

Project Title

LONDON CROSS CONNECTION CONTROL MEASURES PROJECT

Project Number

R.106155.001

Project Date

2020-05-29

	
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END OF SECTION

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Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises domestic water network modification of The Agriculture & Agri-Food Canada London Research and Development Centre, located at 1391 Sandford St, London, ON; and further identified as London Cross Connection Project.
- .2 The scope of work includes, but not limited to the following as outlined in the design drawings and tender document.
 - .1 Demolition of existing pumps and piping to accommodate separating domestic water networks into potable and non-potable systems.
 - .2 Installation of new pumps and water heaters complete with associated accessories and piping.
 - .3 Reconnection of existing fixtures to new potable water system.
 - .4 Existing BAS control system integration as required to accommodate new work as outlined in the tender document.
 - .5 Electrical system modifications as required to accommodate new mechanical installation.
 - .6 New concrete pad to support new installation.
 - .7 General site requirement as outlined in elsewhere of the tender document.

1.2 CONTRACT METHOD

- .1 Construct work under lump sum contract.

1.3 COST BREAKDOWN

- .1 Within 48 hours of notification of acceptance of bid furnish a cost breakdown by Section aggregating contract amount.
- .2 Show separately cost of equipment purchased exempt from Ontario Retail Sales Tax under your Ontario Sales Tax license number.
- .3 Within 48 hours of acceptance of bid submit a list of subcontractors.

1.4 WORK SEQUENCE

- .1 Construct Work in stages to accommodate Owner's continued use of premises during construction.
- .2 Coordinate Progress Schedule and coordinate with Owner Occupancy during construction.

- .3 Refer to design drawings for detailed construction sequence and phase plan.

1.5 CONTRACTOR USE OF PREMISES

- .1 Contractor shall limit use of premises for Work, for storage, and for access, to allow;
 - .1 Owner occupancy.
- .2 Coordinate use of premises under direction of Departmental Representative.
- .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

1.6 OWNER OCCUPANCY

- .1 Owner will occupy premises during entire construction period for execution of normal operations.
- .2 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

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 ACCESS AND EGRESS

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.2 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Contractor shall provide temporary sanitary facilities for their personnel. Location of facilities will be determined on-site with Departmental Representative. Sanitary facilities shall include hand washing stations and sanitizer for the Contractor's personnel at all work areas.
- .5 Use elevators where possible, existing in building for moving workers and material.
 - .1 Protect walls of passenger elevators, to approval of Departmental Representative prior to use.
 - .2 Accept liability for damage, safety of equipment and overloading of existing equipment.
 - .3 Contractor access to elevators is only permitted outside regular business hours.
- .6 Closures: protect work temporarily until permanent enclosures are completed.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to building operations, occupants, public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.4 EXISTING SERVICES

- .1 Notify, Departmental Representative utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, except domestic water services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.

- .3 A minimum of two water closets are required to be operational at all times for males and four water closets are required to be operational for females. For males, one of the water closets could be substituted for a urinal.
- .4 Provide for personnel and vehicular traffic.

1.5 SPECIAL REQUIREMENTS

- .1 Contractor's regular work hours on-site shall be Monday to Friday 13:00 to 21:30 hours.
- .2 Carry out noise generating Work Monday to Friday from 18:00 to 07:00 hours and on Saturdays, Sundays, and statutory holidays.
- .3 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .4 Keep within limits of work and avenues of ingress and egress.
- .5 Deliver materials during working hours, but outside of peak traffic hours of 13:00 to 15:00 unless otherwise approved by Departmental Representative. Contractor is responsible for unloading all materials.
- .6 Prior to cutting or drilling horizontal or vertical surfaces including concrete, concrete block or other structural substrate, determine location of reinforcing, service lines, pipes, conduits or other items by appropriate method. X-ray scanning is not permitted on-site. Submit findings to Departmental Representative prior to cutting or drilling.
- .7 Contractor shall complete the site access form prior to accessing site. The site access form is attached as an appendix.

1.6 SECURITY

- .1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.
- .2 Security clearances:
 - .1 Obtain requisite clearance, as instructed, for each individual required to enter premises.
 - .2 All contractor employees and staff intended to work on project need to get security paperwork submitted within 48 hours of award of Contract.
- .3 Security escort:
 - .1 Personnel employed on this project must be escorted when executing work in non-public areas during normal working hours. Personnel must be escorted in all areas after normal working hours.
 - .2 Submit an escort request to Departmental Representative at least 5 days before service is needed. For requests submitted within time noted above, costs of

security escort will be paid for by Departmental Representative. Cost incurred by late request will be Contractor's responsibility.

- .3 Any escort request may be cancelled free of charge if notification of cancellation is given at least 4 hours before scheduled time of escort. Cost incurred by late request will be Contractor's responsibility.
- .4 Calculation of costs will be based on average hourly rate of security officer for minimum of 8 hours per day for late service request and of 4 hours for late cancellations.
- .5 Departmental Representative shall pay for commissionaire escorts for first 3 months of project, and contractor shall pay for all commissionaire escorts for remainder of Contract. Commissionaire escorts are only needed until all Contractor personnel have obtained their Reliability Status security clearance as per the Contract.

1.7 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions. Smoking is not permitted.

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 ADMINISTRATIVE

- .1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting 4 days in advance of meeting date to Departmental Representative.
- .4 Departmental Representative will supply meeting space if required.
- .5 Preside at meetings.
- .6 Record minutes of meetings. Minutes shall be circulated to attending parties and affected parties not in attendance within 5 days after meeting.
- .7 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Within 15days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work.
 - .3 Schedule of submission of shop drawings, samples, mock-ups, colour chips.
 - .4 Requirements for temporary facilities, offices, storage sheds, utilities, fences.
 - .5 Delivery schedule of specified equipment.
 - .6 Site security.
 - .7 Health and safety.

- .8 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .9 Owner provided products.
- .10 Record drawings and specifications.
- .11 Maintenance manuals.
- .12 Take-over procedures, acceptance, warranties.
- .13 Monthly progress claims, administrative procedures, photographs, hold backs.
- .14 Appointment of inspection and testing agencies or firms.
- .15 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

- .1 During course of Work, schedule progress meetings biweekly.
- .2 Contractor, major Subcontractors involved in Work and Departmental Representative are to be in attendance.
- .3 Notify parties minimum 5 days prior to meetings.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 5 days after meeting.
- .5 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Review proposed changes for affect on construction schedule and on completion date.
 - .12 Other business.

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 DEFINITIONS

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally, Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 business days, to allow for progress reporting.

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit Project Schedule to Departmental Representative within 10 business days of receipt of acceptance of Master Plan / contract award.

1.4 PROJECT MILESTONES

- .1 Project milestones form interim targets for Project Schedule.

1.5 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules within 5 business days.
- .3 Revise impractical schedule and resubmit within 5 business days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.
- .5 Schedules require approval by Departmental Representative prior to commencement of work. Any revisions in schedule must be approved by Departmental Representative prior to work progressing.

1.6 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.
 - .4 Mobilization.
 - .5 Electrical.
 - .6 Controls.
 - .7 Plumbing.
 - .8 Millwork.
 - .9 Testing and Commissioning.

.10 Supplied equipment long delivery items.

.3 Project schedule shall include time for document and construction reviews by Departmental Representative.

1.7 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on 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.

1.8 PROJECT MEETINGS

.1 Discuss Project Schedule at regular 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.

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 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal 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 submittals 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. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and 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's review of submittals.
- .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.
- .11 Submit number of hard copies specified for each type and format of submittal and also submit in electronic format as pdf files. Forward pdf, NMSEdit Professional spp, MS Word, MS Excel, MS Project and Autocad dwg files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

- .2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .3 Allow 5 working days for Departmental Representative's review of each submission.
- .4 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Amount. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .5 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .6 Accompany submissions with transmittal letter, in duplicate, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .7 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.

- .8 Wiring diagrams.
- .9 Single line and schematic diagrams.
- .10 Relationship to adjacent work.
- .8 After Departmental Representative's review, distribute copies.
- .9 Submit one electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .10 Submit one electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .11 Submit one electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .12 Submit one electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .13 Submit one electronic copy of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and WHMIS Safety Data Sheets concerning impedances, hazards and safety precautions.
- .14 Submit one electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .15 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .16 Submit one electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .17 Delete information not applicable to project.
- .18 Supplement standard information to provide details applicable to project.

- .19 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned, and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .20 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that the Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's site office.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Amount. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic copy of colour digital photography in jpg format, fine resolution as directed by Departmental Representative.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints: 4 locations.

- .1 Viewpoints and their location as determined by Departmental Representative.
- .4 Frequency of photographic documentation: biweekly and as directed by Departmental Representative. Ensure photographs capture all stages of construction progress and construction completion as regular site reviews will not be occurring as a result of COVID-19.
- .1 Upon completion of Work, and as directed by Departmental Representative.

1.5 FEES, PERMITS AND CERTIFICATES

- .1 Provide authorities having jurisdiction with information requested.
- .2 Pay fees and obtain certificates and permits required.
- .3 Furnish certificates and permits.

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 REQUIREMENTS

- .1 Asbestos Survey Report - March 21, 2018
- .2 Designated Substances Survey – December 2005

1.2 REFERENCE STANDARDS

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2 National Building Code 2015 (NBC):
 - .1 NBC 2015, Division B, Part 8 Safety Measures at Construction and Demolition Sites.
- .3 Province of Ontario:
 - .1 Occupational Health and Safety Act Revised Statutes of Ontario 1990, Chapter O.1 as amended, and Regulations for Construction Projects, O. Reg. 213/91 as amended.
 - .2 O. Reg. 490/09, Designated Substances.
 - .3 Workplace Safety and Insurance Act, 1997.
 - .4 Municipal statutes and authorities.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation.
 - .3 Measures and controls to be implemented to address identified safety hazards and risks.
- .3 Provide a Fire Safety Plan, specific to the work location, in accordance with NBC, Division B, Article 8.1.1.1.3 prior to commencement of work. The plan shall be coordinated with, and integrated into, the existing Emergency Procedures and Evacuation Plan in place at the site. Departmental Representative will provide Emergency Procedures and Evacuation Plan. Deliver two copies of the Fire Safety Plan to the Departmental Representative not later than 14 days before commencing work.
- .4 Contractor's and Sub-contractors' Safety Communication Plan.

- .5 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with existing Emergency Response requirements and procedures provided by Departmental Representative.
- .6 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 days after receipt of comments from Departmental Representative.
- .7 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .8 Submit names of personnel and alternates responsible for site safety and health.
- .9 Submit records of Contractor's Health and Safety meetings when requested.
- .10 Submit electronic copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.
- .11 Submit copies of orders, directions or reports issued by health and safety inspectors of the authorities having jurisdiction.
- .12 Submit copies of incident and accident reports.
- .13 Submit Safety Data Sheets (SDS).
- .14 Submit Workplace Safety and Insurance Board (WSIB)- Experience Rating Report.

1.4 FILING OF NOTICE

- .1 File Notice of Project with Provincial authorities prior to commencement of Work.

1.5 WORK PERMIT

- .1 Obtain building permits related to project prior to commencement of Work. Contractor is responsible for all fees associated with obtaining building permit.
- .2 Obtain Hot Work Permit from Departmental Representative.

1.6 SAFETY ASSESSMENT

- .1 Perform site specific safety hazard assessment related to project.

1.7 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.8 REGULATORY REQUIREMENTS

- .1 Comply with the Acts and regulations of the Province of Ontario.
- .2 Comply with specified standards and regulations to ensure safe operations at site.

1.9 PROJECT/SITE CONDITIONS

- .1 Work at site may involve contact with:
 - .1 Silica could be present in concrete, bricks, concrete block, cement, mortar, asphalt aggregate, etc.
 - .2 Asbestos in window glazing.
- .2 Refer to 2018 Asbestos Survey Report and 2005 Designated Substances Survey in the appendix of these specifications.

1.10 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns either accepting or requesting improvements.
- .3 Relief from or substitution for any portion or provision of minimum Health and Safety standards specified herein or reviewed site-specific Health and Safety Plan shall be submitted to Departmental Representative in writing.

1.11 COMPLIANCE REQUIREMENTS

- .1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990 Chapter 0.1, as amended.

1.12 RESPONSIBILITY

- .1 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.
- .2 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.
- .3 Where applicable the Contractor shall be designated "Constructor", as defined by Occupational Health and Safety Act and Regulations for Construction Projects for the Province of Ontario.

1.13 UNFORSEEN HAZARDS

- .1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, immediately stop work and advise Departmental Representative verbally and in writing.
- .2 Follow procedures in place for Employees Right to Refuse Work as specified in the Occupational Health and Safety Act for the Province of Ontario.

1.14 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province of Ontario, and in consultation with Departmental Representative.
 - .1 Contractor's Safety Policy.
 - .2 Constructor's Name.
 - .3 Notice of Project.
 - .4 Name, trade, and employer of Health and Safety Representative or Joint Health and Safety Committee members (if applicable).
 - .5 Ministry of Labour Orders and reports.
 - .6 Occupational Health and Safety Act and Regulations for Construction Projects for Province of Ontario.
 - .7 Address and phone number of nearest Ministry of Labour office.
 - .8 WHMIS Safety Data Sheets.
 - .9 Written Emergency Response Plan.
 - .10 Site Specific Safety Plan.
 - .11 Valid certificate of first aider on duty.
 - .12 WSIB "In Case of Injury At Work" poster.
 - .13 Location of toilet and cleanup facilities.

1.15 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.16 BLASTING

- .1 Blasting or other use of explosives is not permitted.

1.17 POWDER ACTUATED DEVICES

- .1 Use powder actuated devices only after receipt of written permission from Departmental Representative.

1.18 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.
- .2 Assign responsibility and obligation to Competent Supervisor to stop or start Work when, at Competent Supervisor's discretion, it is necessary or advisable for reasons of health or safety. Departmental Representative may also stop Work for health and safety considerations.

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 DEFINITIONS

- .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative.
- .3 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.
- .4 Address topics at level of detail commensurate with environmental issue and required construction tasks.

1.3 FIRES

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

1.4 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties.
- .2 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m minimum.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.
 - .1 Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas designated by Departmental Representative.

1.5 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.
 - .1 Provide temporary enclosures where directed by Departmental Representative.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.6 NOTIFICATION

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
 - .1 Take action only after receipt of written approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning.
 - .1 Leave Work area clean at end of each day.

- .2 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 – Waste Management and Disposal.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES AND CODES

- .1 Perform Work in accordance with National Building Code of Canada (NBC) 2015, National Fire Code of Canada (NFC) 2015 and Ontario Building Code (OBC) 2012, 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 as directed by the Departmental Representative.
- .2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

- .1 Stop work immediately and notify Departmental Representative if materials which may contain designated substances or PCB's are discovered in course of work.

1.3 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions.

1.4 TAXES

- .1 Pay applicable Federal, Provincial and Municipal taxes.

1.5 EXAMINATION

- .1 Examine existing conditions and determine conditions affecting work.
- .2 Conduct concrete floor moisture testing using Calcium Chloride moisture tests.
 - .1 Submit test results to Departmental Representative for approval prior to installing any flooring. Conduct one test per 100 m2 of area being covered.

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 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 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.
- .3 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.
- .4 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.

1.2 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.

1.3 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.
- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative may deduct from Contract Amount difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Departmental Representative.

1.4 REPORTS

- .1 Submit electronic copies of inspection and test reports to Departmental Representative.
- .2 Provide copies to Subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

1.5 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as may be requested.
- .2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Departmental Representative. Work shall not start prior to approval.

1.6 MILL TESTS

- .1 Submit mill test certificates as required of specification Sections.

1.7 EQUIPMENT AND SYSTEMS

- .1 Submit testing, adjusting and balancing reports for mechanical, electrical and building equipment systems.

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 ACTION AND INFORMATION SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

1.2 INSTALLATION AND REMOVAL

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.3 WATER SUPPLY

- .1 Departmental Representative will provide continuous supply of potable water for construction use.

1.4 TEMPORARY POWER AND LIGHT

- .1 Contractor can utilize building power during construction for temporary lighting and operating of power tools, to a maximum supply of 120 volts 30 amps. Prior to using building power, coordinate with Departmental Representative.
- .2 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.
- .3 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.

1.5 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.
 - .1 Sprinkler system to be operational when fire watch or construction is closed down. All exit signs, alarm sounders, and initiating devices used to occupant evacuation shall be operating, unless fire watch is configured to cover those requirements.
- .2 Burning rubbish and construction waste materials is not permitted on site.

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 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-Z797-18, Code of Practice for Access Scaffold.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

1.3 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas which have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

1.4 SCAFFOLDING

- .1 Scaffolding in accordance with CAN/CSA-Z797.
- .2 Provide and maintain scaffolding as required to complete work.

1.5 HOISTING

- .1 Provide, operate and maintain hoists/cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.
- .2 Hoists/cranes shall be operated by qualified operator.

1.6 ELEVATORS

- .1 Designated existing elevators to be used by construction personnel. Co-ordinate use with Departmental Representative.
- .2 Provide protective coverings for finish surfaces of cars and entrances.
- .3 Elevators shall only be used outside of regular working hours.

1.7 SITE STORAGE/LOADING

- .1 Confine work and operations of employees to areas defined 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.

1.8 CONSTRUCTION PARKING

- .1 Provide and maintain adequate access to project site.
- .2 Clean construction runways and taxi areas where used by Contractor's equipment.

1.9 SECURITY

- .1 Pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.10 EQUIPMENT, TOOL AND MATERIALS 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.

1.11 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Protect travelling public from damage to person and property.
- .2 Dust control: adequate to ensure safe operation at all times.

1.12 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material.

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 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

1.2 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around open shafts, open stair wells, open edges of floors and roofs.
- .2 Provide as required by governing authorities.

1.3 WEATHER ENCLOSURES

- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

1.4 DUST TIGHT SCREENS

- .1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- .2 Maintain and relocate protection until such work is complete.

1.5 ACCESS TO SITE

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.6 PUBLIC TRAFFIC FLOW

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

1.7 FIRE ROUTES

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.8 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

1.9 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.

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 REFERENCE STANDARDS

- .1 Within text of specifications, reference may be made to reference standards.
- .2 Conform to these standards, in whole or in part as specifically requested in specifications.
- .3 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.
- .4 The cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .5 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.
- .6 OPSS Ontario Provincial Standard Specifications and OPSD Ontario Provincial Standard Drawings quoted in these specifications are available online at <http://www.raqsa.mto.gov.on.ca/techpubs/ops.nsf/OPSHomepage>.

1.2 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.

1.3 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Amount or Contract Time.

1.4 METRIC SIZED MATERIALS

- .1 SI metric units of measurement are used exclusively on the drawings and in the specifications for this project.
- .2 The Contractor is required to provide metric products in the sizes called for in the Contract Documents except where a valid claim can be made that a particular product is not available on the Canadian market.
- .3 Claims for exemptions from use of metric sized products shall be in writing and fully substantiated with supportive documentation. Promptly submit application to Departmental Representative for consideration and ruling. Non-metric sized products may not be used unless Contractor's application has been approved in writing by the Departmental Representative.
- .4 Difficulties caused by the Contractor's lack of planning and effort to obtain modular metric sized products which are available on the Canadian market will not be considered sufficient reasons for claiming that they cannot be provided.
- .5 Claims for additional costs due to provision of specified modular metric sized products will not be considered.

1.5 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.

1.6 TRANSPORTATION

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

1.7 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 Amount or Contract Time.

1.8 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.

1.9 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.

1.10 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.

1.11 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 to neither damage nor put at risk any portion of Work.

1.12 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.

1.13 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.

1.14 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.

1.15 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.

1.16 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants and pedestrian and vehicular traffic.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

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 ACTION AND INFORMATION SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Owner or separate contractor.
- .3 Include in request:
 - .1 Identification of project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Owner or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

Part 2 Products

2.1 MATERIALS

- .1 Required for original installation.
- .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 – Submittal Procedures.

2.2 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 are to be exposed by uncovering work; maintain excavations free of water.

