3)

Reviewed and approved by:

Nicole Yeo, Laboratory Manager
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Burnaby, BC

Initial report from: 08/15/201817:21:39

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EMSL Canada Or	551809098
CustomerID:	55JACQ30L
CustomerPO:	123221164.200
ProjectID:	

Attn: **Luke Sweet**
Stantec Consulting Ltd.
500 - 4730 Kingsway
Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Received: 08/03/18 11:13 AM
Collected: 7/16/2018

Project: **123221164.200**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client SampleDescription	*Collected*	*Analyzed*	*Weight*	*RDL*	*Lead Concentration*
TU-P-01	7/16/2018	8/9/2018	0.2442 g	82 ppm	<82 ppm
551809098-0001	Site: Tunnels - Kent Institution / Room GH, Corridor Desc: Yellow - Drywall/Concrete				
TU-P-02	7/16/2018	8/9/2018	0.2488 g	80 ppm	<80 ppm
551809098-0002	Site: Tunnels - Kent Institution / TU7, Storage, Floors Desc: Light Green - Concrete				

Rowena Fanto, Lead Supervisor
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 08/10/2018 09:09:24

APPENDIX 5.43

FINDINGS AND RECOMMENDATIONS—MAIN BUILDING—ROOF (836-08-RP)

Appendix 5.43 FINDINGS AND RECOMMENDATIONS—MAIN BUILDING—ROOF (836-08-RP)

Main Building—Roof (subject area) was reportedly constructed in 1979. The typical structural components and finishes associated with the roof consist of an asphalt roof with metal flashings.

The results of the assessment for each of the considered hazardous materials within the subject area are provided in the following sub-sections.

Floor plan drawings, which include locations of the samples collected during this assessment and locations of identified hazardous building materials (where practical), are attached to this Appendix.

5.43-1. ASBESTOS

The previous report indicated the presence of the following ACMs, with notes regarding condition or other changes noted during the current assessment:

- Grey mastic on exterior roof around louvers (SNC Living Unit Mechanical Room Reports 2017)
  - Observed to still be present and in good condition

In addition to the above, Stantec identified and sampled various additional suspected ACMs and/or collected confirmatory samples of previously identified ACMs. The samples collected were submitted to EMSL for analysis of asbestos content and nature.

A summary of the materials sampled as part of the current assessment, along with the sample locations and analytical results is presented in Table 5.43-1, below. A copy of the certificate of analysis provided by EMSL for the suspected ACM samples submitted as part of this assessment is attached at the end of this Appendix.

Table 5.43-1 Suspected ACM Sample Collection and Analysis Summary Main Building—Roof

Material/Homogenous Application Description	Sample Number	Sample Location	Result (%/type asbestos)
Vent Sealant, White, Applied to Seam of Vent Stack	WX-VS-01A	Maintenance Storage and Shops, Roof	None Detected
	WX-VS-01B	Maintenance Storage and Shops, Roof	None Detected
	WX-VS-01C	Maintenance Storage and Shops, Roof	None Detected
Vent Sealant, Grey, Applied to Seams of Large Exhaust Fan	Q-VS-02A	Kitchen, Roof	None Detected
	Q-VS-02B	Kitchen, Roof	None Detected
	Q-VS-02C	Kitchen, Roof	None Detected
Vent Sealant, Grey, Applied to Seams of Large Vents	V-VS-03A	Industries, Roof	None Detected
	V-VS-03B	Industries, Roof	None Detected

Table 5.43-1 Suspected ACM Sample Collection and Analysis Summary Main Building—Roof

Material/Homogenous Application Description	Sample Number	Sample Location	Result (%/type asbestos)
	V-VS-03C	Industries, Roof	None Detected
Vent Sealant, Silver, Applied to HVAC Electrical Penetrations	PC-VS-04A	Programs Corridor, Roof	None Detected
	PC-VS-04B	Programs Corridor, Roof	None Detected
	PC-VS-04C	Programs Corridor, Roof	None Detected
Vent Sealant, Grey, Applied to Base of Vent	PC-VS-05A	Programs Corridor, Roof	None Detected
	PC-VS-05B	Programs Corridor, Roof	None Detected
	PC-VS-05C	Programs Corridor, Roof	None Detected
Electrical Penetration Putty, Black, Applied to AHU S12 Penetrations	L-EPP-01A	Laundry, Roof	None Detected
	L-EPP-01B	Laundry, Roof	None Detected
	L-EPP-01C	Laundry, Roof	None Detected
Electrical Penetration Putty, Brown, Applied to AHU Penetrations	AC-EPP-02A	Academic Centre, High Roof	None Detected
	AC-EPP-02B	Academic Centre, High Roof	None Detected
	AC-EPP-02C	Academic Centre, High Roof	None Detected
Window Frame Caulking, Black	WX-WFC-01A	Academic Centre, Roof	None Detected
	WX-WFC-01B	Industries, Roof	None Detected
	WX-WFC-01C	Industries, Roof	None Detected
Window Pane Caulking, Grey	V-WPC-01A	Industries, Roof	None Detected
	V-WPC-01B	Industries, Roof	None Detected
	V-WPC-1C	Academic Centre, Roof	None Detected
Flashing Mastic, Grey, Applied to Seams of Flashing and Brick	GH-RFS-01A	Living Unit GH, Roof	None Detected
	Q-RFS-01B	Kitchen, Roof	None Detected
	R-RFS-01C	Recreation, Roof	None Detected
Roof Membrane, Red	R-GR-01A	Recreation, Roof	None Detected
	R-GR-01B	Recreation, Roof	None Detected
	R-GR-01C	Recreation, Roof	None Detected
Seam Sealant, Grey, Applied to AHU S12 Seams	L-SS-01A	Laundry, Roof	None Detected
	L-SS-01B	Laundry, Roof	None Detected
	L-SS-01C	Laundry, Roof	None Detected

Table 5.43-1 Suspected ACM Sample Collection and Analysis Summary Main Building—Roof

Material/Homogenous Application Description	Sample Number	Sample Location	Result (%/type asbestos)
Remnant Roof Tar, Black	GH-RT-01A	Living Unit GH, Roof	None Detected
	CD-RT-01B	Living Unit CD, Roof	None Detected
	AB-RT-01C	Living Unit AB, Roof	None Detected
Flashing Mastic, Grey, Applied to Seams of Flashing	GH-RFM-01A	Living Unit GH, Roof	None Detected
	EF-RFM-01B	Living Unit EF, Roof	None Detected
	CD-RFM-01C	Living Unit CD, Roof	None Detected
Roof Membrane, Red	GH-RM-01A	Living Unit GH, Roof	None Detected
	L-RM-01B	Laundry, Roof	None Detected
	Q-RM-01C	Kitchen, Roof	None Detected
Roof Membrane, Red	AC-RM-02A	Academic Centre, High Roof	None Detected
	V-RM-02B	Industries, High Roof	None Detected
	V-RM-02C	Industries, High Roof	None Detected

Based on our observations of building construction (estimated vintage of interior finishes and uniformity of building material use) and on our interpretations of suspected ACM sample analytical results along with the information provided in the Previous Reports, the materials presented in Table 5.43-2, below were identified or confirmed as ACMs that remain within the subject building.

Table 5.43-2 Summary of Identified ACMs Main Building—Roof

Identified ACM Description and Condition Information		Photo
Grey mastic on exterior living units' roofs around louvers.		 Photo from SNC Living Unit Mechanical Room Reports 2017 report
Friability	Non-friable	
Condition	Good	
Total Quantity	Approximately 50 linear metres	
Content	4.9% Chrysotile (SNC Living Unit Mechanical Room Reports 2017 report)	

5.43.1.1. Potential Asbestos-Containing Vermiculite Insulation

As part of the assessment, Stantec assessed the subject area for areas where vermiculite insulation, a potential ACM, would likely be present. This included making note of attic spaces, floor cavities and masonry block or brick walls, which are typical areas where vermiculite is found. No locations that may potentially contain vermiculite (that could not otherwise be assessed) were observed.

5.43-2. LEAD

Lead is expected to be present in the following within the subject area:

- Vent and pipe flashings

With respect to paint, LCPs were not identified through the Previous Reports. As such, chip samples were obtained from the predominant suspected LCP applications within the subject building. A summary of the sample types, locations and analytical results is presented in Table 5.43-3, below. A copy of the certificate of analysis provided by EMSL for the suspected LCP samples submitted is attached to this Appendix.