Part 3 Execution

3.1 GENERAL REQUIREMENTS

- .1 Execute cutting, fitting, and patching 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 masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Submit proposed materials, finishes and installation method for patching to Departmental Representative for approval, prior to patching.
- .11 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .12 Fit Work weathertight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .13 Provide firestopping to maintain the integrity of fire separations, including:
 - .1 Protecting penetrations at fire-resistance rated wall, ceiling or floor construction.
 - .2 Using construction joint fire stops and building perimeter fire stops to protect gaps at fire separations and between fire separations and other construction assemblies.
- .14 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

3.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20 – Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.
- .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.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Provide on-site containers for collection of waste materials and debris.
- .5 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 20 – 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.

1.2 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 debris other than that caused by Owner or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.

- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 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.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .11 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .12 Remove dirt and other disfiguration from exterior surfaces.
- .13 Clean and sweep roofs, gutters, areaways, and sunken wells.
- .14 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.
- .15 Clean roofs, downspouts, and drainage systems.
- .16 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20 – Waste Management and Disposal.

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 CONSTRUCTION & DEMOLITION WASTE

- .1 Carefully deconstruct and source separate materials/equipment and divert, from D&C waste destined for landfill to maximum extent possible. Target for this project is 60% diversion from landfill. Reuse, recycle, compost, anaerobic digest or sell material for reuse except where indicated otherwise. On site sales are not permitted.
- .2 Source separate waste and maintain waste audits in accordance with the Environmental Protection Act, Ontario Regulation 102/94 and Ontario Regulation 103/94.
 - .1 Provide facilities for collection, handling and storage of source separated wastes.
 - .2 Source separate the following waste:
 - .1 Brick and portland cement concrete.
 - .2 Corrugated cardboard.
 - .3 Wood, not including painted or treated wood or laminated wood.
 - .4 Gypsum board, unpainted.
 - .5 Steel.
- .3 Submit a waste reduction workplan indicating the materials and quantities of material that will be recycled and diverted from landfill.
- .4 Submit proof that all waste is being disposed of at a licensed land fill site or waste transfer site. A copy of the disposal/waste transfer site's license and a letter verifying that said landfill site will accept the waste must be supplied to Departmental Representative prior to removal of waste from the demolition site.

1.2 WASTE PROCESSING SITES

- .1 Recycling Council of Ontario: 55 University Avenue, #1500, Toronto, ON, M5J 2H7.
 - .1 Telephone: 416-657-2797 or 1-888-501-9637.
 - .2 Fax: 416-960-8053.
 - .3 Email: rco@rco.on.ca.
 - .4 Internet: <http://www.rco.on.ca/>.
- .2 Alternatively, contact the Ontario Ministry of Environment, Conservation and Parks. Contact info provided in Part 3 of this Section.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

**3.1 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY
FOR THE ENVIRONMENT**

Province	Address	General Inquiries	Fax
Ontario	Ministry of Environment, Conservation and Parks 135 St Clair Avenue W Toronto, ON, M4V 1P5	(416) 323-4321 (800) 565-4923	(416) 314-6713
	Environment and Climate Change Canada Toronto, ON	(416) 734-4494	

END OF SECTION

Part 1 General

1.1 INSPECTION AND DECLARATION

- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Departmental Representative's Inspection.
- .2 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.
- .3 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 Operation of systems have been demonstrated to Owner's personnel.
 - .5 Work is complete and ready for final inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request reinspection.

1.2 CLEANING

- .1 In accordance with Section 01 74 00 – Cleaning.

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 SUBMISSION

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Departmental Representative's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final hard copies, and one electronic copy on USB key, of maintenance manuals and commissioning documentation in English.
- .5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .6 If requested, furnish evidence as to type, source and quality of products provided.
- .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .8 Pay costs of transportation.

1.2 FORMAT

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.

- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg format. Forward pdf, MS Word, MS Excel, and Autocad dwg files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.

1.3 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project;
 - .1 Date of submission; names,
 - .2 Addresses, and telephone numbers of Contractor with name of responsible parties;
 - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

1.4 AS-BUILTS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Amendments and addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.
- .6 Turn one set, paper copy and electronic copy, of AS-BUILT drawings and specifications over to Departmental Representative on completion of work. Submit files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.
- .7 If project is completed without significant deviations from Contract drawings and specifications submit to Departmental Representative one set of drawings and specifications marked "AS-BUILT".

1.5 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Amendments and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.6 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Design-Builder's coordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified.
- .15 Additional requirements: As specified in individual specification sections.

1.7 MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specifications sections.

1.8 SPARE PARTS

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.9 MAINTENANCE MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.10 SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to location as directed; place and store.

- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.11 STORAGE, HANDLING AND PROTECTION

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

1.12 WARRANTIES AND BONDS

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .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 Owner's permission, leave date of beginning of time of warranty until the Date of Certificate of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

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 DESCRIPTION

- .1 Demonstrate operation and maintenance of equipment and systems to Departmental Representative's personnel two weeks prior to date of final inspection.
- .2 Departmental Representative will provide list of personnel to receive instructions and will coordinate their attendance at agreed-upon times.

1.2 QUALITY CONTROL

- .1 Submit training schedule of time and date for demonstration and training of each item of equipment and each system in accordance with the training plan four 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 Report shall give time and date of each demonstration and training, with list of persons present.

1.3 CONDITIONS FOR DEMONSTRATIONS

- .1 Equipment has been inspected and put into operation in accordance with the relevant Sections.
- .2 Testing, adjusting, and balancing has been performed in accordance with the relevant Sections and equipment and systems are fully operational.
- .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.4 PREPARATION

- .1 Verify that conditions for demonstration and instructions comply with requirements.
- .2 Verify that designated O&M personnel are present.

1.5 DEMONSTRATION AND INSTRUCTIONS

- .1 Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, and maintenance of each item of equipment at agreed upon times, at the designated location.
- .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.

1.6 TIME ALLOCATED FOR INSTRUCTIONS

- .1 Ensure amount of time required for instruction of each item of equipment or system as per relevant sections, to a minimum of 4 hours for the complete project.

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 ACRONYMS

- .1 BMM - Building Management Manual.
- .2 Cx - Commissioning.
- .3 EMCS - Energy Monitoring and Control Systems.
- .4 O&M - Operation and Maintenance.
- .5 PI - Product Information.
- .6 PV - Performance Verification.
- .7 TAB - Testing, Adjusting and Balancing.

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.
- .3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

- .1 Contractor is responsible for retaining Cx Agent to lead commissioning process, preparing Cx Plan for Departmental Representative review, and for preparing and completing all Cx forms for new equipment and systems.

- .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 system 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 Departmental Representative will issue Certificate of Substantial Performance when:
 - .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 unfunctional system, 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 ROLES AND RESPONSIBILITIES - CONTRACTOR

- .1 Before Construction:
 - .1 Review contract documents, confirm by writing to Departmental Representative.
 - .2 Adequacy of provisions for Cx.
 - .3 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
 - .2 Conduct commissioning meetings and prepare minutes of meetings.
 - .3 Submit shop drawings.
 - .4 Conduct equipment installation and startup tests, and submit test reports.
 - .5 Perform TAB and submit TAB report.
 - .6 Conduct System Startup Verification Testing and complete Startup Checklists and PI Report forms.

- .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 Commissioning Phase:
 - .1 Conduct commissioning meetings and prepare minutes of meetings.
 - .2 Conduct Functional Performance Testing and complete PV Report forms.
 - .3 Demonstrate system operation.
 - .4 Submit Maintenance Manuals.
 - .5 Conduct O&M training.
- .5 Contractor's Responsibilities during Operation Phase:
 - .1 Provide fine-tuning.
 - .2 Provide specified inspection and maintenance services during warranty period.
- .6 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 ROLES AND RESPONSIBILITIES – DEPARTMENTAL REPRESENTATIVE

- .1 The Departmental Representative will carry out the following commissioning activities related to the Contractor:
 - .1 Review and approve shop drawings.
 - .2 Review and inspect installation, and prepare construction deficiencies report.
 - .3 Review and approve TAB report.
 - .4 Review and approve System Startup Verification Testing.
 - .5 Review and approve Functional Performance Testing.
 - .6 Review and approve Maintenance Manuals.
 - .7 Review and approve "As-Built" drawings.
 - .8 Review O&M training.
 - .9 Review and approve post-acceptance fine-tuning and review warranty services.

1.7 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.

1.8 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Submit no later than 4 weeks after award of Contract:
 - .1 Draft Cx documentation.
 - .2 Preliminary Cx schedule.
 - .2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
 - .3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 8 weeks prior to start of Cx.
 - .4 Provide additional documentation relating to Cx process required by Departmental Representative.

1.9 COMMISSIONING DOCUMENTATION

- .1 The Contractor's Commissioning Documentation shall include the following:
 - .1 Commissioning Schedule.
 - .2 Minutes of commissioning meetings.
 - .3 Shop drawings and product data.
 - .4 Installation inspection and test reports.
 - .5 TAB reports.
 - .6 Startup Checklists.
 - .7 Product Information (PI) Report forms.
 - .8 Performance Verification (PV) Report forms.
 - .9 "As-Built" drawings.
 - .10 Project Issued for Construction specifications, with all contract changes.
 - .11 Maintenance Manuals.
 - .12 O&M Training Schedule.
 - .13 O&M Training Report.
- .2 Departmental Representative to review and approve Cx documentation.
- .3 Provide completed and approved Cx documentation to Departmental Representative.

1.10 COMMISSIONING SCHEDULE

- .1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16.19 – Construction Progress Schedule – Bar (GANTT) Chart, indicating anticipated date of start, duration, and date of completion for the following key activities:
 - .1 Commissioning meetings.
 - .2 Shop drawings.
 - .3 Pre-startup installation inspections and tests.
 - .4 System and Equipment Startup and Verification.
 - .5 TAB.
 - .6 Functional Performance Test.
 - .7 O&M manuals.
 - .8 "As-Built" drawings.
 - .9 O&M Training.
 - .10 O&M Training Report.
- .2 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.

1.11 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings in accordance with Section 01 31 19 – Project Meetings and as specified herein.
- .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.

- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.12 STARTING AND TESTING

- .1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.13 WITNESSING OF STARTING AND TESTING

- .1 Provide 14 days notice prior to commencement.
- .2 Departmental Representative to witness of start-up and testing.
- .3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.14 MANUFACTURER'S INVOLVEMENT

- .1 Obtain manufacturer's installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative.
 - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
 - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .2 Integrity of warranties:
 - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.
- .3 Qualifications of manufacturer's personnel:
 - .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

1.15 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Requirements of Pre-commissioning Verification: range of checks and tests to determine that all components, equipment, systems, and interfaces between systems (e.g., emergency, fire, and life safety) operate in accordance with contact documents. This includes all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions. Verification of the proper operation of the control

system also includes verifying the interface of the control system with the TAB criteria and the response of EMCS controllers and sensors. Also, the Departmental Representative shall select, at random, 10 percent of the reported TAB and EMCS data for verification, and a failure of selected items shall result in the rejection of the final TAB report or the report of system startup and testing.

- .3 The Startup Checklists and PI Report forms shall be completed by the Contractor and verified by the Departmental Representative.
- .4 Conduct start-up and testing in following distinct phases:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
 - .2 Visual inspection of quality of installation.
 - .2 Start-up: follow accepted start-up procedures.
 - .3 Operational testing: document equipment performance.
 - .4 System PV: include repetition of tests after correcting deficiencies.
 - .5 Post-substantial performance verification: to include fine-tuning.
- .5 Commissioning Testing shall include System Operation Demonstration and Functional Performance Testing of systems. Test each system independently and then in unison with integrated systems.
- .6 Requirements of Functional Performance Testing (FPT): FPT shall determine if the system is providing the required heating, ventilating, and cooling services in accordance with the finalized design intent. If FPT cannot be completed due to seasonal reasons, lack of occupancy, deficiencies beyond the scope of the work, or any other reason, this shall be noted along with an indication of when tests will be rescheduled. If any identified performance deficiencies need to be corrected, the tests shall be repeated after corrective work is carried out, and this process shall continue until acceptable performance is achieved.
- .7 The Functional Performance Tests forms shall be completed by the Contractor and verified by the Departmental Representative.
- .8 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.
- .9 Document required tests on approved PV forms.
- .10 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
 - .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.

- .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
- .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
 - .1 Rejected equipment to be remove from site and replace with new.
 - .2 Subject new equipment/systems to specified start-up procedures.

1.16 START-UP DOCUMENTATION

- .1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports,
 - .5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.17 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit Departmental Representative for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.18 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.19 START OF COMMISSIONING

- .1 Notify Departmental Representative at least 21 days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.20 INSTRUMENTS/EQUIPMENT

- .1 Submit to Departmental Representative for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.
- .2 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders.
 - .3 Equipment as required to complete work.

1.21 COMMISSIONING PERFORMANCE VERIFICATION

- .1 Carry out Cx:
 - .1 Under accepted simulated operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.
- .4 EMCS trending to be available as supporting documentation for performance verification.

1.22 WITNESSING COMMISSIONING

- .1 Departmental Representative to witness activities and verify results.

1.23 AUTHORITIES HAVING JURISDICTION

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies to Departmental Representative within 5 days of test and with Cx report.

1.24 EXTENT OF VERIFICATION

- .1 Laboratory areas:
 - .1 Provide manpower and instrumentation to verify up to 100% of reported results.

- .2 Elsewhere:
 - .1 Provide manpower and instrumentation to verify up to 30% of reported results, unless specified otherwise in other sections.
- .3 Number and location to be at discretion of Departmental Representative.
- .4 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .5 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.
- .6 Perform additional commissioning until results are acceptable to Departmental Representative.

1.25 REPEAT VERIFICATIONS

- .1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive Departmental Representative's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Departmental Representative deems Contractor's request for second verification was premature.

1.26 SUNDRY CHECKS AND ADJUSTMENTS

- .1 Make adjustments and changes which become apparent as Cx proceeds.
- .2 Perform static and operational checks as applicable and as required.

1.27 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.
- .2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.28 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 to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.29 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.30 TRAINING

- .1 In accordance with Section 01 79 00 – Demonstration and Training.

1.31 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

- .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.32 OCCUPANCY

- .1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

1.33 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:
 - .1 Accuracy complies with these specifications.
 - .2 Calibration certificates have been deposited with Departmental Representative.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.34 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application tolerances:
 - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/-10% of specified values.
- .2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within +/-2% of recorded values.

1.35 OWNER'S PERFORMANCE TESTING

- .1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing 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 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-14, Concrete Materials and Methods of Concrete Construction
 - .2 CSA-O86S1-14, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.
 - .3 CSA O121-M1978(R2013), Douglas Fir Plywood.
 - .4 CSA O151-09(R2014), Canadian Softwood Plywood.
 - .5 CSA O153-13, Poplar Plywood.
 - .6 CAN3-O188.0-M78, Standard Test Methods for Mat-Formed Wood Particleboards and Waferboard.
 - .7 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.
 - .8 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
 - .9 CAN/CSA-S269.3-M92(R2013), Concrete Formwork.
 - .10 CAN/CSA-O325.0-92(R2003), Construction Sheathing.
- .2 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings for formwork and falsework.
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.
- .3 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- .4 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.
- .5 When slip forming or flying forms are used, submit details of equipment and procedures for review by Departmental Representative.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling

- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Divert wood materials from landfill to a recycling facility as approved by Departmental Representative.
- .4 Divert plastic materials from landfill to a recycling facility as approved by Departmental Representative.
- .5 Divert unused form release material from landfill to an official hazardous material collections site as approved by the Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, CSA O437 Series and CSA-O153.
- .2 Pan forms: removable as indicated.
- .3 Use 19mm plywood for all framing.
- .4 Form release agent: biodegradable, non-toxic, and low VOC.
- .5 Form stripping agent: colourless mineral oil, low VOC, biodegradable, non-toxic, free of kerosene, with viscosity between 70 and 110s Saybolt Universal at 40 degrees C, flashpoint minimum 150 degrees C, open cup.
- .6 Falsework materials: to CSA-S269.1.

Part 3 Execution

3.1 FABRICATION AND ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Obtain Departmental Representative's approval for use of earth forms framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect falsework in accordance with CSA S269.1 and COFI Exterior Plywood for Concrete Formwork.
- .5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.
- .6 Do not place shores and mud sills on frozen ground.
- .7 Provide site drainage to prevent washout of soil supporting mud sills and shores.

- .8 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .9 Align form joints and make watertight.
 - .1 Keep form joints to minimum.
- .10 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .11 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
 - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .12 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Remove formwork as soon as possible after concrete has attained adequate strength to support its own weight and superimposed loads, without cracking or deflecting excessively in order to facilitate effective finishing, but not earlier than 30 hours after placement.
- .2 Remove formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 10 00 – Concrete Forms and Accessories.
- .2 Section 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCE STANDARDS

- .1 CSA International
 - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A23.3-14, Design of Concrete Structures.
 - .3 CSA-G30.18-09(R2014), Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA-G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .6 CSA W186-M1990(R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .2 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Prepare and submit reinforcement shop drawings in accordance with RSIC Manual of Standard Practice.
- .2 Shop Drawings:
 - .1 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .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 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .4 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
- .5 Deformed steel wire for concrete reinforcement: to ASTM A82/A82M.
- .6 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .7 Mechanical splices: subject to approval of Departmental Representative.
- .8 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2.
- .2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.
- .2 Upon request inform Departmental Representative of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on placing drawings in accordance with CSA-A23.1/A23.2.

- .2 Epoxy new reinforcement into existing mechanical room concrete slab.
- .3 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.

3.3

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 Division 01 requirements.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 20 00 – Concrete Reinforcing.

1.2 REFERENCE STANDARDS

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-19.24-M90, Multicomponent, Chemical-Curing Sealing Compound.
- .2 CSA International
 - .1 CSA-A23.1/A23.2-2014, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .3 CAN/CSA-G30.18-M92(R2007), Billet-Steel Bars for Concrete Reinforcement.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide testing results for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .2 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

1.4 QUALITY ASSURANCE

- .1 Provide to Departmental Representative, 4 weeks minimum prior to starting concrete work, valid and recognized certificate from plant delivering concrete.
 - .1 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
 - .1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by the Departmental Representative.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 Products

2.1 DESIGN CRITERIA

- .1 Alternative 1 - Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

2.2 PERFORMANCE CRITERIA

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.3 MATERIALS

- .1 Cement: to CSA A3001, Type GU.
- .2 Water: to CSA A23.1/A23.2.
- .3 Reinforcing bars: to CAN/CSA-G30.18, Grade 400.

2.4 MIXES

- .1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance.
 - .2 Provide concrete mix to meet following hard state requirements:
 - .1 Durability and class of exposure: N.
 - .2 Compressive strength at 28 days: 35MPa minimum.
 - .3 Intended application: housekeeping pad.
 - .4 Max. Aggregate size 20mm
 - .3 Concrete supplier's certification.
 - .4 Provide quality management plan to ensure verification of concrete quality to specified performance.

Part 3 Execution

3.1 PREPARATION

- .1 Provide Departmental Representative 48 hours notice before each concrete pour.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of rehandling, and without damage to existing structure or Work.
- .4 Protect previous Work from staining.

- .5 Clean and remove stains prior to application of concrete finishes.

3.2 INSTALLATION/APPLICATION

- .1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2.
- .2 Sleeves and inserts:
 - .1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in.
 - .2 All exposed concrete edges shall receive a 20mm chamfer.

3.3 FINISHES

- .1 Formed surfaces exposed to view: sack rubbed finish in accordance with CSA A23.1/A23.2.
- .2 Equipment pads: provide smooth trowelled surface.

3.4 CURING

- .1 Use curing compounds compatible with applied finish on concrete surfaces free of bonding agents and to CSA A23.1/A23.2.

3.5 SITE TOLERANCES

- .1 Concrete finishing tolerance to CSA A23.1/A23.2.

3.6 FIELD QUALITY CONTROL

- .1 Concrete testing: to CSA A23.1/A23.2 by testing laboratory designated and paid for by the Contractor. A minimum of three (3) concrete cylinders shall be obtained and tested at each concrete pour. Test results shall be submitted to the Departmental Representative.

3.7 CLEANING

- .1 Use trigger operated spray nozzles for water hoses.
- .2 Designate cleaning area for tools to limit water use and runoff.
- .3 Cleaning of concrete equipment to be done in accordance with local requirements.
- .4 Waste Management:
 - .1 Divert unused concrete materials from landfill to local facility after receipt of written approval from Departmental Representative.
 - .2 Provide appropriate area on job site where concrete trucks and be safely washed.
 - .3 Divert admixtures and additive materials from landfill to approved official hazardous material collections site after receipt of written approval from Departmental Representative.
 - .4 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Section 07 92 00 – Joint Sealants
- .2 Section 22 05 00 – Common Work Results for Mechanical.
- .3 American National Standards Institute (ANSI)
 - .1 ANSI/NPA A208.1-16, Particleboard.
 - .2 ANSI/NPA A208.2-16, Medium Density Fiberboard (MDF) for Interior Applications.
 - .3 ANSI/HPVA HP-1-16, Standard for Hardwood and Decorative Plywood.
- .4 Architectural Woodwork Manufacturers Association of Canada (AWMAC), Architectural Woodwork Institute (AWI) and Woodwork Institute (WI).
 - .1 AWMAC/WI North American Architectural Woodwork Standards, NAAWS Edition 3.1-2017.
- .5 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- .6 CSA International
 - .1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.
 - .2 CSA O112.4 SERIES-M1977(R2006), Standards for Wood Adhesives.
 - .3 CSA O121-17, Douglas Fir Plywood.
 - .4 CSA O151-17, Canadian Softwood Plywood.
 - .5 CSA O153-13(R2017), Poplar Plywood.
 - .6 CAN/CSA-Z809-16, Sustainable Forest Management.
- .7 Forest Stewardship Council (FSC)
 - .1 FSC-STD-CAN-1-2018 V1-0 EN, FSC National Forest Stewardship Standard of Canada.
 - .2 FSC-STD-20-002-2009, Structure and Content of Forest Stewardship Standards V3-0.
- .8 Green Seal Environmental Standards (GS).
 - .1 GS-11-2015, Edition 3.2, Paints and Coatings.
 - .2 GS-36-2013, Commercial Adhesives.
- .9 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).

- .10 National Electrical Manufacturers Association (NEMA)
 - .1 ANSI/NEMA LD-3-05, High-Pressure Decorative Laminates (HPDL).
- .11 National Hardwood Lumber Association (NHLA)
 - .1 Rules for the Measurement and Inspection of Hardwood and Cypress 1998.
- .12 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber GR 2017.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for architectural woodwork and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit two copies of WHMIS SDS.

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 to CSA and ANSI standards.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .1 Protect millwork against dampness and damage during and after delivery.
 - .2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect architectural woodwork from nicks, scratches, and blemishes.
- .4 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Softwood lumber: unless specified otherwise, S4S, S-DRY graded and stamped in accordance with following standards:
 - .1 CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 AWMAC/WI NAAWS custom grade, moisture content as specified.
 - .4 CAN/CSA-Z809, SFI or Forestry Stewardship Council (FSC) certified.
- .2 Machine stress-rated lumber is acceptable for all purposes.
- .3 Hardwood lumber: moisture content 11 % or less in accordance with following standards:
 - .1 National Hardwood Lumber Association (NHLA).
 - .2 AWMAC/WI NAAWS premium grade, moisture content as specified.
- .4 Douglas fir plywood (DFP): to CSA O121, standard construction, FSC certified.
 - .1 Plywood resin to contain no added urea-formaldehyde.
- .5 Canadian softwood plywood (CSP): to CSA O151, standard construction, FSC certified.
 - .1 Plywood resin to contain no added urea-formaldehyde.
- .6 Hardwood plywood: to ANSI/HPVA HP-1, FSC certified.
 - .1 Plywood resin to contain no added urea-formaldehyde.
- .7 Poplar plywood (PP): to CSA O153, standard construction, FSC certified.
 - .1 Plywood resin to contain no added urea-formaldehyde.
- .8 Interior mat-formed wood particleboard: to ANSI/NPA A208.1, FSC certified.
 - .1 Particleboard resin to contain no added urea-formaldehyde.
- .9 Birch plywood: to AWMAC/WI NAAWS Paint Grade FSC certified.
 - .1 Plywood resin to contain no added urea-formaldehyde.
- .10 Fibreboard must contain less than 10% roundwood by weight, using weighted average over three month period at manufacturing locations.
 - .1 Fibreboard resin to contain no added urea-formaldehyde.
 - .2 FSC certified.
- .11 Hardboard:
 - .1 To CAN/CGSB-11.3, FSC certified.
 - .2 Hardboard resin to contain no added urea-formaldehyde.
- .12 MDF (medium density fibreboard) core: to ANSI/NPA A208.2, density 769 kg/m², FSC certified.

- .1 Medium density fibreboard performance requirements to: ANSI/NPA A208.2.
- .2 MDF resin to contain no added urea-formaldehyde.
- .13 Laminated plastic for flatwork: to NEMA LD3, Grade VGL, to match existing.
- .14 Nails and staples: to CSA B111.
- .15 Wood screws: stainless steel, type and size to suit application.
- .16 Splines: metal.

2.2 MANUFACTURED UNITS

- .1 Casework:
 - .1 Fabricate caseworks to AWMAC/WI NAAWS premium quality grade.
 - .2 Furring, blocking, nailing strips, grounds and rough bucks and sleepers.
 - .1 Board sizes: "standard" or better grade.
 - .2 Dimension sizes: "standard" light framing or better grade.
 - .3 Urea-formaldehyde free.
 - .4 Casework panels and doors to match existing.

2.3 FABRICATION

- .1 Set nails and countersink screws apply stained wood filler to indentations, sand smooth and leave ready to receive finish.
- .2 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
- .3 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .4 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .5 Apply laminated plastic liner sheet to interior of cabinetry where required.

2.4 FINISHING

- .1 Finish to match existing millwork.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for architectural woodwork installation in accordance with manufacturer's instructions.

3.2 INSTALLATION

- .1 Do architectural woodwork to AWMAC/WI NAAWS.
- .2 Install prefinished millwork at locations shown on drawings.
 - .1 Position accurately, level, plumb straight.
- .3 Fasten and anchor millwork securely.
 - .1 Supply and install heavy duty fixture attachments for wall mounted cabinets.
- .4 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.
- .5 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of sealant in accordance with Section 07 92 00.
- .6 Apply bituminous coating over wood framing members in contact with masonry or cementitious construction.
- .7 Fit hardware accurately and securely in accordance with manufacturer's written instructions.
- .8 Site apply laminated plastic to units as indicated.
 - .1 Adhere laminated plastic over entire surface.
 - .2 Make corners with hairline joints.
 - .3 Use full sized laminate sheets.
 - .4 Slightly bevel arises.
- .9 For site application, offset joints in plastic laminate facing from joints in core.

3.3 CLEANING

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment
 - .1 Clean millwork and cabinet work surfaces.
 - .2 Remove excess glue from surfaces.
- .3 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Protect millwork and cabinet work from damage until final inspection.
- .2 Protect installed products and components from damage during construction.

- .3 Repair damage to adjacent materials caused by architectural woodwork installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2015 (NBC).
 - .2 National Fire Code of Canada 2015 (NFC).
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S115:2018, Fire Tests of Fire stop Systems.
 - .2 CAN/ULC-S101-14, Standard Methods for Fire Endurance Tests of Building Construction and Materials.
 - .3 CAN/ULC-S102:18, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 DEFINITIONS

- .1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.
- .4 Tightly Fitted; (ref: NBC Division B Part 3.1.9.1(1) and 9.10.9.6(1)): penetrating items that are cast in place in buildings of non-combustible construction or have "0" annular space in buildings of combustible construction.
 - .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.
 - .2 Construction details should accurately reflect actual job conditions.

- .4 Samples:
 - .1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.
- .5 Quality assurance submittals: submit following in accordance with Section 01 45 00 – Quality Control.
 - .1 Test reports: in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.4 QUALITY ASSURANCE

- .1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with Departmental Representative in accordance with Section 01 32 16.19 – Construction Progress Schedule – Bar (GANTT) Chart to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building sub-trades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
- .2 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, 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 Upon completion of Work, after cleaning is carried out.
- .3 Comply with all requirements of the National Fire Code of Canada 2015 (NFC), including all subsequent revisions, issued by the National Research Council of Canada, Ottawa.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate, ULC markings.

- .2 Storage and Protection:
 - .1 Store materials in dry location indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20 – Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Fire stopping and smoke seal systems: in accordance with CAN/ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN/ULC-S115 and not to exceed opening sizes for which they are intended and conforming to specified special requirements described in PART 3.
- .2 Service penetration assemblies: systems tested to CAN/ULC-S115.
- .3 Service penetration fire stop components: certified by test laboratory to CAN/ULC-S115.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 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.
- .10 Sealants for vertical joints: non-sagging.

2.2 MECHANICAL FIRESTOP SEALS

- .1 Use where required to maintain fire separations.
- .2 Product is an intumescent mechanical seal with a slide surface that guides piping as it moves through the riser hole.
- .3 UL listed.
- .4 Rated to match fire separation.

Part 3 Execution

3.1 GENERAL

- .1 All penetrations through floors and walls shall be fire stopped.
- .2 Fire stop material will be flexible-type only.
- .3 Uninsulated unheated pipes not subject to movement: no special preparation.
- .4 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fire stopping material or installation.
- .5 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers at fire separation.

3.2 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.3 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
 - .1 Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.4 INSTALLATION

- .1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

3.5 SPECIAL REQUIREMENTS

- .1 Location of special requirements for fire stopping and smoke seal materials at openings and penetrations in fire resistant rated assemblies are as follows:

- .1 Non-dust generation: at location.
- .2 Movement: as indicated.
- .3 1 ½ hour rating except as indicated

3.6 SEQUENCES OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by Departmental Representative.
- .2 Install floor fire stopping before interior partition erections.
- .3 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.
- .4 Mechanical pipe insulation: certified fire stop system component.
 - .1 Ensure pipe insulation installation precedes fire stopping.

3.7 FIELD QUALITY CONTROL

- .1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

3.8 CLEANING

- .1 Proceed in accordance with Section 01 74 00 – Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.9 SCHEDULE

- .1 Fire stop 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 and precast concrete panels.
 - .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 Rigid ducts: greater than 129 cm²: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials, preparation and application for caulking and sealants.

1.2 REFERENCE STANDARDS

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C834-17, Standard Specification for Latex Sealants.
 - .2 ASTM C919-19, Standard Practice for Use of Sealants in Acoustical Applications.
 - .3 ASTM C920-18, Standard Specification for Elastomeric Joint Sealants.
- .2 Canadian General Standards Board (CGSB)
 - .1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
 - .2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
 - .3 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .4 General Services Administration (GSA) - Federal Specifications (FS)
 - .1 FS-SS-S-200-E(2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .6 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .7 Sealant, Waterproofing & Restoration Institute (SWRI)
 - .1 Product Validation Program

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00.
- .2 Manufacturer's product to describe.
 - .1 Caulking compound.

- .2 Primers.
- .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .3 Submit samples in accordance with Section 01 33 00.
- .4 Submit duplicate samples of each type of material and colour.
- .5 Cured samples of exposed sealants for each color where required to match adjacent material.
- .6 Submit manufacturer's instructions in accordance with Section 01 33 00.
- .1 Instructions to include installation instructions for each product used.

1.4 QUALITY ASSURANCE/MOCK-UP

- .1 Construct mock-up in accordance with Section 01 45 00.
- .2 Construct mock-up to show location, size, shape and depth of joints complete with back-up material, primer, caulking and sealant.
- .3 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
- .4 Locate where directed.
- .5 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with sealant work.
- .6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work. Approved mock-up may remain as part of finished Work. Remove mock-up and dispose of materials when no longer required and when directed by Departmental Representative.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with Section 01 61 00.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Place materials defined as hazardous or toxic in designated containers.
- .5 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .6 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .7 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Departmental Representative.
- .8 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.
- .9 Fold up metal banding, flatten, and place in designated area for recycling.

1.7 PROJECT CONDITIONS

- .1 Environmental Limitations:
 - .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°C.
 - .2 When joint substrates are wet.
- .2 Joint-Width Conditions:
 - .1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- .3 Joint-Substrate Conditions:
 - .1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Safety Data Sheets (SDS) acceptable to Labour Canada.
- .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 SEALANT MATERIALS

- .1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.
- .3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Sealant Type 1 - Urethane One Part, Non-Sag:
 - .1 To ASTM C920, Type S, Grade NS, Class 25, SWRI validated; CAN/CGSB-19.13, Type 2.
 - .2 Joint movement $\pm 25\%$ maximum.
- .2 Sealant Type 2 - Urethane, One Part, Self-Leveling:
 - .1 To ASTM C920, Type S, Grade P, SWRI validated or CAN/CGSB-19.13, Type 1.
 - .2 Joint movement $\pm 25\%$ maximum.
- .3 Sealant Type 3 - Urethanes, Two Part, Non-Sag:
 - .1 To ASTM C920, Type M, Grade NS, Class 25; CAN/CGSB-19.24, Type 2, Class B.
 - .2 Joint movement: $\pm 25\%$ maximum.
- .4 Sealant Type 4 - Acrylic Latex, One Part:
 - .1 To ASTM C834.
- .5 Sealant Type 5 - Acoustical sealant:
 - .1 To ASTM C834.
- .6 Sealant Type 6 - Silicone, One Part, Mildew Resistant:
 - .1 To ASTM C920, Type S, Grade NS, Class 25, SWRI validated.
- .7 Preformed Compressible and Non-Compressible back-up materials.
 - .1 Polyethylene, Urethane, Neoprene or Vinyl Foam.
 - .1 Extruded open or closed cell foam backer rod.
 - .2 Size: oversize 30 to 50%.
 - .2 Neoprene or Butyl Rubber.
 - .1 Round solid rod, Shore A hardness 70.

- .3 High Density Foam.
 - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
- .4 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 SEALANT SELECTION

- .1 Perimeters of exterior openings where frames meet exterior facade of building (i.e. brick, block, precast masonry): Sealant type: 1 or 2.
- .2 Seal interior perimeters of exterior openings as detailed on drawings: Sealant type: 3.
- .3 Perimeters of interior frames, as detailed and itemized: Sealant type: 4.
- .4 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, waterclosets, basins, vanities): Sealant type: 6.
- .5 Exposed interior control joints in drywall: Sealant type: 4.

2.4 JOINT CLEANER

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.
- .2 Primer: as recommended by manufacturer.

Part 3 Execution

3.1 PROTECTION

- .1 Protect installed Work of other trades from staining or contamination.

3.2 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.

3.3 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.

3.4 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.

3.5 MIXING

- .1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 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.
- .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 Cleanup.
 - .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 RELATED REQUIREMENTS

- .1 Section 09 91 00 - Painting.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C473-19, Standard Test Methods for Physical Testing of Gypsum Panel Products.
 - .2 ASTM C475/C475M-17, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .3 ASTM C514-04(2014), Standard Specification for Nails for the Application of Gypsum Board.
 - .4 ASTM C557-03(2017), Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
 - .5 ASTM C840-19b, Standard Specification for Application and Finishing of Gypsum Board.
 - .6 ASTM C919-19, Standard Practice for Use of Sealants in Acoustical Applications.
 - .7 ASTM C920-18, Standard Specification for Elastomeric Joint Sealants.
 - .8 ASTM C954-18, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
 - .9 ASTM C1002-18, 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.
 - .10 ASTM C1047-19, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .11 ASTM C1177/C1177M-17, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - .12 ASTM C1178/C1178M-18, Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.
 - .13 ASTM C1278/C1278M-17, Standard Specification for Fiber-Reinforced Gypsum Panel.
 - .14 ASTM C1280-18, Standard Specification for Application of Gypsum Sheathing.
 - .15 ASTM C1396/C1396M-17, Standard Specification for Gypsum Board.
- .2 Association of the Wall and Ceilings Industries International (AWCI)
 - .1 AWCI Levels of Gypsum Board Finish 101a-97.
- .3 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.
- .2 CAN/CGSB-71.25-M88, Adhesives, for Bonding Drywall to Wood Framing and Metal Studs.
- .4 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102:2018-REV1, Surface Burning Characteristics of Building Materials and Assemblies.

1.3 QUALITY ASSURANCE

- .1 Gypsum board materials supplied for use on this project shall not contain hydrogen sulphide, sulphur dioxide, sulphur or any sulphur byproducts.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in original packages, containers or bundles bearing manufacturers brand name and identification.
- .2 Store materials inside, level, under cover. Keep dry. Protect from weather, other elements and damage from construction operations and other causes.
- .3 Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.
- .4 Gypsum board that becomes damp, wet or contaminated with dust or dirt shall be considered damaged materials. Replace damaged materials at no additional cost to the Contract.
- .5 When shipping, handling and storing gypsum board protect from weather; take all precautions to prevent moisture or dust contamination.
 - .1 Wrap gypsum board in waterproof covers at plant or distribution centre prior to shipping.
 - .2 Load gypsum board in indoor facilities, and ship to project site in enclosed vehicles only. Do not use flat-bed trucks exposed to the elements.
 - .3 Unload at project site only during dry weather.
 - .4 Store gypsum board indoors in dry location, off concrete floors.

1.5 SITE ENVIRONMENTAL REQUIREMENTS

- .1 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.
- .2 Apply board and joint treatment to dry, frost free surfaces.
- .3 Ventilation: Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Comply with Section 01 74 20.

Part 2 PRODUCTS

2.1 GYPSUM BOARD

- .1 Standard board: to ASTM C1396/C1396M, regular and Type X, thickness indicated, 1220 mm (4'-0") wide x maximum practical length, ends square cut, edges beveled.
- .2 Backing board and coreboard: to ASTM C1396/C1396M, regular and fire-rated, thickness indicated, squared edges.
- .3 Water resistant board: to ASTM C1396/C1396M, regular and fire-rated, thickness indicated, 1220 mm wide x maximum practical length. Moisture and mould resistant.
- .4 Glass mat gypsum board sheathing - regular: to ASTM C1177/C1177M, of thickness indicated, 1220 mm wide x maximum practical length.

2.2 METAL FURRING AND SUSPENSION SYSTEMS

- .1 Metal furring, runners, hangers, tie wires, inserts, anchors: to ASTM C1280, galvanized.
- .2 Drywall furring channels: 0.5 mm thick, galvanized steel channels for screw attachment of gypsum board.
- .3 Resilient clips: 0.5 mm thick, galvanized steel channels for resilient attachment of gypsum board.
- .4 Wire hangers: minimum 1.0 mm thick, galvanized mild steel.

2.3 ACCESSORIES

- .1 Steel drill screws: to ASTM C954 and ASTM C1002, corrosion resistant for water resistant gypsum board.
- .2 Stud adhesive: to CAN/CGSB-71.25.
- .3 Laminating compound: as recommended by manufacturer, asbestos free.
- .4 Casing beads, corner beads fill type: to ASTM C1047, 0.455mm commercial grade sheet steel, zinc coated, perforated flanges; one piece length per location. Plastic casing bead and corner beads not acceptable.
- .5 Corner trim: extruded aluminum 6063 T5 alloy, 31mm x 31mm x 3000mm length, powder paint applied over chemical conversion coating and primer.
- .6 Joint compound and joint tape: to ASTM C475/C475M, asbestos free.
- .7 Acoustical sealant: to ASTM C834.
 - .1 Purpose made, acoustical underlayment in 175mm x 175mm x 3mm thick pads.
 - .2 For sound damping around outlet/switch boxes, conduit, pipes, ducts and other items penetrating sound rated or sound insulation wall and ceiling assemblies.
- .8 Insulating strip: rubberized, moisture resistant, 6mm thick closed cell neoprene strip, 12mm wide, with self-sticking permanent adhesive on one face, lengths as required.
- .9 Acoustic batt insulation: batt and blanket mineral fibre insulation to ASTM C665, Type 1 (no membrane), thickness indicated, formaldehyde free.