Table 5.43-3 Suspected LCP Sample Collection and Analysis Summary Main Building—Roof

Sample No.	Sample Colour/Substrate	Sample Location	Lab Result (ppm)
AC-P-01	**Grey on metal HVAC units**	**Academic Centre, Roof**	**5,400 ppm**

NOTE:
Bold, highlighted text indicates confirmed LCP

Based on our observations and on our interpretations of suspected LCP sample analytical results from the Previous Reports, the paint presented in Table 5.43-4, below was identified as an LCP:

Table 5.43-4 Summary of Identified LCPs
Main Building—Roof

Identified LCP Description		Photo
Paint colour	Grey	
Substrate	Metal	
Location/approx. extent	HVAC units and vents	
Lead content	5,400 ppm	
Condition	Generally good, some localized areas in poor condition	

5.43-3. POLYCHLORINATED BIPHENYLS

No suspected PCB-containing equipment was observed.

5.43-4. MERCURY

Items suspected to contain liquid mercury or mercury vapour were not observed.

5.43-5. MOULD

Suspect mould or moisture-impacted building materials were not observed at the time of the assessment.

5.43-6. OZONE-DEPLETING SUBSTANCES

The following equipment was identified by labels to be ODS-containing:

- Three Trane rooftop A/C unit (R-22, 10 lbs, 3 oz)

The following equipment is suspected to be ODS-containing (labels were not legible):

- Two unknown rooftop air handling units above Building PC (no label visible)

Additional building-related refrigeration and/or air conditioning equipment observed was confirmed (by label information) to be charged with refrigerants that are not considered ODSs.

5.43-7. SILICA

Silica is expected to be present in the following, which were observed in various locations throughout:

- Asphalt and asphalt products containing rock or stone (e.g., roof membrane)

6.43 RECOMMENDATIONS

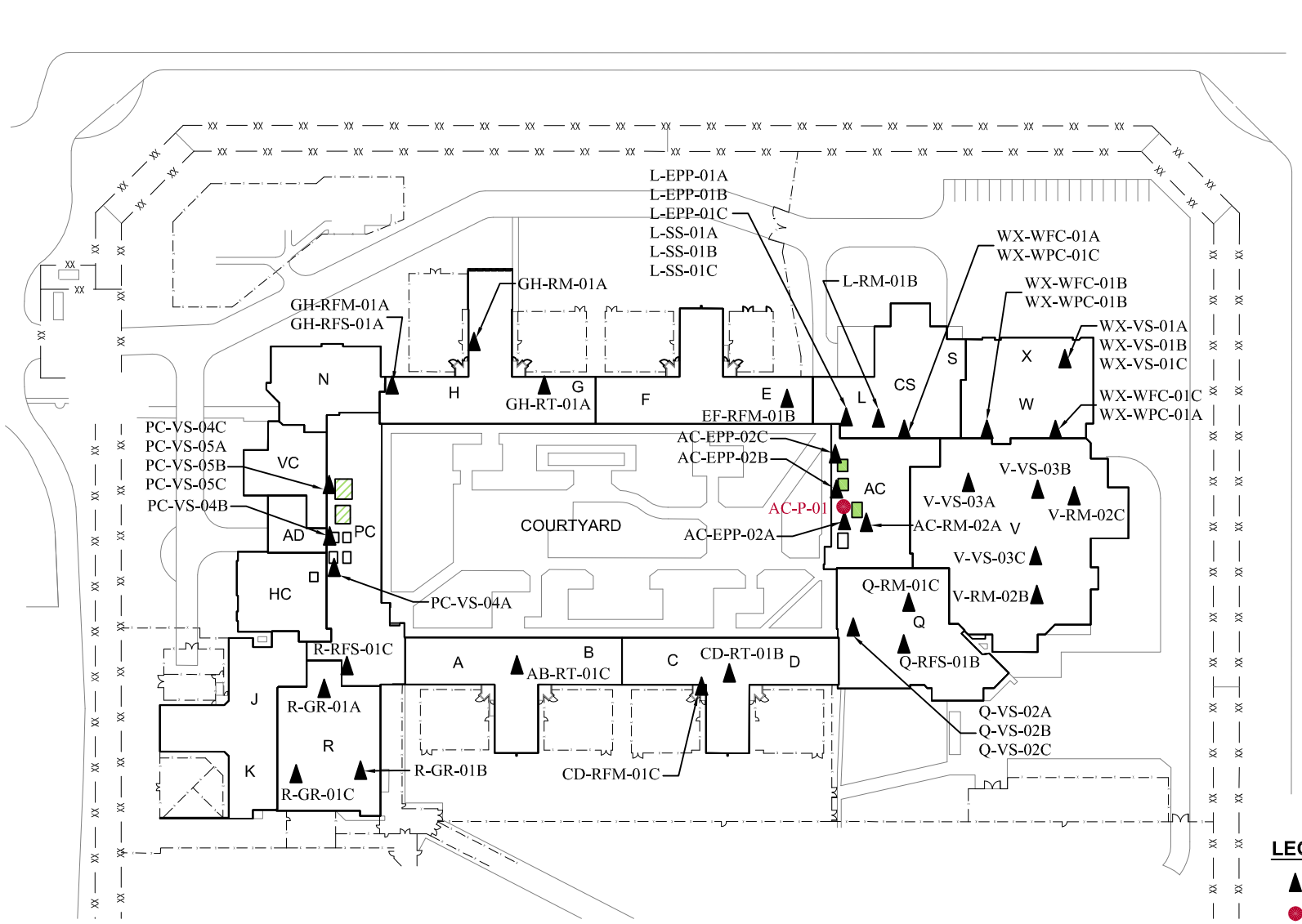
In general, identified hazardous building materials were observed to be in good condition and do not appear to require specific action to maintain compliance with applicable regulations for continued operations and maintenance. Refer to Section 6.0 of the main body of this report for applicable material-by-material general recommendations.