Part 3 EXECUTION

3.1 ERECTION

- .1 Do application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.
- .2 Do application of gypsum board sheathing in accordance with ASTM C1280.
- .3 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250mm.
- .4 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.
- .5 Install gypsum board with face side out.
- .6 Do not install damaged or damp boards.
- .7 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.2 SUSPENDED AND FURRED CEILINGS

- .1 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C840, except where indicated or specified otherwise.
- .2 Support light fixtures by providing additional ceiling suspension hangers within 150mm of each corner and at maximum 600mm around perimeter of fixture.
- .3 Install work level to tolerance of 1:1200
- .4 Provide additional ceiling suspension hangers to support all items suspended from ceilings such as grilles, diffusers, etc. Refer to drawings and specifications and co-ordinate with other trades for specific items.
- .5 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.
- .6 Install 19mm x 64mm furring channels parallel to, and at exact locations of steel stud partition header track.
- .7 Provide casing beads around perimeter of suspended gypsum board ceilings and adjacent walls. Make joint tight fitting to wall.
- .8 Furr for gypsum board faced vertical bulkheads within or at termination of ceilings.
- .9 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

3.3 WALL FURRING

- .1 Install wall furring for gypsum board wall finishes in accordance with ASTM C840, except where indicated otherwise.
- .2 Frame openings and around built-in equipment on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

- .3 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

3.4 GYPSUM BOARD APPLICATION

- .1 Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical work are approved.
- .2 Apply single layer gypsum board to furring or framing using screw fasteners. Apply double layer gypsum board to furring or framing using screw fasteners for first layer, laminating adhesive for second layer. Maximum spacing of screws 300mm on centre.
 - .1 Single-Layer Application:
 - .1 Apply gypsum board on ceilings prior to application of walls in accordance with ASTM C840.
 - .2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
 - .2 Double-Layer Application:
 - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
 - .2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250mm.
 - .3 Apply base layers at right angles to supports unless otherwise indicated.
 - .4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 10" with base layer joints.
- .3 Apply single and double layer of gypsum board to concrete and concrete block surfaces, where indicated, using laminating adhesive.
 - .1 Comply with gypsum board manufacturer's recommendations.
 - .2 Brace or fasten gypsum board until fastening adhesive has set.
 - .3 Mechanically fasten gypsum board at top and bottom of each sheet.
- .4 Exterior soffits and ceilings: install exterior gypsum board perpendicular to supports; stagger end joints over supports. Install with 6mm gap where boards abut other work.
- .5 Install gypsum board full height of stud framing where studs extend to underside of overhead structures, floors or roof decks, except where otherwise indicated.
- .6 Where gypsum board is installed above finished ceilings, fit work tight to all items penetrating through gypsum board. Seal around full perimeter of items with sealant. For fire rated assemblies and smoke barriers use fire stopping in accordance with Section 07 84 00, and acoustical sealant elsewhere.

3.5 FIRE RATED ASSEMBLIES

- .1 Construct fire rated assemblies where indicated
- .2 Apply Type X (fire rated) gypsum board where indicated, to obtain fire ratings as indicated or required.

- .3 For fire rated partitions and ceilings apply first and second layers with screw fasteners. No adhesives permitted. Screw spacing as follows:
 - .1 Ceilings: 150mm on centre around perimeter and 300mm on centre in field of sheet.
 - .2 Walls: 200mm on centre around perimeter and 300mm on centre in field of sheet.
- .4 At door and window openings in fire rated walls and partitions install gypsum board filler full width and length of opening to cover stud header as specified in National Building Code.
- .5 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250mm.
- .6 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.
- .7 Install gypsum board with face side out.
- .8 Do not install damaged or damp boards.
- .9 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.
- .10 Provide perimeter relief control joints in fire rated partitions in accordance with GA - 600.

3.6 SOUND RATED/ACOUSTICALLY INSULATED Partitions

- .1 Install acoustic insulation in sound rated and sound insulated partitions and ceiling assemblies, of thickness indicated or required to provide sound rating indicated.
- .2 Install insulation tight between studs, full height of partition.
- .3 Cut and trim insulation to fit tight around protrusions, electrical boxes, and other obstructions. Leave no voids or gaps. Do not compress batts.
- .4 Apply 6mm – 10mm round bead of acoustical sealant to seal perimeter of sound rated partitions to prevent noise transmission and to provide required sound rating
- .5 Seal sound-rated partitions:
 - .1 On both sides where facings abut dissimilar materials;
 - .2 Around perimeter, in the angle formed by panels and abutting dissimilar materials;
 - .3 At intersections;
 - .4 At panel terminations in door and window frames; and
 - .5 At control joint locations before attaching the control joint to the panels.
- .6 Seal full perimeter of openings for electrical boxes, ducts, conduit and other cut-outs and penetrations in partitions where perimeter sealed with acoustical sealant.
- .7 Seal joints around penetrations in sound rated partitions using glass fibre insulation to fill joints completely.

- .8 Apply continuous beads of acoustical sealant around all openings formed for outlets, lights, etc.
- .9 Cut gypsum panels with 3mm maximum relief at perimeter to receive sealant. Install before sealant skins.
- .10 Extrude a full bead of acoustical sealant into each joint between first layer of wallboard and floor or other adjoining surface.
- .11 Sound dampening putty:
 - .1 Seal around back of outlet and switch boxes with sound dampening putty.
 - .2 Clean surfaces of dust, dirt and other foreign matter that may inhibit adhesion.
 - .3 Cover back and all sides of boxes with putty and overlap and seal putty to studs or back of gypsum board.
 - .4 Cut putty pads to fit and seal around conduits and wiring entering box ensuring full sound seal.
 - .5 Pleat extra material at corners.
 - .6 Press putty pads firmly against substrate ensure full adhesion and coverage.

3.7 ACCESSORIES

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces wherever possible. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges.
- .2 Secure casing beads, corner beads and trim with screws. Staples and crimping not permitted. Secure at 300mm on centre.
- .3 Install casing beads around perimeter of suspended ceilings and bulkheads, around openings and where gypsum board abuts a dissimilar material.
- .4 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and elsewhere indicated.
- .5 Seal joints with acoustic sealant.
- .6 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

3.8 TRIMS, REVEALS & MOULDINGS

- .1 Aluminum reveals and trims:
 - .1 Extruded aluminum of design, profile and function as indicated. Select trims to suit reveal width and depth in 3000mm lengths to reduce the number of end joints. Complete with factory formed pre-welded and soldered, mitred intersections where reveal changes direction or abuts other trim. Attachment flanges perforated at 200mm on centre for attachment to structure and slotted to accept bedding compound.

3.9 CONTROL JOINTS

- .1 Construct control joints set in gypsum board facing and supported independently on both sides of joint.

- .1 For joints moving in only one plane use preformed units.
- .2 For joints moving in multiple planes use back-to-back casing beads.
- .2 Install continuous 6 mil polyethylene dust barrier behind and across control joints.
- .3 Install control joints, plumb, straight and true with not more than 1 mm gap.
- .4 Use gypsum board with tapered edges on both sides of control joint. Tape, fill and sand casing beads flush with adjacent surface.
- .5 Locate control joints where indicated, and at the following locations:
 - .1 where partitions or furring abuts a structural element or dissimilar wall or ceiling.
 - .2 where a ceiling or bulkhead abuts a structural element or dissimilar wall or other vertical penetration.
 - .3 construction changes within plane of the partition or ceiling.
 - .4 partition or furring runs exceed 9000mm
 - .5 ceiling dimensions exceed 15000mm for gypsum board in either direction
 - .6 wings of "L", "U" and "T" shaped ceiling areas are joined.
 - .7 expansion or control joints occur in structural elements of the building.
- .6 On walls locate control joints over door and window openings wherever possible. Align control joint with corner of frames.

3.10 EXPANSION JOINTS

- .1 Construct expansion joints as indicated, at building expansion joints and construction joints. Provide continuous polyethylene dust barrier.
- .2 Install expansion joints straight and true.

3.11 ACCESS DOORS

- .1 Install access doors to electrical and mechanical fixtures specified in respective Sections.
- .2 Rigidly secure frames to furring or framing systems

3.12 GYPSUM BOARD FINISHING

- .1 Do taping and filling to ASTM C840, except where indicated otherwise.
- .2 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 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.
- .4 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after painting is completed.
- .5 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .6 Sanding not require behind solid finishes and above finished ceilings.

- .7 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for painting or other thin finish coating including fabric wall coverings.

3.13 GYPSUM BOARD FINISH LEVELS

- .1 Finish gypsum board in accordance with the following finish levels for specific areas indicated.
- .2 Finish levels as defined in GA-214.
- .3 Where a fire resistance rating is required for the gypsum board assembly, details of construction and finishing shall be in accordance with reports of fire tests of assemblies that have met the fire-rating requirement, regardless of the finish level specified below.
- .4 Level 2:
 - .1 All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife or trowel, leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
 - .2 Location:
 - .1 Gypsum board in unfinished rooms (excluding service spaces).
- .5 Level 4:
 - .1 All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife or trowel, leaving a thin coating of joint compound over all joints and interior angles. In addition, two separate coats of joint compound shall be applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compounds shall be smooth and free of tool marks and ridges.
 - .2 Locations:
 - .1 Where gypsum board is to be painted.
 - .2 Gypsum board behind light-duty vinyl coated fabric wall coverings.
 - .3 For abuse resistant gypsum board apply purpose made primer-sealer.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 92 00 - Joint Sealants.
- .2 Section 09 22 16 – Gypsum Board Assemblies

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .2 ASTM C645-18, Standard Specification for Nonstructural Steel Framing Members.
 - .3 ASTM C754-18, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - .4 ASTM C920-18, Standard Specification for Elastomeric Joint Sealants.
 - .5 ASTM E90-09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - .6 ASTM E2638-10(2017), Standard Test Method for Objective Measurement of the Speech Privacy Provided by a Closed Room.
 - .7 ASTM F1267-18, Standard Specification for Metal, Expanded, Steel.
- .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 - 2019.
 - .1 MPI #26, Primer, Galvanized Metal, Cementitious.
- .4 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102:2018-REV1, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.
- .4 Partition assembly to be non-combustible construction and fire resistance rate where required.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .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 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect metal framing from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Non-load bearing channel stud framing: to ASTM C645, roll formed from thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board.
 - .1 0.53 mm for general interior framing
 - .2 0.91 mm for jamb studs
 - .3 Knock-out service holes at 460 mm centres.
- .2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height.
- .3 Non-load bearing truss stud framing system: to consist of:
 - .1 Floor track: snap-in type formed to hold studs securely in place at 50 mm intervals; fabricated from 0.5 mm thick steel sheet; size to suit studs.

- .2 Ceiling track: channel shaped track for use with stud shoes and 1.2 mm diameter double wire ties; size to suit studs.
- .3 After fabrication apply one shop coat of MPI #26 primer to steel surfaces.
 - .1 Descale and clean surfaces before painting.
- .4 Metal channel stiffener: 38 x 20 mm size, 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.
- .5 Acoustic insulation: mineral fibre batt, 40 kg/m³, Ecologo certified.
- .6 Acoustic insulation (semi-rigid): mineral fibre, semi-rigid board to ASTM C612, Type IVA, reinforced foil facing, density 64 kg/m³, Ecologo certified, NRC 0.90, FS 5 and SD 10 to CAN/ULC-S102. Foil tape: minimum 100 mm wide, compatible with foil facing.
- .7 Acoustical sealant: one part silicone to ASTM C920, primerless, Type S, Grade NS, Class 25, SWRI validated, Ecologo certified, maximum VOC 60 g/L., in accordance with Section 07 92 00.
- .8 Insulating strip: rubberized, moisture resistant 3 mm thick cork or foam strip, 12 mm wide, with self sticking adhesive on one face, lengths as required.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for non-structural metal framing application in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 ERECTION

- .1 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.
- .2 Install damp proof course under stud shoe tracks of partitions on slabs on grade.
- .3 Place studs vertically at 400 mm on centre and not more than 50 mm from abutting walls, and at each side of openings and corners.
 - .1 Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .4 Erect metal studding to tolerance of 1:1000.

- .5 Attach studs to bottom ceiling track using screws.
- .6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .7 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .8 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified.
 - .1 Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- .9 Install heavy gauge single jamb studs at openings.
- .10 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs.
 - .1 Secure track to studs at each end, in accordance with manufacturer's instructions.
 - .2 Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .11 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .12 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.
- .13 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .14 Extend partitions to ceiling height except where noted otherwise on drawings.
- .15 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.
 - .1 Use 50 mm leg ceiling tracks.
- .16 Install continuous insulating strips to isolate studs from uninsulated surfaces.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

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

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by non-structural metal framing application.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Architectural Painting Specifications Manual, Master Painters Institute (MPI), 2019.
- .2 Systems and Specifications Manual, SSPC Painting Manual, Volume Two, Society for Protective Coatings (SSPC).
- .3 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

1.2 QUALITY ASSURANCE

- .1 Contractor shall have a minimum of five years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .3 Conform to latest MPI requirements for interior painting work including preparation and priming.
- .4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- .5 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.
- .6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.
- .7 Standard of Acceptance:
 - .1 Walls: No defects visible from a distance of 1000 mm at 90° to surface.
 - .2 Ceilings: No defects visible from floor at 45° to surface when viewed using final lighting source.
 - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.3 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

- .1 Provide paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA Method 24) content levels.
- .2 Where indoor air quality (odour) is a problem, use only MPI listed materials having a minimum E2 rating.

1.4 SCHEDULING OF WORK

- .1 Submit work schedule for various stages of painting to Departmental Representative for approval. Submit schedule minimum of 48 hours in advance of proposed operations.
- .2 Obtain written authorization from Departmental Representative for any changes in work schedule.
- .3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.5 SUBMITTALS

- .1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be used in accordance with Section 01 33 00.
- .2 Submit WHMIS SDS - Safety Data Sheets.
- .3 Upon completion, submit records of products used. List products in relation to finish system and include the following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour number.
 - .4 MPI Environmentally Friendly classification system rating.
 - .5 Manufacturer's WHMIS Safety Data Sheets (SDS).

1.6 SAMPLES

- .1 Submit full range colour sample chips in accordance with Section 01 33 00.
- .2 Submit 200 x 300 mm sample panels of each paint finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards submitted on the following substrate materials:
 - .1 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
- .3 When approved, sample panels shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

1.7 QUALITY CONTROL

- .1 When requested by Departmental Representative, prepare and paint designated surface, area, room or item (in each colour scheme) to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

1.8 EXTRA MATERIALS

- .1 Submit maintenance materials in accordance with Section 01 78 00.
- .2 Submit one - four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.
- .3 Deliver to Contractor and store where directed.

1.9 DELIVERY, HANDLING AND STORAGE

- .1 Deliver, store and handle materials in accordance with Section 01 61 00.
- .2 Labels shall clearly indicate:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
- .3 Remove damaged, opened and rejected materials from site.
- .4 Provide and maintain dry, temperature controlled, secure storage.
- .5 Observe manufacturer's recommendations for storage and handling.
- .6 Store materials and supplies away from heat generating devices.
- .7 Store materials and equipment in a well ventilated area with temperature range 7°C to 30°C.
- .8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Departmental Representative.
- .10 Remove paint materials from storage only in quantities required for same day use.

- .11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- .12 Fire Safety Requirements:
 - .1 Provide one 9 kg Type ABC fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.10 SITE REQUIREMENTS

- .1 Heating, Ventilation and Lighting:
 - .1 Perform no painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application until paint has cured sufficiently.
 - .2 Where required, provide continuous ventilation for seven days after completion of application of paint.
 - .3 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.
 - .4 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities shall be provided by General Contractor.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Unless specifically pre-approved by the specifying body, Paint Inspection Agency and the applied product manufacturer, perform no painting work when:
 - .1 Ambient air and substrate temperatures are below 10°C.
 - .2 Substrate temperature is over 32°C unless paint is specifically formulated for application at high temperatures.
 - .3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.
 - .4 The relative humidity is above 85% or when the dew point is less than 3°C variance between the air/surface temperature.
 - .2 Perform no painting work when the maximum moisture content of the substrate exceeds:
 - .1 12% for concrete and masonry (clay and concrete brick/block).
 - .2 15% for wood.
 - .3 12% for plaster and gypsum board.
 - .3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".

- .4 Test concrete, masonry and plaster surfaces for alkalinity as required.
- .3 Surface and Environmental Conditions:
 - .1 Apply paint finish only 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 only to adequately prepared surfaces and to surfaces within moisture limits noted herein.
 - .3 Apply paint only when previous coat of paint is dry or adequately cured.
- .4 Additional Interior Application Requirements:
 - .1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.
 - .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.

1.11 WASTE MANAGEMENT AND DISPOSAL

- .1 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .2 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground the following procedures shall be strictly adhered to:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
 - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
 - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
- .3 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
- .4 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

Part 2 Products

2.1 MATERIALS

- .1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Paint materials for paint systems shall be products of a single manufacturer.
- .3 Only qualified products with E2 "Environmentally Friendly" rating are acceptable for use on this project.
- .4 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, shall:
 - .1 be water-based, water soluble, water clean-up.
 - .2 be non-flammable biodegradable.
 - .3 be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
 - .4 be manufactured without compounds which contribute to smog in the lower atmosphere.
 - .5 do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
- .5 Water-borne surface coatings must be manufactured and transported in a manner that steps of process, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).
- .6 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .7 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61.0°C or greater.
- .8 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:
 - .1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
 - .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
- .9 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.

- .10 Recycled water-borne surface coatings must contain 50% post-consumer material by volume.
- .11 Recycled water-borne surface coatings must not contain:
 - .1 Lead in excess of 600.0 ppm weight/weight total solids.
 - .2 Mercury in excess of 50.0 ppm weight/weight total product.
 - .3 Cadmium in excess of 1.0 ppm weight/weight total product.
 - .4 Hexavalent chromium in excess of 3.0 ppm weight/weight total product.
 - .5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.
- .12 The following must be performed on each batch of consolidated post-consumer material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.
 - .1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.
 - .2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.
 - .3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

2.2 COLOURS

- .1 Colour schedule will be based upon existing colours.
- .2 Selection of colours will be from manufacturer's full range of colours.
- .3 Where specific products are available in a restricted range of colours, selection will be based on the limited range.
- .4 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Departmental Representative's written permission.
- .2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- .3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

- .4 Thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Departmental Representative.
- .5 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.

2.4 GLOSS/SHEEN RATINGS

- .1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following values:

Gloss Level	Units @ 60°	Units @ 85°
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Category		
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G1 - matte finish	0 to 5	max. 10
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G2 - velvet finish	0 to 10	10 to 35
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G3 - eggshell finish	10 to 25	10 to 35
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G4 - satin finish	20 to 35	min. 35
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G5 - semi-gloss finish	35 to 70	
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G6 - gloss finish	70 to 85	
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G7 - high gloss finish	> 85	
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- .2 Gloss level ratings of painted surfaces to match existing.

2.5 INTERIOR PAINTING SYSTEMS

- .1 Concrete Masonry Units: smooth face block.
 - .1 INT 4.2A Latex semi-gloss finish.
 - .2 INT 4.2C Alkyd semi-gloss finish.
- .2 Galvanized Metal: doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.
 - .1 INT 5.3A Latex semi-gloss finish.
 - .2 INT 5.3C Alkyd semi-gloss finish (over cementitious primer).
- .3 Plaster and Gypsum Board: gypsum wallboard.
 - .1 INT 9.2A Latex eggshell finish (over latex sealer).
 - .2 INT 9.2B High performance architectural latex eggshell finish.
 - .3 INT 9.2C Alkyd eggshell finish (over latex sealer).

Part 3 Execution

3.1 GENERAL

- .1 Perform preparation and operations for interior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 EXISTING CONDITIONS

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Departmental Representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
 - .1 Stucco, Plaster and Gypsum Board: 12%.
 - .2 Concrete: 12%.
 - .3 Clay and Concrete Block/Brick: 12%.
 - .4 Wood: 15%.

3.3 PROTECTION

- .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 such 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.
- .4 Protect building occupants in and about the building.
- .5 Removal of electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings shall be done prior to undertaking any painting operations by General Contractor. Items shall be securely stored and re-installed after painting is completed by Contractor.
- .6 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .7 As painting operations progress, place "WET PAINT" signs in occupied areas to approval of Departmental Representative.

3.4 CLEANING AND PREPARATION

- .1 Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
 - .2 Wash surfaces with a biodegradable detergent and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly.
 - .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
 - .6 Use trigger operated spray nozzles for water hoses.
 - .7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.
- .2 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 pretreatment as soon as possible after cleaning and before deterioration occurs.
- .3 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
 - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
 - .2 Apply wood filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
- .4 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.
- .5 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. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes, blowing with clean dry compressed air, or vacuum cleaning.
- .6 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.
- .7 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

3.5 APPLICATION

- .1 Method of application to be as approved by Engineer. Apply paint by brush, roller or air sprayer. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
 - .1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.
 - .2 Work paint into cracks, crevices and corners.
 - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
 - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Departmental Representative.
 - .5 Remove runs, sags and brush marks from finished work and repaint.
- .3 Spray application:
 - .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
 - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
 - .3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
- .4 Brush out immediately all runs and sags.
 - .1 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.
- .5 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Engineer.
- .6 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .7 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .8 Sand and dust between coats to remove visible defects.
- .9 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
- .10 Finish inside of cupboards and cabinets as specified for outside surfaces.
- .11 Finish closets and alcoves as specified for adjoining rooms.