Additional building-specific recommendations to be considered are provided below.

6.43-2. LEAD

Lead-containing paint observed in poor condition within the subject area should be cleaned-up and/or addressed to mitigate potential for additional deterioration and dispersal of lead-containing paint chips/dust. Consideration should be given to re-painting surfaces to mitigate the potential for additional deterioration and hazards associated with the lead-containing paint chips/dust that may be created. If re-painting is completed, appropriate precautions to protect workers and work areas from exposure to lead will be required during painting preparation activities.

Provisions for worker protection and waste disposal related to the above are included in Section 6.2 of the main body of this report.



ROOF
MAIN BUILDING

LEGEND

- ASBESTOS BULK SAMPLE
- LEAD PAINT SAMPLE
- ODS-CONTAINING EQUIPMENT
- SUSPECT ODS-CONTAINING EQUIPMENT

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

KENT INSTITUTION
4732 CEMETERY ROAD, AGASSIZ, BC

Client: PUBLIC SERVICES AND PROCUREMENT CANADA

Project No.:	123221164
Scale:	N.T.S.
Date:	18/11/29
Dwn. By:	CD DM SL2018110217
App'd By:	TW

Dwg. No.: 43

Stantec

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http://www.EMSL.com / vancouverlab@EMSL.com

EMSL Canada Order 691802102
Customer ID: 55JACQ30L
Customer PO: 123221164.200
Project ID:

Attn: Luke Sweet
Stantec Consulting Ltd.
500 - 4730 Kingsway
Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Collected:
Received: 8/03/2018
Analyzed: 8/10/2018

Proj: 123221164.200- MAIN BUILDING ROOF

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: WX-VS-01A **Lab Sample ID:** **691802102-0001**
Sample Description: Maintenance Storage and Shops, Roof/Vent Sealant, White, Applied to Seam of Vent Stack

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	White	0.0%	100%	None Detected	

Client Sample ID: WX-VS-01B **Lab Sample ID:** **691802102-0002**
Sample Description: Maintenance Storage and Shops, Roof/Vent Sealant, White, Applied to Seam of Vent Stack

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	White	0.0%	100%	None Detected	

Client Sample ID: WX-VS-01C **Lab Sample ID:** **691802102-0003**
Sample Description: Maintenance Storage and Shops, Roof/Vent Sealant, White, Applied to Seam of Vent Stack

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	White	0.0%	100%	None Detected	

Client Sample ID: Q-VS-02A **Lab Sample ID:** **691802102-0004**
Sample Description: Kitchen, Roof/Vent Sealant, Grey, Applied to Seams of Large Exhaust Fan

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: Q-VS-02B **Lab Sample ID:** **691802102-0005**
Sample Description: Kitchen, Roof/Vent Sealant, Grey, Applied to Seams of Large Exhaust Fan

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: Q-VS-02C **Lab Sample ID:** **691802102-0006**
Sample Description: Kitchen, Roof/Vent Sealant, Grey, Applied to Seams of Large Exhaust Fan

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Brown	0.0%	100%	None Detected	

Client Sample ID: V-VS-03A **Lab Sample ID:** **691802102-0007**
Sample Description: Industries, Roof/Vent Sealant, Grey, Applied to Seams of Large Vents

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Gray	<0.25%	100%	None Detected	

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EMSL Canada Order 691802102
Customer ID: 55JACQ30L
Customer PO: 123221164.200
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: V-VS-03B **Lab Sample ID:** **691802102-0008**