- .12 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 Unless otherwise specified, paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.
- .2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.
- .3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .5 Do not paint over nameplates.
- .6 Keep sprinkler heads free of paint.
- .7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .8 Paint fire protection piping red.
- .9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .10 Paint natural gas piping yellow.
- .11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
- .12 Do not paint interior transformers and substation equipment.

3.7 FIELD QUALITY CONTROL

- .1 Advise Departmental Representative when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

3.8 RESTORATION

- .1 Clean and re-install all hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.

- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Departmental Representative. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 For all hazardous products, submit Safety Data Sheets (SDS) in accordance with Section 01 35 29.06 – Health and Safety Requirements.
- .3 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for all new equipment.
 - .2 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Shop Drawings:
 - .1 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .2 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.
 - .3 In addition to transmittal letter referred to in Section 01 33 00 – Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Operation and Maintenance Data:
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .2 Operation data to include:
 - .1 Manufacturer's name, equipment type, model, year, capacity, and serial number.
 - .2 Control schematics for systems including environmental controls.
 - .3 Description of systems and their controls.
 - .4 Description of operation of systems at various loads together with reset schedules and seasonal variances.

- .5 Operation instruction for systems and component.
 - .6 Description of actions to be taken in event of equipment failure.
 - .7 Valves schedule and flow diagram.
 - .8 Colour coding chart.
 - .3 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.
 - .3 Recommended spare parts list.
 - .4 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.
 - .5 Approvals:
 - .1 Submit 2 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.
 - .6 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .3 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. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
 - .5 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 with Operating and Maintenance Manuals.
- .6 Submit copies of as-built drawings for inclusion in final TAB report.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Furnish spare parts 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.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00 – Common Product Requirements.
- .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 Store materials off ground, in dry location, indoors, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect all new equipment from nicks, scratches, and blemishes
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 FIELD QUALITY CONTROL

- .1 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.
 - .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.

3.3 DEMONSTRATION

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 Pumps
 - .2 Water heaters
 - .3 Backflow preventers
- .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, troubleshooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .4 Use operation and maintenance manual, as-built drawings, and audio-visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Departmental Representative will record these demonstrations on video tape for future reference.

3.4 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.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes , cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .3 Remove and Salvage: Detach items from existing construction and deliver them to Departmental Representative ready for reuse.
- .4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.
- .6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Action Submittals: Provide the following in accordance with Section 01 33 00 – Submittal Procedures before starting work of this Section:
 - .1 Construction Waste Management Plan (CWM Plan): Submit plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 20 – Waste Management and Disposal.
- .2 Landfill Records: Indicate receipt and acceptance of selective demolition waste and hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.
- .2 Scheduling: Account for Departmental Representative's continued occupancy requirements during selective demolition and schedule staged occupancy and worksite activities as a defined Activity item in accordance with Section 01 32 16.19 – Construction Progress Schedule – Bar (GANTT) Chart.

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements: Perform work of this Section in accordance with the following:

- .1 WSIB and Federal Workers' Compensation Service
- .2 Provincial/Territorial Occupational Health and Safety Standards and Programs and Government of Canada, Labour Program: Workplace Safety

1.5 SITE CONDITIONS

- .1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition at time of site examination before tendering.
- .2 Existing Hazardous Substances: Departmental Representative performed a hazardous substances assessment and it is not expected that hazardous substances will be encountered in the Work.
 - .1 Hazardous substances will be removed by a hazardous abatement specialist engaged by the Departmental Representative before start of the Work.
- .3 Existing Hazardous Substances: Departmental Representative has performed a hazardous substances assessment and identified materials requiring abatement as follows:
 - .1 Hazardous substances are as defined in the Hazardous Products Act.
 - .2 Hazardous substances will be removed by the Contractor as a part of the Contract before starting Work in accordance with work results described in Related Requirements listed above.
- .4 Discovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in the Work; immediately notify Departmental Representative if materials suspected of containing hazardous substances are encountered and perform the following activities:
 - .1 Refer to Section 01 41 00 – Regulatory Requirements for directives associated with specific material types.
 - .2 Hazardous substances will be as defined in the Hazardous Products Act.
 - .3 Stop work in the area of the suspected hazardous substances.
 - .4 Take preventative measures to limit users' and workers' exposure, provide barriers and other safety devices and do not disturb.
 - .5 Hazardous substances will be removed by Departmental Representative under a separate contract or as a change to the Work.
 - .6 Proceed only after written instructions have been received Departmental Representative.

1.6 SALVAGE AND DEBRIS MATERIALS

- .1 Demolished items become Contractor's property and will be removed from Project site; except for items indicated as being reused, salvaged, or otherwise indicated to remain Departmental Representative's property
- .2 Carefully remove materials and items designated for salvage and store in a manner to prevent damage or devaluation of materials.

Part 2 Products

2.1 MATERIALS

- .1 Plumbing Repair Materials: Use only new materials required for completion or repair matching materials damaged during performance of work of this Section; new materials are required to meet assembly or system characteristics as existing systems indicated to remain and carry CSA approval labels required by the Authority Having Jurisdiction.
- .2 Fire stopping Repair Materials: Use fire stopping materials compatible with existing fire stopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before tendering the Bid; Departmental Representative will not consider claims for extras for work or materials necessary for proper execution and completion of the contract that could have been determined by a site visit.

3.2 PREPARATION

- .1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:
 - .1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.
 - .2 Notify Departmental Representative and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.
 - .3 Prevent debris from blocking drainage inlets.
 - .4 Protect mechanical systems that must remain in operation.
- .2 Protection of Building Occupants: Sequence demolition work so that interference with the use of the building by the Departmental Representative and users is minimized and as follows:
 - .1 Prevent debris from endangering the safe access to and egress from occupied buildings.
 - .2 Notify Departmental Representative and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

3.3 EXECUTION

- .1 Coordinate requirements of this Section with the following:

- .1 Disconnect and cap mechanical services in accordance with requirements of local Authority Having Jurisdiction.
- .2 Do not disrupt active or energized utilities without approval of the Departmental Representative.
- .3 Erect and maintain dust proof and weather tight partitions to prevent the spread of dust and fumes to occupied building areas; remove partitions when complete.
- .4 Demolish parts of existing building to accommodate new construction and remedial work as indicated.
- .5 At end of each day's work, leave worksite in safe condition.
- .6 Perform demolition work in a neat and workmanlike manner:
 - .1 Remove any tools or equipment after completion of work and leave site clean and ready for subsequent renovation work.
 - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.

3.4 CLOSEOUT ACTIVITIES

- .1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) except where explicitly noted otherwise for materials being salvaged for re use in new construction.
- .2 Hazardous Substances Disposal: Arrange for disposal of hazardous substances.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 00 – Common Work Results For Mechanical.

1.2 REFERENCE STANDARDS

- .1 American Society of Sanitary Engineering (ASSE):
 - .1 ASSE 1071-2012, Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment.
- .2 CSA Group (CSA):
 - .1 CSA B64.10-17/B42.10.1-17, Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers
- .3 National Research Council (NRC):
 - .1 National Plumbing Code of Canada (NPC) 2015
- .4 NSF International (NSF):
 - .1 NSF 61-2019, Drinking Water System Components – Health Effects
- .5 Plumbing and Drainage Institute (PDI)
 - .1 PDI-WH201-R2017, Water Hammer Arresters Standard.
- .6 Province of Ontario:
 - .1 Ontario Building Code (OBC) 2012, including amendments.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Product Data

1.4 CLOSEOUT SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Operations and Maintenance Data

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 22 05 00 – Common Work Results For Mechanical.

Part 2 Products

2.1 BACK FLOW PREVENTERS

- .1 Size, materials, types: as indicated on drawings.
- .2 To CSA-B64.10.1, application as indicated.

2.2 STRAINERS

- .1 Y type with 20 mesh stainless steel removable screen.
- .2 NPS 2 and under: bronze body, screwed NPT ends, with brass cap.
- .3 NPS 2 1/2 and over: cast iron body, Class 125 flanged ends, with bolted cap.

2.3 WATER HAMMER ARRESTORS

- .1 Copper construction, piston type: to PDI-WH201.

2.4 TEMPERED /HOT WATER MIXING VALVE

- .1 Thermostatic mixing valve (factory set to 29.4°C) for tempered water piping system. Unit shall include a built-in cold water bypass, rough bronze finish, solid bimetal thermostat, locking temperature regulator with high temperature limit stop factory set for 32.2 °C, integral check stops, dial thermometer, and surface mounted stainless steel cabinet with door and lock.
- .2 Performance: Unit shall have a flow range of 0.18 L/s to 2.40 L/s with a maximum pressure loss of 206 kPa.
- .3 Quality Assurance: Unit shall be certified to ASSE 1071. Unit shall be certified to meet Low Lead requirements of wetted surface area containing less than 0.25% lead by weight.

2.5 EXPANSION TANKS

- .1 ET-1, ET-2:
 - .1 Volume, dimensions, acceptance factor: per schedules on drawings.
 - .2 Shell: High strength steel
 - .3 Diaphragm: Heavy duty butyl to NSF 61.
 - .4 Liner: Antimicrobial.
 - .5 System connection: stainless steel.
 - .6 Factory pre-charge: 275 kPa.
 - .7 Max operating conditions: 93°C, 1035 kPa

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: in accordance with Section 22 05 00 – Common Work Results for Mechanical.

3.2 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.

3.3 INSTALLATION

- .1 Install in accordance with National Plumbing Code of Canada (NPC), Ontario Building Code, and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

3.4 BACK FLOW PREVENTERS

- .1 Install in accordance with CSA B64.10/ CSA B64.10.1.
- .2 Relief pipe discharge to terminate over nearest drain.

3.5 WATER HAMMER ARRESTORS

- .1 Install on branch supplies to fixtures or group of fixtures.

3.6 STRAINERS

- .1 Install with sufficient room to remove basket for maintenance.

3.7 CLEANING

- .1 Clean in accordance with Section 22 05 00 – Common Work Results For Mechanical.

3.8 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 00 – Common Work Results For Mechanical.

1.2 REFERENCE STANDARDS

- .1 American Petroleum institute (API):
 - .1 API 609-2016 and Errata 2017, Butterfly Valves: Double-Flanged, Lug- and Wafer-type, 8th Edition
- .2 ASTM International (ASTM):
 - .1 ASTM A126-04(2019), Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
 - .2 ASTM A193/A193M-19, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
 - .3 ASTM A313/A313M-18, Standard Specification for Stainless Steel Spring Wire
 - .4 ASTM A351/A351M-18e1, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts
 - .5 ASTM A536-84(2019)e1, Standard Specification for Ductile Iron Castings
 - .6 ASTM B584-14, Standard Specification for Copper Alloy Sand Castings for General Applications
- .3 American Water Works Association (AWWA):
 - .1 AWWA C508-17, Swing-Check Valves for Waterworks Service, 2-in. Through 48-In. (50-mm Through 1200-mm) NPS.
- .4 Manufacturers Standardization Society (MSS):
 - .1 MSS SP-67-2017, Butterfly Valves
- .5 National Fire Protection Association (NFPA):
 - .1 NFPA 70, National Electrical Code (NEC), 2020 Edition.
- .6 NSF International (NSF):
 - .1 NSF 61-2019, Drinking Water System Components – Health Effects
 - .2 NSF 372-2016, Drinking Water System Components – Lead Content
- .7 Underwriters Laboratories (UL):
 - .1 UL 508A-2018, Industrial Control Panels
 - .2 UL 508C-2016, Power Conversion Equipment

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Product Data

.2 Shop Drawings

1.4 CLOSEOUT SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:

.1 Operations and Maintenance Data

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 22 05 00 – Common Work Results For Mechanical.

Part 2 Products

2.1 P-1/P-2/P-3

- .1 Type: packaged triplex system certified to NSF 61 for potable water use.
- .2 Flow, head, hp, and electrical: as indicated on drawings.
- .3 The control system shall include, as a minimum, the programmable logic station controller, variable frequency drives, a manifold mounted 4-20mA pressure transducer and any additional equipment as specified or as required to properly execute the sequence of operation.
- .4 System shall require only suction, discharge and drain connections and single point power connections from a service entrance disconnect.
- .5 All components shall be mounted and shipped as a single unit.
- .6 The discharge of each pump shall be fitted with a control valve appropriate for station operation. Each pump and discharge valve assembly shall also be equipped with isolation valves so that the pump can be serviced while system is still filled.
- .7 Pressure gauges shall be installed on the suction and discharge headers.
- .8 Piping shall be sized so that water velocity shall not exceed 3 m/sec in either the branches or manifolds.
- .9 Pumps shall be protected from thermal accumulation via individual thermal relief mechanisms.
- .10 Controller:
- .1 The pump controller shall be listed/recognized by and bear the label of Underwriter's Laboratory, Inc. (UL/cUL) and certified by the BACnet Testing Laboratory (BTL). The controller shall be specifically designed for packaged pressure booster applications.
- .2 The pump logic controller and operator interface shall be one integrated unit and shall be capable of controlling from 1-6 pumps.
- .3 The pump logic controller shall be microcomputer based and hold its software in flash memory. On- line field modified data entries, such as stage point, alternation, serial communication, and sensor setup, as a minimum, shall be stored in non-volatile memory storage with capability to prevent accidental loss

of data due to voltage surge or spike. In the event of a complete power outage, all factory preset or last saved data values remain stored and available for recall by the operator.

- .4 The variable speed pump controller shall function to a proven program that safeguards the pumps/system against damaging hydraulic conditions including:
 - .1 Motor Overload
 - .2 Pump Flow Surges
 - .3 Hunting
 - .4 Integral Curve Limiting Feature: The pump logic controller shall automatically protect the system from overload through frequency/current optimization.
 - .5 End of Curve Protection: The pump logic controller through a factory pre-programmed algorithm shall be capable of protecting the pumps from hydraulic damage due to operation beyond their published end of curve.
- .5 The pump logic controller shall be capable of accepting individual analog inputs from up to 4 zone sensor/transmitters as indicated on the plans. Analog input resolution shall be 12-bit minimum, and the controller shall scan each analog input a minimum of once every 100 milliseconds. Use of a multiplexer for multiple sensor inputs is not acceptable. All sensor/transmitter inputs shall be individually wired to the pump logic controller for continuous scan and comparison function. All analog inputs shall be provided with current limit circuitry to provide short circuit protection and safeguard against incorrect wiring of sensors.
- .6 Hydraulic stabilization program shall utilize a proportional-integral-derivative control function. The proportional, integral and derivative values shall be user adjustable over an infinite range. The scan and compare rate that selects the command set point and process variable signal shall be continuous and automatically set for optimum performance. Each sensor shall be scanned at least once every 100 milliseconds.
- .7 The pump logic controller shall be self-prompting. All messages shall be displayed in plain English. The following features shall be provided:
 - .1 Multi-fault memory and recall
 - .2 On-screen help functions
 - .3 LED pilot lights and switches
 - .4 Soft-touch membrane keypad switches
- .8 The variable speed pumping controller shall be provided with a user friendly operator interface complete with membrane switches and numeric keypad. Display shall be no less than four lines with each line capable of displaying up to twenty characters. The human interface panel shall display the following values:
 - .1 Pump On/Off Status
 - .2 Pump % Speed
 - .3 Individual Alarm Conditions
 - .4 Troubleshooting Diagnostics
 - .5 User-adjustable parameters such as alternation, PID, set points, etc.

- .9 The system shall utilize the QuickStart feature to simplify programming and startup of the pump control system. The feature shall be specific to pump systems and use suitable pump terminology.
- .10 An energy saving set point scheduling feature to be provided allowing for an alternate set point for certain hours of the weekdays or weekend.
- .11 A data-logging feature shall be provided as a function of the pump logic controller. The Alarm log shall include the last 40 alarms with date/time stamp. The Pump data log shall display individual pump run timers and pump cycle counters. A Signal log shall be provided to display the maximum and minimum values with date/time stamps for each process variable.
- .12 The Logic controller shall incorporate a Flash Memory for saving and reloading customized settings. These field determined values shall be permanently retained in Flash memory for automatic reloading of the site specific setup values in the event of data corruption due to external disturbances. The Controller shall also employ a sensor setup copy feature.
- .13 The pump controller shall be capable of communicating with the Building Automation System (BAS) by both hardwired and serial communications. The following communication features shall be provided to the BAS in 'hard wired' form via 4-20ma analog output signals and digital input/outputs:
 - .1 Remote system start/stop (dry contact supplied by BAS)
 - .2 General Alarm (qty. 1, relay output from pump controller)
 - .3 Process variable or VFD speed (qty. 1 4-20ma analog output supplied by pump controller)
 - .4 System on/off status (qty. 1 relay output supplied by pump controller)
- .14 The following communication features shall be provided to the Building Automation System via an onboard RS-485 port utilizing BACnet MS/TP protocol:
 - .1 All sensor process variables
 - .2 Individual zone setpoints
 - .3 Individual pump failure
 - .4 Individual pump on/off status
 - .5 Individual VFD on/off status
 - .6 VFD speed
 - .7 Individual VFD Failure
 - .8 Individual sensor failure
- .15 Enclosure shall be NEMA 1 with NEMA 4 operator interface.
- .16 Dynamic Flow Loss Compensation: To maximize energy efficiency, the controller shall be capable of using algorithms to simulate operational control, as if using a sensor located at the critical fixture, such that the friction loss associated with varying flow through the system is compensated for by corresponding set point adjustments. As flow increases, the pressure losses due to friction in the system will increase accordingly. This feature will allow controller to modify the set-point in real time based on the speed changes to compensate system friction loss. The use of a flow meter is not required. The controller will log the last 40 real time setpoint changes.

.11 VFD

.1 Description:

- .1 The VFD shall be rated NEMA 1. The VFD shall have been evaluated by UL and found acceptable for mounting in a plenum or other air handling compartment. Manufacturer shall supply a copy of the UL plenum evaluation upon request.
- .2 The VFD shall be tested to UL 508C. The appropriate UL label shall be applied. VFD shall be manufactured in ISO 9001, 2000 certified facilities.
- .3 The VFD shall be UL listed for a short circuit current rating of 100 kA and labeled with this rating.
- .4 The VFD manufacturer shall supply the VFD and all necessary controls as herein specified.

.2 Components

- .1 The VFD shall convert incoming fixed frequency three-phase AC power into an adjustable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for the driven load and to eliminate the need for motor de-rating.
- .2 When properly sized, the VFD shall allow the motor to produce full rated power at rated motor voltage, current, and speed without using the motor's service factor. VFDs utilizing sine weighted/ coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.
- .3 The VFD shall include an input full-wave bridge rectifier and maintain a fundamental (displacement) power factor near unity regardless of speed or load.
- .4 The VFD shall have a dual 5% impedance DC link reactor on the positive and negative rails of the DC bus to minimize power line harmonics and protect the VFD from power line transients. The chokes shall be non-saturating. Swinging chokes that do not provide full harmonic filtering throughout the entire load range are not acceptable. VFDs with saturating (non-linear) DC link reactors shall require an additional 3% AC line reactor to provide acceptable harmonic performance at full load, where harmonic performance is most critical.
- .5 The VFD's full load output current rating shall meet or exceed NFPA 70 Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 120% of rated torque for up to 0.5 second while starting.
- .6 A programmable automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continuously monitor the motor's speed and load to adjust the applied voltage to maximize energy savings.
- .7 Output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD.