Sample Description: Industries, Roof/Vent Sealant, Grey, Applied to Seams of Large Vents

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Gray	0.26%	99.7%	None Detected	

Client Sample ID: V-VS-03C **Lab Sample ID:** **691802102-0009**

Sample Description: Industries, Roof/Vent Sealant, Grey, Applied to Seams of Large Vents

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: PC-VS-04A **Lab Sample ID:** **691802102-0010**

Sample Description: Programs Corridor, Roof/Vent Sealant, Silver, Applied to HVAC Electrical Penetrations

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: PC-VS-04B **Lab Sample ID:** **691802102-0011**

Sample Description: Programs Corridor, Roof/Vent Sealant, Silver, Applied to HVAC Electrical Penetrations

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: PC-VS-04C **Lab Sample ID:** **691802102-0012**

Sample Description: Programs Corridor, Roof/Vent Sealant, Silver, Applied to HVAC Electrical Penetrations

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: PC-VS-05A **Lab Sample ID:** **691802102-0013**

Sample Description: Programs Corridor, Roof/Vent Sealant, Grey, Applied to Base of Vent

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: PC-VS-05B **Lab Sample ID:** **691802102-0014**

Sample Description: Programs Corridor, Roof/Vent Sealant, Grey, Applied to Base of Vent

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: PC-VS-05C **Lab Sample ID:** **691802102-0015**

Sample Description: Programs Corridor, Roof/Vent Sealant, Grey, Applied to Base of Vent

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Gray	0.0%	100%	None Detected	

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EMSL Canada Order 691802102
Customer ID: 55JACQ30L
Customer PO: 123221164.200
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: L-EPP-01A ***Lab Sample ID:*** **691802102-0016**

Sample Description: Laundry, Roof/Electrical Penetration Putty, Black, Applied to AHU S12 Penetrations

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: L-EPP-01B ***Lab Sample ID:*** **691802102-0017**

Sample Description: Laundry, Roof/Electrical Penetration Putty, Black, Applied to AHU S12 Penetrations

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: L-EPP-01C ***Lab Sample ID:*** **691802102-0018**

Sample Description: Laundry, Roof/Electrical Penetration Putty, Black, Applied to AHU S12 Penetrations

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: AC-EPP-02A ***Lab Sample ID:*** **691802102-0019**

Sample Description: Academic Centre, High Roof/Electrical Penetration Putty, Brown, Applied to AHU Penetrations

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: AC-EPP-02B ***Lab Sample ID:*** **691802102-0020**

Sample Description: Academic Centre, High Roof/Electrical Penetration Putty, Brown, Applied to AHU Penetrations

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: AC-EPP-02C ***Lab Sample ID:*** **691802102-0021**

Sample Description: Academic Centre, High Roof/Electrical Penetration Putty, Brown, Applied to AHU Penetrations

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: WX-WFC-01A ***Lab Sample ID:*** **691802102-0022**

Sample Description: Academic Centre, Roof/Window Frame Caulking, Black

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: WX-WFC-01B ***Lab Sample ID:*** **691802102-0023**

Sample Description: Industries, Roof/Window Frame Caulking, Black

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

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Customer ID: 55JACQ30L
Customer PO: 123221164.200
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: WX-WFC-01C ***Lab Sample ID:*** **691802102-0024**

Sample Description: Industries, Roof/Window Frame Caulking, Black

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: V-WPC-01A ***Lab Sample ID:*** **691802102-0025**

Sample Description: Industries, Roof/Window Pane Caulking, Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Gray/Black	<0.25%	100%	None Detected	

Client Sample ID: V-WPC-01B ***Lab Sample ID:*** **691802102-0026**

Sample Description: Industries, Roof/Window Pane Caulking, Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: V-WPC-01C ***Lab Sample ID:*** **691802102-0027**

Sample Description: Academic Centre, Roof/Window Pane Caulking, Grey

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: GH-RFS-01A ***Lab Sample ID:*** **691802102-0028**

Sample Description: Living Unit GH, Roof/Flashing Mastic, Grey, Applied to Seams of Flashing and Brick

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: Q-RFS-01B ***Lab Sample ID:*** **691802102-0029**

Sample Description: Kitchen, Roof/Flashing Mastic, Grey, Applied to Seams of Flashing and Brick

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: R-RFS-01C ***Lab Sample ID:*** **691802102-0030**

Sample Description: Recreation, Roof/Flashing Mastic, Grey, Applied to Seams of Flashing and Brick

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: R-GR-01A ***Lab Sample ID:*** **691802102-0031**