- .8 An automatic motor adaptation algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to perform the test.
- .9 Galvanic isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete digital I/O shall include additional isolation modules.
- .10 VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier shall be automatically adjusted to optimize motor and VFD operation while reducing motor noise. VFDs with fixed carrier frequency are not acceptable.
- .3 Protective features
 - .1 A minimum of Class 20 I2t electronic motor overload protection for single motor applications shall be provided. Overload protection shall automatically compensate for changes in motor speed.
 - .2 Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over voltage, under voltage, VFD over temperature and motor over temperature. The VFD shall display all faults in plain language. Codes are not acceptable.
 - .3 Protect VFD from input phase loss. The VFD should be able to protect itself from damage and indicate the phase loss condition. During an input phase loss condition, the VFD shall be able to be programmed to either trip off while displaying an alarm, issue a warning while running at reduced output capacity, or issue a warning while running at full commanded speed. This function is independent of which input power phase is lost.
 - .4 Protect from under voltage. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output, without faulting, with an input voltage as low as 70% of the nominal voltage.
 - .5 Protect from over voltage. The VFD shall continue to operate without faulting with a momentary input voltage as high as 130% of the nominal voltage.
 - .6 The VFD shall incorporate a programmable motor preheat feature to keep the motor warm and prevent condensation build up in the motor when it is stopped in a damp environment by providing the motor stator with a controlled level of current.
 - .7 VFD shall include a "signal loss detection" algorithm with adjustable time delay to sense the loss of an analog input signal. It shall also include a programmable time delay to eliminate nuisance signal loss indications. The functions after detection shall be programmable.
 - .8 VFD shall function normally when the keypad is removed while the VFD is running. No warnings or alarms shall be issued as a result of removing the keypad.

- .9 VFD shall catch a rotating motor operating forward or reverse up to full speed without VFD fault or component damage.
- .10 Selectable over-voltage control shall be provided to protect the drive from power regenerated by the motor while maintaining control of the driven load.
- .11 VFD shall include current sensors on all three output phases to accurately measure motor current, protect the VFD from output short circuits, output ground faults, and act as a motor overload. If an output phase loss is detected, the VFD will trip off and identify which of the output phases is low or lost.
- .12 If the temperature of the VFD's heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. It shall also be possible to program the VFD so that it reduces its output current limit value if the VFD's temperature becomes too high.
- .13 In order to ensure operation during periods of overload, it must be possible to program the VFD to automatically reduce its output current to a programmed value during periods of excessive load. This allows the VFD to continue to run the load without tripping.
- .14 The VFD shall have temperature controlled cooling fan(s) for quiet operation, minimized losses, and increased fan life. At low loads or low ambient temperatures, the fan(s) may be off even when the VFD is running.
- .15 The VFD shall store in memory the last 10 alarms. A description of the alarm, and the date and time of the alarm shall be recorded.
- .16 When used with a pumping system, the VFD shall be able to detect no-flow situations, dry pump conditions, and operation off the end of the pump curve. It shall be programmable to take appropriate protective action when one of the above situations is detected.
- .4 Interior Features
 - .1 Hand, Off and Auto keys shall be provided to start and stop the VFD and determine the source of the speed reference. It shall be possible to either disable these keys or password protect them from undesired operation.
 - .2 There shall be an "Info" key on the keypad. The Info key shall include "on-line" context sensitive assistance for programming and troubleshooting.
 - .3 The VFD shall be programmable to provide a digital output signal to indicate whether the VFD is in Hand or Auto mode. This is to alert the Building Automation System whether the VFD is being controlled locally or by the Building Automation System.
 - .4 Password protected keypad with alphanumeric, graphical, backlit display can be remotely mounted. Two levels of password protection shall be provided to guard against unauthorized parameter changes.
 - .5 All VFDs shall have the same customer interface. The keypad and display shall be identical and interchangeable for all sizes of VFDs.
 - .6 To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFD's keypad, place that keypad on all other VFDs in

- turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters. Keypad shall provide visual indication of copy status.
- .7 Display shall be programmable to communicate in multiple languages including English and French.
 - .8 A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
 - .9 A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD. The VFD shall also have individual Fan, Pump, and Compressor menus specifically designed to facilitate start-up of these applications.
 - .10 The VFD's PID controller shall be able to actively adjust its setpoint based on flow. This allows the VFD to compensate for a pressure feedback sensor which is located near the output of the pump rather than out in the controlled system.
 - .11 Floating point control interface shall be provided to increase/decrease speed in response to contact closures.
 - .12 Five simultaneous meter displays shall be available. They shall include at a minimum, frequency, motor current, motor voltage, VFD output power, VFD output energy, VFD temperature in degrees, actual process variable and set point among others.
 - .13 Programmable Sleep Mode shall be able to stop the VFD. When its output frequency drops below set "sleep" level for a specified time, when an external contact commands that the VFD go into Sleep Mode, or when the VFD detects a no-flow situation, the VFD may be programmed to stop. When the VFD's speed is being controlled by its PID controller, it shall be possible to program a "wake-up" feedback value that will cause the VFD to start. To avoid excessive starting and stopping of the driven equipment, it shall be possible to program a minimum run time before sleep mode can be initiated and a minimum sleep time for the VFD.
 - .14 A run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of initiating an output "run request" signal to indicate to the external equipment that the VFD has received a request to run.
 - .15 VFD shall be programmable to display feedback signals in appropriate units, such as inches of water column (inwg), pressure per square inch (psi) or temperature (°F).
 - .16 VFD shall be programmable to sense the loss of load. The VFD shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. To ensure against nuisance indications, this feature must be based on motor torque, not current, and must include a proof timer to keep brief periods of no load from falsely triggering this indication.

- .5 Standard Inputs and Outputs
 - .1 Four dedicated, programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
 - .2 Two terminals shall be programmable to act either as digital outputs or additional digital inputs.
 - .3 Two programmable relay outputs, Form C 240 V AC, 2 A, shall be provided for remote indication of VFD status.
 - .1 Each relay shall have an adjustable on delay / off delay time.
 - .4 Two programmable analog inputs shall be provided that can be either direct-or-reverse acting.
 - .1 Each shall be independently selectable to be used with either an analog voltage or current signal.
 - .2 The maximum and minimum range of each shall be able to be independently scalable from 0 to 10 V dc and 0 to 20 mA.
 - .3 A programmable low-pass filter for either or both of the analog inputs must be included to compensate for noise.
 - .4 The VFD shall provide front panel meter displays programmable to show the value of each analog input signal for system set-up and troubleshooting,
 - .5 One programmable analog current output (0/4 to 20 mA) shall be provided for indication of VFD status. This output shall be programmable to show the reference or feedback signal supplied to the VFD and for VFD output frequency, current and power. It shall be possible to scale the minimum and maximum values of this output.
 - .6 It shall be possible through serial bus communications to read the status of all analog and digital inputs of the VFD.
 - .7 It shall be possible to command all digital and analog output through the serial communication bus.
 - .8 Optional Control and Monitoring Inputs and Outputs
 - .1 It shall be possible to add optional modules to the VFD in the field to expand its analog and digital inputs and outputs.
 - .2 These modules shall use rigid connectors to plug into the VFD's control card.
 - .3 The VFD shall automatically recognize the option module after it is powered up. There shall be no need to manually configure the module.
 - .4 Modules may include such items as:
 - .1 Additional digital outputs, including relay outputs
 - .2 Additional digital inputs
 - .3 Additional analog outputs
 - .4 Additional analog inputs, including Ni or Pt temperature sensor inputs
 - .9 It shall be possible through serial bus communications to control the status of all optional analog and digital outputs of the VFD.
 - .10 A real-time clock shall be an integral part of the VFD.

- .11 It shall be possible to use this to display the current date and time on the VFD's display.
- .12 Ten programmable time periods, with individually selectable ON and OFF functions shall be available. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter setpoints and output relays. It shall be possible to program unique events that occur only during normal work days, others that occur only on non-work days, and others that occur on specific days or dates. The manufacturer shall provide free PC-based software to set up the calendar for this schedule.
- .13 All VFD faults shall be time stamped to aid troubleshooting.
- .14 It shall be possible to program maintenance reminders based on date and time, VFD running hours, or VFD operating hours.
- .15 The real-time clock shall be able to time and date stamp all faults recorded in the VFD fault log.
- .16 The VFD shall be able to store load profile data to assist in analyzing the system demand and energy consumption over time.
- .17 The VFD shall include a sequential logic controller to provide advanced control interface capabilities. This shall include:
 - .1 Comparators for comparing VFD analog values to programmed trigger values
 - .2 Logic operators to combine up to three logic expressions using Boolean algebra
 - .3 Delay timers
 - .4 A 20-step programmable structure
- .18 The VFD shall include a Cascade Controller which allows the VFD to operate in closed loop set point (PID) control mode one motor at a controlled speed and control the operation of 3 additional constant speed motor starters.
- .6 Serial Communications
 - .1 The VFD shall include a standard EIA-485 communications port and capabilities to be connected to the following serial communication protocols at no additional cost and without a need to install any additional hardware or software in the VFD:
 - .1 BACnet MS/TP
 - .2 VFD controls must be compatible with the existing controls on site.
- .7 Adjustments
 - .1 The VFD shall have a manually adjustable carrier frequency that can be adjusted in 0.5 kHz increments to allow the user to select the desired operating characteristics. The VFD shall also be programmable to automatically reduce its carrier frequency to avoid tripping due to thermal loading.
 - .2 Four independent setups shall be provided.
 - .3 Four preset speeds per setup shall be provided for a total of 16.

- .4 Each setup shall have two programmable ramp up and ramp down times. Acceleration and deceleration ramp times shall be adjustable over the range from 1 to 3,600 seconds.
- .5 Each setup shall be programmable for a unique current limit value. If the output current from the VFD reaches this value, any further attempt to increase the current produced by the VFD will cause the VFD to reduce its output frequency to reduce the load on the VFD. If desired, it shall be possible to program a timer which will cause the VFD to trip off after a programmed time period.
- .6 If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: external interlock, under-voltage, over-voltage, current limit, over temperature, and VFD overload.
- .7 The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.
- .8 An automatic "start delay" may be selected from 0 to 120 seconds. During this delay time, the VFD shall be programmable to either apply no voltage to the motor or apply a DC braking current if desired.
- .9 Four programmable critical frequency lockout ranges to prevent the VFD from operating the load at a speed that causes vibration in the driven equipment shall be provided. Semi-automatic setting of lockout ranges shall simplify the set-up.
- .8 Service Conditions
 - .1 All power and control wiring shall be done from the bottom.
 - .2 All VFDs shall be plenum rated.
- .9 Quality Assurance
 - .1 To ensure quality, the complete VFD shall be tested by the manufacturer. The VFD shall drive a motor connected to a dynamometer at full load and speed and shall be cycled during the automated test procedure.
- .10 VFD shall utilize a full wave rectifier to convert three phase AC to a fixed DC voltage. Power factor shall remain above 0.98 regardless of speed or load. VFD's employing power factor correction capacitors shall not be acceptable.
- .11 An internal line reactor (5% impedance) shall be provided to lower harmonic distortion of the power line and to increase the fundamental power factor.
- .12 The VFD shall be capable of displaying the following information in plain English via an alphanumeric display:
 - .1 Output Frequency
 - .2 Output Voltage
 - .3 Motor Current
 - .4 Kilowatts per hour
 - .5 Fault identification with text
 - .6 Percent torque
 - .7 Percent power
 - .8 RPM

- .13 The VFD shall have the ability to automatically restart after an over-current, overvoltage, undervoltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable.
- .14 Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.
- .15 Operator Control Panel (Keypad)
 - .1 Each VFD shall be equipped with a front mounted operator control panel (keypad) consisting of a backlit, alphanumeric, graphic display and a keypad with keys for Start/Stop, Local/Remote, Up/ Down and Help. Two (2) Softkeys will be provided which change functionality depending upon the position within the parameter hierarchy or state of panel.
 - .2 All parameter names, fault messages, warnings and other information shall be displayed in complete English words or Standard English abbreviations to allow the user to understand what is being displayed without the use of a manual or cross-reference table.
 - .3 The Display shall have contrast adjustment provisions to optimize viewing at any angle.
 - .4 The control panel shall provide a real time clock for time stamping events and fault conditions.
 - .5 The control panel shall include a feature for uploading parameter settings to control panel memory and downloading from the control panel to the same Drive or to another Drive.
 - .6 All Drives throughout the entire power range shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating.
 - .7 The keypad shall be able to be installed or removed from the drive while it is powered, capable of remote mounting, and shall have its own non-volatile memory.
- .16 Protective Functions
 - .1 For each programmed warning and fault protection function, the Drive shall display a message in complete English words or Standard English abbreviations. The three (3) most recent fault messages along with time, current, speed, voltage, frequency and DI Status shall be stored in the Drive's fault history. The last ten (10) fault names shall be stored in Drive memory.
 - .2 The Drive shall include internal MOV's for phase to phase and phase to ground line voltage transient
 - .3 protection.
 - .4 Output short circuit withstand rating and ground fault protection rated for 100,000 AIC shall be provided per UL 508C without relying on line fuses. Motor phase loss protection shall be provided.
 - .5 The Drive shall provide electronic motor overload protection qualified per UL 508C.

- .6 Protection shall be provided for AC line or DC bus overvoltage at 130% of maximum rated or under voltage at 65% of min. rated and input phase loss.
- .7 A power loss ride through feature will allow the Drive to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.
- .17 Integrated Drive Disconnects: Individual integrated drive fused disconnects shall have exterior operators.
- .18 Variable Speed System Sequence of Operation
 - .1 The system shall consist of a pump logic controller with multi-pump parallel operation control, duty-standby pump selection, automatic alternation and automatic transfer to the standby pump upon pump/VFD failure.
 - .2 The pumping system shall start upon the closure of contact when the pump logic controller Mode of Operation is in REMOTE.
 - .3 When the pump logic controller mode in LOCAL, the pumping system shall operate automatically.
 - .4 Each sensor/transmitter shall send a 4-20mA signal to the pump logic controller, indicative of process variable condition.
 - .5 When the set point is satisfied by the process variable, the pump speed shall remain constant at the optimum energy consumption level.
 - .6 When the process variable exceeds the allowable drift from the set point for a set time the pump controller shall automatically start the next lag pump and continue in this fashion as necessary to satisfy system demand. To maintain system set point the controller will operate the pumps synchronously or sequentially to ensure maximum energy conservation.
 - .7 As demand is satisfied, the controller shall automatically stop lag pumps as necessary to conserve energy.
 - .8 In the event of a pump failure or a VFD fault, the pump logic controller automatically initiates a timed sequence of operation to start the redundant pump/VFD set in the variable speed mode.
 - .9 In the event of the failure of a zone sensor/transmitter, its process variable signal shall be removed from the scan/compare program. The redundant zone sensor/transmitters, if available, shall remain in the scan/compare program for control.
 - .10 PUMP or VFD hard fault shall be flash continuously on the display on the operator interface of the pump logic controller until the fault has been corrected and the controller has been manually reset.
 - .11 When the system is satisfied, the pump controller shall shut down the single running lead pump without the need of a flow sensor/switch or hydropneumatic tank and enter energy saving / no flow shutdown mode.
- .19 Electrical
 - .1 Pump Logic Controller Enclosure. Main station disconnect shall have a through door operator and shall be sized as shown in the technical data sheet. Individual integrated fusible drive disconnects shall have exterior operators, and shall be sized as shown in the technical data sheet. Station

- disconnect panel shall be housed in a NEMA 1 enclosure with integral latches. The control enclosure shall be constructed of 14-gauge (1.9 mm) steel and the back plate assembly shall be constructed of 14-gauge (1.9 mm) steel.
- .2 Controls and Enclosure. The control panel with controls shall be built in accordance with NFPA 70, and shall comply with UL standards. Pump station manufacturer shall be authorized under UL 508A to manufacture its own control panels. All equipment and wiring shall be mounted within the enclosure and each device shall be labeled with proper identification. All adjustments and maintenance shall be accessible from the front of the control enclosure. A complete wiring circuit diagram and legend with terminals, components, and wiring completely identified shall be provided. Main disconnect shall be interlocked with door.
- .3 Station shall have a short circuit current rating (SCCR) OF 5000A
- .20 Sensor / Transmitters
- .1 Pressure transducer shall be utilized for providing all pressure signals for the pump control logic.
- .2 Pressure transducer shall be a solid-state bonded strain gage type with an accuracy of $< \pm 0.5\%$ BFSI and constructed of 316 stainless steel. Transducer shall be rated for a pressure of 300 psi and shall provide gauge pressure output, rather than an absolute. Pressure transducer constructed of plastic is not acceptable. Pressure transducer shall be 4-20mA analog type with 10-28 VDC supply range shall utilize a packard type connector to prevent moisture intrusion and include surge protection against voltage spikes.
- .12 Station Frame
- .1 The pump station frame shall be designed and fabricated to provide structural support for all attached equipment, and provide anchor bolt support. The base shall supply sufficient rigidity to withstand the stresses of reasonable and competent transportation to site, off loading, installation, and operation.
- .13 Manifolds
- .1 All piping shall be constructed from 304 stainless steel, schedule 10 or heavier pipe as required to maintain a 3 to 1 pressure safety factor (including 0.062 in corrosion allowance).
- .14 Isolation Lug Style Butterfly Valve
- .1 Valve shall be certified to NSF 61 for use with potable drinking water.
- .2 Valve body shall be made of ASTM A536 ductile iron and will be coated with an FDA approved epoxy.
- .3 Valve face to face dimensions shall comply with API 609 and MSS-SP-67.
- .4 Disc shall be made of ASTM A351/A351M stainless steel. Shaft shall be made of 316SS.
- .5 Bushing shall be made of a PTFE inner liner bonded to fiberglass-epoxy resin outer shell.
- .6 Seat shall be EPDM.
- .7 Valve shall be rated to 1375 kPa WOG.

.15 Wafer Style Silent Check Valve

- .1 The valve body shall be constructed of ASTM A126 Class B cast iron for Class 125/250 (lead free).
- .2 The seat and double guided disc shall be ASTM B584, C87600 silicon bronze.
- .3 The compression spring shall be ASTM A313/A313M Type 316 Stainless Steel with ground ends.
- .4 NSF 61 & NSF 372 certification
- .5 The valve design shall incorporate a center guided, spring loaded disc, guided at opposite ends and having a short linear stroke that generates a flow area equal to the nominal valve size.
- .6 The operation of the valve shall not be affected by the position of installation. The valve shall be capable of operating in the horizontal or vertical positions with the flow up or down.
- .7 All component parts shall be field replaceable without the need of special tools. A replaceable guide bushing shall be provided and held in position by the spring. The spring shall be designed to withstand 100,000 cycles without failure and provide a cracking pressure of 0.5 psig.
- .8 The valve disc shall be concave to the flow direction providing for disc stabilization, maximum strength, and a minimum flow velocity to open the valve.
- .9 The valve disc and seat shall have a seating surface finish of 16 micro-inch or better to ensure positive seating at all pressures. The leakage rate shall not exceed the allowable rate for metal seated valves allowed by AWWA C508 or 1 oz (30 ml) per hour per inch (mm) of valve diameter.
- .10 The valve flow way shall be contoured and unrestricted to provide full flow areas at all locations within the valve. Cv flow coefficients shall be equal to or greater than specified below and verified by an independent testing laboratory.

Valve Size (mm)	Wafer Style CV
50	43
65	88
75	130
100	228
125	350
150	520

- .11 The valves shall be hydrostatically tested at 1.5 times their rated cold working pressure and seat tested at the valve CWP.

.16 Pressure Gauges

- .1 Gauges shall be provided for the suction and discharge manifold.
- .2 Accuracy shall be $\pm 1.5\%$
- .3 Bourdon tube and connection shall be constructed of 316SS.
- .4 Case, bezel and internals shall be constructed of 316SS.
- .5 Gauge shall be filled with glycerin in order to dampen pulsation and vibration and to provide lubrication to the internal parts.

- .6 Gauge range shall be selected to cover the largest operating range for the specific conditions and pump selected.
- .17 Flange Bolts. Bolts shall be zinc plated and shall meet ASTM A193/A193M Grade B7.
- .18 Paint. The finish coat shall be acrylic enamel to a thickness of no less than 0.08 mm.

2.2 P-4

- .1 Flow, head, electrical: as indicated on design drawings.
- .2 Type: In-line, suitable for potable water use.
- .3 Maximum operating conditions: 1035 kPa, 110 °C.
- .4 Features include:
 - .1 Spherical ECM motor.
- .5 The pumps shall be a wet rotor inline pump, in cast iron or lead free bronze body construction specifically designed for quiet operation. The pump internals shall be capable of being serviced without disturbing piping connections.
- .6 Pump shall be equipped with a water-tight seal to prevent leakage.
- .7 Pump volute shall be of a lead free bronze construction for domestic water systems. The connection style shall be flanged.
- .8 Each motor shall have an Integrated Variable Frequency Drive tested as one unit by the manufacturer.
- .9 Supports: provide as recommended by manufacturer.
- .10 Pumps to be equipped with local controllers that allow for manual speed adjustment.

2.3 P-5

- .1 Flow, head, electrical: as indicated on design drawings.
- .2 Type: In-line, suitable for potable water use.
- .3 Pump shall have MODBUS or BACnet connections built into the VFD as standard options.
- .4 The pump shall have sensorless control to automatically adjust performance as required to manage flow and head setpoint.
- .5 Maximum operating conditions: 1035 kPa, 110 °C.
- .6 Pump shall operate in constant pressure mode, but be capable of operating in proportional pressure or constant speed modes.
- .7 Supports: provide as recommended by manufacturer.
- .8 Pumps to be equipped with local controllers that allow for manual speed adjustment.

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 Make piping and electrical connections to pump and motor assembly and controls as indicated.
- .2 Ensure pump and motor assembly do not support piping.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 00 – Common Work Results For Mechanical
- .2 Section 23 05 15 – Common Installation Requirements for HVAC Pipework
- .3 Section 23 08 13 – Cleaning, Start-up, and Performance Verification of Mechanical Systems

1.2 REFERENCE STANDARDS

- .1 American Society of Mechanical Engineers International (ASME)
 - .1 ASME B16.18-18, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .2 ASME B16.22-18, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .2 ASTM International (ASTM)
 - .1 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM A536-84(2019)e1, Standard Specification for Ductile Iron Castings
 - .3 ASTM B88M-18, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 Manufacturers Standardization Society (MSS):
 - .1 MSS-SP-67-17, Butterfly Valves.
- .4 NSF International (NSF):
 - .1 NSF 61-2019, Drinking Water System Components – Health Effects

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Product Data

1.4 CLOSEOUT SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Operations and Maintenance Data

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 22 05 00 – Common Work Results For Mechanical.

Part 2 Products

2.1 GENERAL

- .1 Valves:
 - .1 Except for specialty valves, to be single manufacturer.
 - .2 Products to have CRN registration numbers.
 - .3 To be repackable under full line pressure.

2.2 PIPING

- .1 Domestic hot, cold and recirculation systems, within building.
 - .1 Copper tube, hard drawn, type L: to ASTM B88M.

2.3 FITTINGS

- .1 Cast copper: to ASME B16.18.
- .2 Wrought copper and copper alloy: to ASME B16.22.
- .3 NPS 2 and smaller: Solder type.
- .4 NPS 2 ½ and larger: Class 150 flanged, with flanges brazed to fitting.

2.4 JOINTS

- .1 NPS 2 and smaller: soldered.
- .2 NPS 2 ½ and larger: flanged, with flanges brazed to pipe.
- .3 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .4 Solder: tin copper alloy 95/5.
- .5 Teflon tape: for threaded joints.
- .6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.5 BALL VALVES

- .1 NPS 2 and under:
 - .1 Connections: Screwed or soldered, to suit piping.
 - .2 Body: Forged lead-free bronze
 - .3 Stem: Lead-free brass
 - .4 Ball: Chrome-plated lead-free brass
 - .5 Seat: PTFE
 - .6 Operator: Handle
 - .7 Pressure Rating: 1379 kPa WOG
 - .8 Temperature Rating: 60°C
 - .9 Service: Domestic water, lead-free

2.6 BUTTERFLY VALVES

- .1 NPS 2-1/2 and over:
 - .1 Resilient seat, To MSS-SP-67
 - .2 Connections: to Class 125/Class 150
 - .3 Body: Full lug, ductile iron to ASTM A536
 - .4 Disc: Nickel plated ductile iron
 - .5 Shaft: 316 SS
 - .6 Seat: Buna-N
 - .7 Operator: 10-position locking handle 90 degree range
 - .8 Pressure rating: 1379 kPa
 - .9 Temperature rating: 60°C
 - .10 Service: Domestic water, lead-free

2.7 FLOW CONTROL VALVES

- .1 NPS 2 and under:
 - .1 Type: K-valve for automatic flow control. Limits flow to maximum rated value.
 - .2 Connections: NPT threaded
 - .3 Body: No-lead brass
 - .4 Cartridge: 304 SS
 - .5 Body Tappings: P/T Test Valve
 - .6 Pressure Rating: 2758 kPa
 - .7 Temperature Rating: 121°C
 - .8 Accessories: 20 mesh SS strainer
 - .9 Maximum flow: As indicated on plans.
 - .10 Service: Domestic Water, lead-free

2.8 SILENT CHECK VALVES

- .1 NPS 2 and under, threaded NPT ends
- .2 NPS 2-1/2 and over, globe style Class 125 flanged ends
- .3 Rated to NSF 61.
- .4 Pressure rating: 1724 kPa CWP
- .5 Body: Lead-Free Bronze
- .6 Disc: Lead-Free Bronze
- .7 Seat: PTFE
- .8 Spring: 316 SS

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 INSTALLATION

- .1 Install in accordance with local authority having jurisdiction and National Plumbing Code.
- .2 Install pipe work in accordance with Section 23 05 15 – Common Installation Requirements for HVAC Pipework, supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI and Standard Council of Canada (SCC) standards.
- .4 Install DCW piping below and away from DHW and DHR and other hot piping so as to maintain temperature of cold water as low as possible.
- .5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .6 Valves
 - .1 Isolate equipment, fixtures and branches with butterfly valves.
 - .2 Balance recirculation system using flow control valves. Mark settings and record on as-built drawings on completion.

3.3 CLEANING, START-UP, PERFORMANCE VERIFICATION

- .1 Pressure testing, cleaning, start-up, and performance verification of domestic water systems to be performed in accordance with Section 23 08 13 – Cleaning, Start-up, and Performance Verification of Mechanical Systems.

3.4 CLEANING

- .1 Clean in accordance with Section 22 05 00 – Common Work Results For Mechanical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 00 – Common Work Results For Plumbing
- .2 Section 23 05 15 – Common installation requirements for HVAC pipework

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
 - .2 CSA B70-19, Cast Iron Soil Pipe, Fittings and Means of Joining.
- .2 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada 2015 (NPC).
- .3 Province of Ontario:
 - .1 Ontario Building Code (OBC) 2012, including amendments.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Product Data

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 22 05 00 – Common Work Results For Mechanical.

Part 2 Products

2.1 CAST IRON PIPING AND FITTINGS

- .1 Above ground sanitary and vent: to CSA B70.
 - .1 Joints:
 - .1 Hub and spigot:
 - .1 Caulking lead: to CSA B67.
 - .2 Mechanical joints:
 - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

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 INSTALLATION

- .1 In accordance with Section 23 05 15 – Common installation requirements for HVAC pipework.
- .2 Install in accordance with local authority having jurisdiction, Ontario Building Code, and National Plumbing Code.

3.3 CLEANING

- .1 Clean in accordance with Section 22 05 00 – Common Work Results For Mechanical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 00 – Common Work Results for Mechanical.
- .2 Section 23 08 13 – Cleaning, Start-up, and Performance Verification of Mechanical Systems.

1.2 REFERENCE STANDARDS

- .1 American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 90.1-2019, Energy Standard for Buildings Except Low-Rise Residential Buildings
- .2 CSA Group (CSA)
 - .1 CSA 4.3-2017/ANSI Z21.10.3-2017, Gas Water Heaters - Volume III - Storage Water Heaters, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous.
 - .2 CSA B149.1-15 with 2017 Ontario Amendments, Natural Gas and Propane Installation Code.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Product Data

1.4 CLOSEOUT SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Operations and Maintenance Data

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 22 05 00 – Common Work Results For Mechanical.

Part 2 Products

2.1 WH-1

- .1 Capacity, storage, fuel, operating temperatures, dimensions, electrical: per drawing schedule.
- .2 Minimum thermal efficiency: 95%
- .3 Hydrostatic working pressure: 1100 kPa

- .4 Unit shall:
 - .1 Include a modulating gas burner that automatically adjusts the input based on demand.
 - .2 Use powered anodes that are non-sacrificial and maintenance free.
 - .3 Be constructed of a seamless glass-lined steel tank, with glass lining applied to all water-side surfaces after the tank has been assembled and welded.
 - .4 Meet thermal efficiency and standby loss requirements of NRCan and ASHRAE 90.1.
 - .5 Have foam insulation and a CSA certified and ASME rated temperature and pressure relief valve.
 - .6 Have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up.
 - .7 Be approved for 0mm clearance to combustibles.
- .5 Controls shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have a digital temperature readout.
 - .1 Unit shall be equipped with a BAS-compatible module capable of two-way communication with the facility BAS. Module shall be capable of sending and receiving all noted points for unit in Division 25.
- .6 Unit shall be design certified by Underwriters Laboratories (UL), according to CSA 4.3/ANSI Z21.10.3 standards governing storage type water heaters.
- .7 Unit shall be suitable for Category IV direct venting as indicated on plans, for a total developed length of minimum 36.5m for each of a 150ø vent pipe and a 150ø intake pipe.
- .8 Vent and Intake Ducts:
 - .1 Material: ULC-listed Polypropylene.
 - .2 Connection type: press-gasket to manufacturer's requirements. Do not use sealant cement type ducts.
 - .3 Starter adapter: provided by manufacturer.
 - .4 Exhaust condensate drain: Provided by manufacturer.
 - .5 Vent and intake terminations: downturned fitting with screen, provided by manufacturer.
 - .6 Condensate neutralizer kit: for exhaust drain line, to manufacturer recommendations.

2.2 WH-2

- .1 Capacity, storage, fuel, operating temperatures, dimensions, electrical: per drawing schedule.
- .2 Hydrostatic working pressure: 1100 kPa
- .3 Unit shall:
 - .1 Be equipped with extruded high-density anode.

- .2 Have all internal surfaces of the heaters exposed to water glasslined an alkaline borosilicate composition that has been fused-to-steel by firing at a temperature of 760°C to 870°C.
- .3 Have low watt density electric heating elements.
- .4 Control each element by an individually mounted thermostat and high temperature cut-off switch.
- .5 Have all internal circuits fused.
- .6 Include an outer jacket of baked enamel finish.
- .7 Be provided with full size control compartment for performance of service and maintenance through the hinged front panel.
- .8 Include foam insulation fully enclosing the tank.
- .9 Include an electrical junction box with heavy duty terminal block.
- .10 Have the drain valve located on the front of the unit.
- .11 Have an ASME rated temperature and pressure relief valve.
- .12 Meet thermal efficiency and standby loss requirements of NRCan and ASHRAE 90.1.

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 INSTALLATION

- .1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.
- .2 Provide insulation between tank and supports.
- .3 Install natural gas fired domestic water heaters in accordance with CSA B149.1.

3.3 CLEANING, START-UP, PERFORMANCE VERIFICATION

- .1 Pressure testing, cleaning, start-up, and performance verification of domestic water systems to be performed in accordance with Section 23 08 13 – Cleaning, Start-up, and Performance Verification of Mechanical Systems.

3.4 CLEANING

- .1 Clean in accordance with Section 22 05 00 – Common Work Results For Mechanical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 00 – Common Work Results For Mechanical

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA B149.1-15 with 2017 Ontario Amendments, Natural Gas and Propane Installation Code.
- .2 National Research Council Canada (NRC)
 - .1 National Fire Code of Canada 2015 (NFC).

Part 2 Products

2.1 NOT USED

- .1 Not used.

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 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and required by National Fire Code of Canada and CSA B149.1.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer without interrupting operation of other system, equipment, components.

3.4 DRAINS

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain.
 - .1 Discharge to be visible.
- .4 Drain valves: NPS 3/4 ball valves unless indicated otherwise, with hose end male thread, cap and chain.

3.5 DIELECTRIC COUPLINGS

- .1 General: compatible with system, to suit pressure rating of system.
- .2 Locations: where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.
- .4 Over NPS 2: isolating flanges.

3.6 PIPEWORK INSTALLATION

- .1 Install code-governed pipework to CSA B149.1.
- .2 Screwed fittings jointed with Teflon tape.
- .3 Protect openings against entry of foreign material.
- .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .5 Assemble piping using fittings manufactured to ANSI standards.
- .6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .8 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .10 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .11 Group piping wherever possible and as indicated.
- .12 Ream pipes, remove scale and other foreign material before assembly.
- .13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .14 Provide for thermal expansion as indicated.

- .15 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Use ball and butterfly valves at branch take-offs for isolating purposes except where specified.
 - .6 Install butterfly valves between weld neck flanges to ensure full compression of liner.
 - .7 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.
- .16 Check Valves:
 - .1 Install silent check valves on discharge of and as indicated.

3.7 INSTALLATION OF BUTTERFLY VALVES

- .1 Valve and mating flange preparation.
 - .1 Inspect adjacent pipeline, remove rust, scale, welding slag, other foreign material.
 - .2 Ensure that valve seats and pipe flange faces are free of dirt or surface irregularities which may disrupt flange seating and cause external leakage.
 - .3 Install butterfly valves with disc in almost closed position.
 - .4 Inspect valve disc seating surfaces and waterway and eliminate dirt or foreign material.
- .2 Install in accordance with manufacturer's instructions.
- .3 Do not use gaskets between pipe flanges and valves unless instructed otherwise by valve manufacturer.
- .4 Verify suitability of valve for application by inspection of identification tag.
- .5 Mount actuator on to valve prior to installation.
- .6 Handle valve with care so as to prevent damage to disc and seat faces.
- .7 Valves in horizontal pipe lines should be installed with stem in horizontal position to minimize liner and seal wear.
- .8 Ensure that valves are centered between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.

3.8 SLEEVES

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: schedule 40 black steel pipe.

- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
 - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
 - .2 Other floors: terminate 25 mm above finished floor.
 - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint.
- .6 Sealing:
 - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere:
 - .1 Provide space for fire stopping.
 - .2 Maintain the fire-resistance rating integrity of the fire separation.
 - .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
 - .4 Ensure no contact between copper pipe or tube and sleeve.

3.9 ESCUTCHEONS

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: one-piece type with set screws.
 - .1 Chrome or nickel-plated brass or type 302 stainless steel.
- .3 Sizes: outside diameter to cover opening or sleeve.
 - .1 Inside diameter to fit around pipe or outside of insulation if so provided.

3.10 PREPARATION FOR FIRE STOPPING

- .1 Pipes subject to movement: conform to fire stop system design listing to ensure pipe movement without damaging fire stopping material or installation.
- .2 Insulated pipes: ensure integrity of insulation and vapour barriers.

3.11 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by Departmental Representative.
- .2 Request written approval by Departmental Representative 10 days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.

3.12 CLEANING

- .1 Clean in accordance with Section 22 05 00 – Common Work Results For Mechanical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 00 – Common Work Results For Mechanical

1.2 REFERENCE STANDARDS

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1-2018, Power Piping.
 - .2 ASME B31.3-2018, Process Piping.
 - .3 ASME BPVC-2019 SET, Boiler and Pressure Vessel Code:
 - .1 BPVC Section I: Power Boilers.
 - .2 BPVC Section V: Nondestructive Examination.
 - .3 BPVC Section IX: Welding and Brazing Qualifications.
- .2 American Water Works Association (AWWA)
 - .1 AWWA C206-17, Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS)
 - .1 AWS C1.1M/C1.1-2019, Recommended Practices for Resistance Welding.
- .4 CSA Group (CSA)
 - .1 CSA W47.2-11(R2015), Certification of Companies for Fusion Welding of Aluminum.
 - .2 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
 - .3 CSA B51-19, Boiler, Pressure Vessel and Pressure Piping Code.
 - .4 CSA W117.2-2019, Safety in Welding, Cutting and Allied Processes.
 - .5 CSA W178.1-2018, Certification of Welding Inspection Organizations.
 - .6 CSA W178.2-2018, Certification of Welding Inspectors.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 All welders' qualifications.
 - .2 Registration of welding procedures in accordance with CSA B51.
 - .3 Inspection and Test Plan for welds.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Welders:
 - .1 Welding qualifications in accordance with CSA B51.

- .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
- .3 Submit welder's qualifications to Departmental Representative.
- .4 Each welder to possess identification symbol issued by authority having jurisdiction.
- .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.
- .2 Inspectors:
 - .1 Inspectors qualified to CSA W178.2.
- .3 Certifications:
 - .1 Registration of welding procedures in accordance with CSA B51.
 - .2 Copy of welding procedures available for inspection.
 - .3 Safety in welding, cutting and allied processes in accordance with CSA W117.2.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 22 05 00 – Common Work Results For Mechanical.

Part 2 Products

2.1 ELECTRODES

- .1 Electrodes: in accordance with CSA W48 Series.

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 QUALITY OF WORK

- .1 Welding: in accordance with ASME B31.3, ASME Boiler and Pressure Vessel Code, Sections I and IX and AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and applicable requirements of provincial authority having jurisdiction.

3.3 INSTALLATION REQUIREMENTS

- .1 Identify each weld with welder's identification symbol.
- .2 Backing rings:
 - .1 Where used, fit to minimize gaps between ring and pipe bore.
 - .2 Do not install at orifice flanges.

- .3 Fittings:
 - .1 NPS 2 and smaller: install welding type sockets.
 - .2 Branch connections: install welding tees or forged branch outlet fittings.

3.4 INSPECTION AND TESTS – GENERAL REQUIREMENTS

- .1 Review weld quality requirements and defect limits of applicable codes and standards with Departmental Representative before work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with Departmental Representative prior to commencing work.
- .3 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.5 SPECIALIST EXAMINATIONS AND TESTS

- .1 General:
 - .1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by Departmental Representative.
 - .2 To ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
 - .3 Inspect and test all welded connections with magnetic particle (hereinafter referred to as "particle") tests.
- .2 Hydrostatically test welds to ASME B31.1.
- .3 Visual examinations: include entire circumference of weld externally and wherever possible internally.
- .4 Failure of visual examinations:
 - .1 Upon failure of welds by visual examination, perform additional testing as directed by Departmental Representative of total of up to 10 particle tests.

3.6 DEFECTS CAUSING REJECTION

- .1 As described in ASME B31.1 and ASME Boiler and Pressure Vessels Code.

3.7 REPAIR OF WELDS WHICH FAILED TESTS

- .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

3.8 CLEANING

- .1 Clean in accordance with Section 22 05 00 – Common Work Results For Mechanical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 00 – Common Work Results for Mechanical
- .2 Section 23 05 53 – Identification For HVAC Piping and Equipment

1.2 REFERENCE STANDARDS

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B40.100-2013, Pressure Gauges and Gauge Attachments.
 - .2 ASME B40.200-2008, Thermometers, Direct Reading and Remote Reading.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Product Data

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 22 05 00 – Common Work Results For Mechanical.

Part 2 Products

2.1 GENERAL

- .1 Design point to be at mid-point of scale or range.
- .2 Ranges: as indicated.

2.2 DIRECT READING THERMOMETERS

- .1 Industrial, variable angle type, mercury-free, liquid filled, 125 mm scale length: to ASME B40.200.
 - .1 Resistance to shock and vibration.

2.3 THERMOMETER WELLS

- .1 Copper pipe: copper or bronze.
- .2 Steel pipe: stainless steel.

2.4 PRESSURE GAUGES

- .1 112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel bourdon tube having 0.5% accuracy full scale unless otherwise specified.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: in accordance with Section 22 05 00 – Common Work Results for Mechanical.

3.2 GENERAL

- .1 Install thermometers and gauges so they can be easily read from floor or platform.
 - .1 If this cannot be accomplished, install remote reading units.
- .2 Install between equipment and first fitting or valve.

3.3 THERMOMETERS

- .1 Install in wells on piping. Include heat conductive material inside well.
- .2 Install in locations as indicated and on inlet and outlet of:
 - .1 DHW tanks.
- .3 Install wells for balancing purposes.
- .4 Use extensions where thermometers are installed through insulation.

3.4 PRESSURE GAUGES

- .1 Install in locations as indicated and as follows:
 - .1 Suction and discharge of pumps.
- .2 Install gauge cocks for balancing purposes, elsewhere as indicated.
- .3 Use extensions where pressure gauges are installed through insulation.

3.5 NAMEPLATES

- .1 Install engraved lamicoid nameplates in accordance with Section 23 05 53 – Identification For HVAC Piping and Equipment, identifying medium.