Sample Description: Recreation, Roof/Roof Membrane, Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

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EMSL Canada Order 691802102
Customer ID: 55JACQ30L
Customer PO: 123221164.200
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: R-GR-01B ***Lab Sample ID:*** **691802102-0032**

Sample Description: Recreation, Roof/Roof Membrane, Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: R-GR-01C ***Lab Sample ID:*** **691802102-0033**

Sample Description: Recreation, Roof/Roof Membrane, Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: L-SS-01A ***Lab Sample ID:*** **691802102-0034**

Sample Description: Laundry, Roof/Seam Sealant, Grey, Applied to AHU S12 Seams

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Gray	0.0%	100%	None Detected	

Client Sample ID: L-SS-01B ***Lab Sample ID:*** **691802102-0035**

Sample Description: Laundry, Roof/Seam Sealant, Grey, Applied to AHU S12 Seams

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Brown/Green	0.0%	100%	None Detected	

Client Sample ID: L-SS-01C ***Lab Sample ID:*** **691802102-0036**

Sample Description: Laundry, Roof/Seam Sealant, Grey, Applied to AHU S12 Seams

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Brown/Green	0.0%	100%	None Detected	

Client Sample ID: GH-RT-01A ***Lab Sample ID:*** **691802102-0037**

Sample Description: Living Unit GH, Roof/Remnant Roof Tar, Black

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: CD-RT-01B ***Lab Sample ID:*** **691802102-0038**

Sample Description: Living Unit CD, Roof/Remnant Roof Tar, Black

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: AB-RT-01C ***Lab Sample ID:*** **691802102-0039**

Sample Description: Living Unit AB, Roof/Remnant Roof Tar, Black

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

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EMSL Canada Order 691802102
Customer ID: 55JACQ30L
Customer PO: 123221164.200
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: GH-RFM-01A ***Lab Sample ID:*** **691802102-0040**

Sample Description: Living Unit GH, Roof/Flashing Mastic, Grey, Applied to Seams of Flashing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: EF-RFM-01B ***Lab Sample ID:*** **691802102-0041**

Sample Description: Living Unit EF, Roof/Flashing Mastic, Grey, Applied to Seams of Flashing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: CD-RFM-01C ***Lab Sample ID:*** **691802102-0042**

Sample Description: Living Unit CD, Roof/Flashing Mastic, Grey, Applied to Seams of Flashing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: GH-RM-01A ***Lab Sample ID:*** **691802102-0043**

Sample Description: Living Unit GH, Roof/Roof Membrane, Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: L-RM-01B ***Lab Sample ID:*** **691802102-0044**

Sample Description: Laundry, Roof/Roof Membrane, Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: Q-RM-01C ***Lab Sample ID:*** **691802102-0045**

Sample Description: Kitchen, Roof/Roof Membrane, Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: AC-RM-02A ***Lab Sample ID:*** **691802102-0046**

Sample Description: Academic Centre, High Roof/Roof Membrane, Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Client Sample ID: V-RM-02B ***Lab Sample ID:*** **691802102-0047**

Sample Description: Industries, High Roof/Roof Membrane, Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

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EMSL Canada Order 691802102
Customer ID: 55JACQ30L
Customer PO: 123221164.200
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: V-RM-02C ***Lab Sample ID:*** **691802102-0048**

Sample Description: Industries, High Roof/Roof Membrane, Red

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/10/2018	Black	0.0%	100%	None Detected	

Analyst(s):

Chloe Huang PLM Grav. Reduction (15)
Kathleen Cruz PLM Grav. Reduction (33)

Reviewed and approved by:

Nicole Yeo, Laboratory Manager
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Burnaby, BC

Report amended: 12/04/201815:25:33 Replaces amended report from: 11/28/201810:00:05 Reason Code: Client-Change to Appearance

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EMSL Canada Or	551809236
CustomerID:	55JACQ30L
CustomerPO:	123221164.200
ProjectID:	

Attn: **Luke Sweet**
Stantec Consulting Ltd.
500 - 4730 Kingsway
Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Received: 08/07/18 11:41 AM
Collected:

Project: **123221164.200**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client SampleDescription	*Collected*	*Analyzed*	*Weight*	*RDL*	*Lead Concentration*
AC-P-01		8/13/2018	0.2507 g	400 ppm	5400 ppm
551809236-0001	Site: Main Building Roof/Academic Centre, Roof Desc: Grey on metal HVAC units				

Rowena Fanto, Lead Supervisor
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 08/14/2018 08:28:00