3.6 CLEANING

- .1 Proceed in accordance with Section 22 05 00 – Common Work Results For Mechanical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 30 00 – Cast-in-Place Concrete
- .2 Section 22 05 00 – Common Work Results for Mechanical
- .3 Section 23 05 48 – Vibration and Seismic Controls for HVAC

1.2 REFERENCE STANDARDS

- .1 ASTM International (ASTM)
 - .1 ASTM A125-1996(2018)e1, Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563-15, Standard Specification for Carbon and Alloy Steel Nuts.
- .2 Factory Mutual (FM)
- .3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP-58-2018, Pipe Hangers and Supports - Materials, Design and Manufacture.
- .4 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada 2015 (NPC).
- .5 Province of Ontario:
 - .1 Ontario Building Code (OBC) 2012, including amendments.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Product Data

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 22 05 00 – Common Work Results For Mechanical.

Part 2 Products

2.1 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

- .2 Base maximum load ratings on allowable stresses prescribed by MSS SP-58.
- .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
- .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP-58.
- .2 Performance Requirements:
 - .1 Design supports, platforms, catwalks, hangers to withstand seismic events in accordance with Section 23 05 48 – Vibration and Seismic Controls for HVAC.

2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP-58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 VIBRATION ISOLATION

- .1 Provide as recommended by equipment manufacturers to prevent system vibration.

2.4 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Use electro-plating galvanizing process.
 - .3 Ensure steel hangers in contact with copper piping are epoxy coated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut carbon steel retaining clip.
 - .1 Rod: 13 mm FM approved.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS SP-58.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP-58.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.
- .4 Upper attachment to concrete:

- .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
- .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS SP-58.
- .5 Shop and field-fabricated assemblies:
 - .1 Trapeze hanger assemblies
 - .2 Steel brackets
 - .3 Sway braces for seismic restraint systems
- .6 Hanger rods: threaded rod material to MSS SP-58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22 mm or 28 mm rod.
- .7 Pipe attachments: material to MSS SP-58:
 - .1 Attachments for steel piping: carbon steel galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.
- .8 Adjustable clevis: material to MSS SP-58 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-58.
- .10 U-bolts: carbon steel to MSS SP-58 with 2 nuts at each end to ASTM A563.
 - .1 Finishes for steel pipework: galvanized.
 - .2 Finishes for copper, glass, brass or aluminum pipework: galvanized, with formed portion plastic coated.
- .11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-58.

2.5 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP-58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS SP-58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

2.6 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP-58, galvanized sheet carbon steel. Length designed for maximum 3 m span.

- .2 Insulated hot piping:
 - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP-58.

2.7 CONSTANT SUPPORT SPRING HANGERS

- .1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).
- .2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
- .3 Provide upper and lower factory set travel stops.
- .4 Provide load adjustment scale for field adjustments.
- .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.8 VARIABLE SUPPORT SPRING HANGERS

- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
- .2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.
- .3 Variable spring hanger complete with factory calibrated travel stops.
- .4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.9 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel.

2.10 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

2.11 HOUSEKEEPING PADS

- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.
- .2 Concrete: to Section 03 30 00 – Cast-in-Place Concrete.

2.12 OTHER EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports from structural grade steel.

- .2 Submit structural calculations with shop 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:
 - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
 - .1 Install on piping systems at pumps and as indicated.
- .3 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to industry standards.
 - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
 - .4 Cast iron pipes: install below joint.
- .4 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6 Use approved constant support type hangers where:
 - .1 Vertical movement of pipework is 13 mm or more,
 - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .7 Use variable support spring hangers where:
 - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

- .1 Plumbing piping: to Ontario Building Code, National Plumbing Code of Canada (NPC), and authority having jurisdiction.
- .2 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
- .3 Copper piping: up to NPS 1/2: every 1.5 m.

- .4 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.
- .5 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m
3	3.7 m	3.0 m
3-1/2	3.7 m	3.3 m
4	3.7 m	3.6 m
5	4.3 m	
6	4.3 m	
8	4.3 m	
10	4.9 m	
12	4.9 m	

- .6 Pipework greater than NPS 12: to MSS SP-58.

3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.7 CLEANING

- .1 Clean in accordance with Section 22 05 00 – Common Work Results For Mechanical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 00 – Common Work Results for Mechanical.
- .2 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC

1.2 REFERENCE STANDARDS

- .1 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2015 (NBC).
- .2 Province of Ontario:
 - .1 Ontario Building Code (OBC) 2012, including amendments.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Shop Drawings:
 - .1 Submit documents stamped and signed by professional engineer registered and licensed in Ontario, Canada.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Operations and Maintenance Data

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 22 05 00 – Common Work Results For Mechanical.

Part 2 Products

2.1 SEISMIC CONTROL MEASURES

- .1 General:
 - .1 Seismic control systems to work in every direction.
 - .2 Fasteners and attachment points to resist same maximum load as seismic restraint.
 - .3 Drilled or power-driven anchors and fasteners not permitted.
 - .4 No equipment, equipment supports or mounts to fail before failure of structure.
 - .5 Supports of cast iron or threaded pipe not permitted.
 - .6 Seismic control measures not to interfere with integrity of fire stopping.
- .2 Static equipment:

- .1 Anchor equipment to equipment supports. Anchor equipment supports to structure.
- .2 Suspended equipment:
 - .1 Use one or more of following methods depending upon site conditions:
 - .1 Install tight to structure.
 - .2 Cross brace in every direction.
 - .3 Brace back to structure.
 - .4 Cable restraint system.
 - .3 Seismic restraints:
 - .1 Cushioning action gentle and steady.
 - .2 Never reach metal-like stiffness.
- .3 Vibration isolated equipment:
 - .1 Seismic control measures not to jeopardize noise and vibration isolation systems. Provide 6 to 9 mm clearance during normal operation of equipment and systems between seismic restraint and equipment.
 - .2 Incorporate seismic restraints into vibration isolation system to resist complete isolator unloading.
 - .3 As indicated.
- .4 Piping systems:
 - .1 Piping systems: hangers longer than 305 mm; brace at each hanger.
 - .2 Compatible with requirements for anchoring and guiding of piping systems.
- .5 Bracing methods:
 - .1 Approved by Departmental Representative.
 - .2 Structural angles or channels.
 - .3 Cable restraint system incorporating grommets, shackles and other hardware to ensure alignment of restraints and to avoid bending of cables at connection points. Incorporate neoprene into cable connections to reduce shock loads.

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 and OBC.
- .2 Install vibration isolation equipment in accordance with manufacturers 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.
 - .2 NPS5 to NPS8: first 4 points of support.
 - .3 NPS10 and Over: first 6 points of support.
 - .4 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.

3.3 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 preparatory work is complete but before installation commences.
 - .2 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 Take vibration measurements for equipment as indicated.
 - .3 Provide Departmental Representative with notice 24 hours in advance of commencement of tests.
 - .4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).
 - .5 Submit complete report of test results including sound curves.

3.4 CLEANING

- .1 Clean in accordance with Section 22 05 00 – Common Work Results For Mechanical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 00 – Common Work Results for Mechanical.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA):
 - .1 CSA B149.1-15 with 2017 Ontario Amendments, Natural Gas and Propane Installation Code.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-24.3-12, Standard for Pipe Identification.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Product Data

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 22 05 00 – Common Work Results For Mechanical.

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 white anodized aluminum, 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.

.5 Identification for PSPC Preventive Maintenance Support System (PMSS):

- .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
- .2 Equipment in Mechanical Room:
 - .1 Main identifier: size #9.
 - .2 Source and Destination identifiers: size #6.
 - .3 Terminal cabinets, control panels: size #5.
- .3 Equipment elsewhere: sizes as appropriate.

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 B149.1 and authority having jurisdiction.

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 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
Domestic hot water	Green	DHW
Domestic hot water recirculation	Green	DHWR
Domestic cold water	Green	DCW
Domestic tempered water	Green	TEMPERED WATER
Waste water	Green	WASTE WATER
Non Potable Water	Green	NP WATER
Sanitary	Green	SAN
Natural gas	to Codes	

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 for each language.

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 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 Identify systems, equipment to conform to PWGSC PMSS.

3.3 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.

3.4 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.

3.5 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.

3.6 CLEANING

- .1 Clean in accordance with Section 22 05 00 – Common Work Results For Mechanical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 00 – Common Work Results for Mechanical.

1.2 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.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 TAB personnel proof of qualifications.
 - .2 Confirmation that project design includes adequate devices for TAB.
 - .3 Proposed methodology and procedures for performing TAB if different from referenced standard. Submit prior to commencement of TAB.
 - .4 Preliminary TAB report.
 - .5 Final TAB report.

1.4 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel to perform TAB to Departmental Representative within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 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-1-2002.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 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.

1.5 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.

1.6 EXCEPTIONS

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.7 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.

1.8 PRE-TAB REVIEW

- .1 Review Contract Documents before project construction is started 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.

1.9 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.

1.10 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.

1.11 START OF TAB

- .1 Notify Departmental Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
 - .1 Provisions for TAB installed and operational.
- .3 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.

1.12 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 Plumbing systems:
 - .1 Pressure at fixtures: +/- 70 kPa.
 - .2 Flow rate at fixtures: +/- 20%.
 - .3 Flow rate at recirculation lines: +/- 5%.
 - .2 Pumps:
 - .1 Flow: +/- 10 %.
 - .2 Pressure: Plus 20 %, minus 5%.

1.13 TAB

- .1 Adjustments:
 - .1 Verify that flow rate and pressure meet design criteria.
 - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
 - .3 Clean out baskets.
- .2 Pressure regulators, PRV assemblies:
 - .1 Adjust settings to suit locations, flow rates, pressure conditions.

- .3 Strainers:
 - .1 Clean out repeatedly until clear.
 - .2 Verify accessibility of cleanout plug and basket.
 - .3 Verify that cleanout plug does not leak.

1.14 ACCURACY TOLERANCES

- .1 Measured values accurate to within plus or minus 2% of actual values.

1.15 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.

1.16 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.

1.17 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 electronic copy of TAB Report to Departmental Representative for verification and approval, in English, complete with index tabs.

1.18 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.

1.19 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.

1.20 COMPLETION OF TAB

- .1 TAB considered complete when final TAB Report received and approved 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 RELATED REQUIREMENTS

- .1 Section 22 05 00 – Common Work Results for Mechanical.

1.2 REFERENCE STANDARDS

- .1 ASTM International (ASTM)
 - .1 ASTM C335/C335M-17, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .2 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2013).
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-18, Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S702.1-14 AMD1, Thermal Insulation, Mineral Fibre, for Buildings

1.3 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as specified.
- .2 TIAC ss:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Product Data

1.5 CLOSEOUT SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Operations and Maintenance Data

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 22 05 00 – Common Work Results For Mechanical.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102.
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre 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/C335M.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Maximum "k" factor: to CAN/ULC-S702.

2.3 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

2.4 JACKETS

- .1 Laminate:
 - .1 Colours: white.
 - .2 Minimum service temperatures: -30 degrees C.
 - .3 Maximum service temperature: 65 degrees C.
 - .4 Moisture vapour transmission: 0.02 perm.
 - .5 Self-adhesive.

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 PRE-INSTALLATION REQUIREMENT

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PREFABRICATED INSULATION AND ENCLOSURES

- .1 Application: at valves, primary flow measuring elements, flanges and unions at equipment.
- .2 Design: to permit movement of expansion joint and permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation, fastenings, and finishes: same as system.

3.5 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
 - .1 Securements: Tape at 300 mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
 - .1 Securements: Tape at 300 mm on centre.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .4 Thickness of insulation as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
 - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
		Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Domestic Hot Water, Domestic Hot Water Return	A-1	25	25	25	38	38	38
Domestic Cold Water, Domestic Tempered Water	A-3	25	25	25	25	25	25

.5 Finishes: self-adhesive laminate jacket.

.6 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.6 CLEANING

.1 Clean in accordance with Section 22 05 00 – Common Work Results For Mechanical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 00 – Common Work Results for Mechanical
- .2 Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA):
 - .1 CSA B149.1-15 with 2017 Ontario Amendments, Natural Gas and Propane Installation Code.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Pressure Test Reports
 - .2 Proposed Cleaning Procedures Report
 - .3 Cleaning Results Report
 - .4 Start-up Reports
 - .5 PV Report Forms

Part 2 Products

2.1 CLEANING SOLUTIONS

- .1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.
- .2 Sodium carbonate: 0.40 kg per 100 L water in system.
- .3 Low-foaming detergent: 0.01 kg per 100 L water in system.

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 Cleaning, start-up, and PV activities are to be completed sequentially. Provide report on each activity and receive authorization to proceed from Departmental Representative before proceeding to next activity.
- .2 Order of activities:

- .1 Pressure tests
- .2 System cleaning
- .3 Start-up
- .4 TAB
- .5 Performance Verification
- .6 Training

3.3 PRESSURE TESTS

- .1 General:
 - .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
 - .2 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
 - .3 Conduct tests in presence of Departmental Representative.
 - .4 Maintain specified test pressure without loss for 4 hours minimum.
 - .5 Provide test results to Departmental Representative within 24 hours of completion of pressure test.
 - .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
 - .7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.
- .2 Domestic Water Piping:
 - .1 Test pressure: greater of 1.5 times maximum system operating pressure or 860 kPa.
- .3 Natural Gas Piping:
 - .1 Test performance of components.
 - .2 Test in accordance with CSA B149.1.

3.4 SYSTEM CLEANING

- .1 General:
 - .1 All safety devices to be functional prior to commencement of cleaning.
 - .2 Retain qualified water treatment specialist to perform system cleaning. Submit qualifications to Departmental Representative for review.
 - .3 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:
 - .1 Cleaning procedures, flow rates, elapsed time.
 - .2 Chemicals and concentrations used.
 - .3 Inhibitors and concentrations.
 - .4 Specific requirements for completion of work.
 - .5 Special precautions for protecting piping system materials and components.

- .6 Complete analysis of water used to ensure water will not damage systems or equipment.
- .4 Conditions at time of cleaning of systems:
 - .1 Systems: free from construction debris, dirt and other foreign material.
 - .2 Strainers: clean prior to initial fill.
 - .3 Install temporary filters on pumps not equipped with permanent filters.
 - .4 Install pressure gauges on strainers to detect plugging.
- .5 Provide reports on cleaning results to Departmental Representative within 3 days of cleaning.
- .2 Domestic water:
 - .1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean to Federal and Provincial potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.
 - .1 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval.
- .3 Natural gas:
 - .1 Purge system in accordance with CSA B149.1.

3.5 START-UP

- .1 General:
 - .1 Provide continuous supervision during start-up.
 - .2 Provide reports to Departmental Representative summarizing start-up activities and results within 3 days of tests.
 - .3 Rectify start-up deficiencies and repeat procedures until system operates correctly.
- .2 Domestic water:
 - .1 Verify that system can be completely drained.
 - .2 Fill system.
 - .3 Establish circulation and ensure that air is eliminated.
 - .4 Establish expansion tank level, set pressure controls.
 - .5 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.
 - .6 Repeat with water at design temperature.
 - .7 Bring system up to design temperature and pressure slowly over a 24 hour period.
 - .8 Fully open balancing valves (except those that are factory-set).
 - .9 Ensure that pressure booster systems are operating properly.
 - .10 Check operation of over-temperature protection devices on circulating pumps.
 - .11 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

- .12 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
- .13 Check control, limit, safety devices for normal and safe operation.
- .14 Ensure that air chambers, expansion compensators are installed properly.
- .15 Monitor pipe movement, and adjust pipe supports, hangers, springs as necessary.
- .16 Adjust valve stem packings as systems settle down.
- .17 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or recharge air chambers. Repeat for each outlet and flush valve.
- .18 Confirm water quality consistent with supply standards, verifying that no residuals remain resulting from flushing and/or cleaning.
- .19 Clean out strainers repeatedly until system is clean.
- .3 Domestic water pumps:
 - .1 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.
 - .2 Check power supply.
 - .3 Check starter protective devices.
 - .4 Start pumps, check impeller rotation.
 - .5 Check for proper and safe operation.
 - .6 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
 - .7 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.
 - .8 Test operation of alternator.
 - .9 Adjust leakage through water-cooled bearings.
 - .10 Adjust shaft stuffing boxes.
 - .11 Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.
 - .12 Check base for free-floating, no obstructions under base.
 - .13 Run-in pumps for 12 continuous hours.
 - .14 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
 - .15 Adjust alignment of piping and conduit to ensure full flexibility.
 - .16 Eliminate causes of cavitation, flashing, air entrainment.
 - .17 Measure pressure drop across strainer when clean and with flow rates as finally set.
 - .18 Replace seals if pump used to degrease system or if pump used for temporary heat.
 - .19 Verify lubricating oil levels.
- .4 Natural gas:

- .1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.
- .2 Check gas trains, entire installation is approved by authority having jurisdiction.
- .3 Test system in accordance with CSA B149.1 and requirements of authorities having jurisdiction.
- .5 Sanitary/drainage:
 - .1 Hydraulically test to verify grades and freedom from obstructions.
 - .2 Ensure that traps are fully and permanently primed.
 - .3 Ensure that fixtures are properly anchored, connected to system.

3.6 TAB

- .1 Perform TAB in accordance with Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC.

3.7 PERFORMANCE VERIFICATION

- .1 General:
 - .1 Obtain manufacturer's approval, before performing PV, to ensure warranties remain intact.
 - .2 Provide reports on PV on approved PV report forms. Provide reports on PV to Departmental Representative within 3 days of completion of tests.
- .2 Domestic Water:
 - .1 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
 - .2 Verify performance of temperature controls.
 - .3 Verify compliance with safety and health requirements.
- .3 Pumps:
 - .1 Open pump balancing valve fully.
 - .2 Measure differential pressure (DP) across pump.
 - .3 Measure amperage and voltage and compare with manufacturer's data sheets and motor nameplate data.
 - .4 If suction is different size than discharge connection, add velocity head correction factor to DP.
 - .5 Mark this DP on manufacturer's pump curve.
 - .6 If flow rate is higher than specified, adjust VFD speed until specified DP is reached.
 - .7 Repeat measurements of amps and volts. Compare with manufacturer's data sheets.
 - .8 Calculate BHP and compare with nameplate data.

3.8 TRAINING

- .1 Provide training in accordance with Section 01 79 00 – Demonstration and Training.

- .2 Training to include all new equipment installed under this contract, and to occur over two 4 hour sessions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 00 – Common Work Results for Mechanical
- .2 Section 23 05 15 – Common Installation Requirements for HVAC Pipework

1.2 REFERENCE STANDARDS

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B16.5-17, Pipe Flanges and Flanged Fittings.
 - .2 ASME B16.18-18, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ASME B16.22-18, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
 - .4 ASME B18.2.1-12, Square and Hex Bolts and Screws Inch Series.
- .2 ASTM International (ASTM)
 - .1 ASTM A47/A47M-99(2018)E1, Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M-18, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM B837-19, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.
- .3 CSA Group (CSA)
 - .1 CSA 6.22-19/ANSI Z21.80-19, Line Pressure Regulators
 - .2 CSA W47.1-19, Certification of Companies for Fusion Welding of Steel.
 - .3 CSA B149.1-15 with 2017 Ontario Amendments, Natural Gas and Propane Installation Code.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide the following submittals in accordance with Section 22 05 00 – Common Work Results for Mechanical:
 - .1 Product Data

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 22 05 00 – Common Work Results For Mechanical.

Part 2 Products

2.1 PIPE

- .1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:

- .1 NPS 1/2 to 2, screwed.
- .2 NPS 2 1/2 and over, plain end.
- .2 Copper tube: to ASTM B837.

2.2 JOINTING MATERIAL

- .1 Screwed fittings: pulverized lead paste.
- .2 Welded fittings: to CSA W47.1.
- .3 Flange gaskets: nonmetallic flat.
- .4 Brazing: to ASTM B837.

2.3 FITTINGS

- .1 Steel pipe fittings, screwed, flanged or welded:
 - .1 Malleable iron: screwed, banded, Class 150.
 - .2 Steel pipe flanges and flanged fittings: to ASME B16.5.
 - .3 Welding: butt-welding fittings.
 - .4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.
 - .5 Bolts and nuts: to ASME B18.2.1.
 - .6 Nipples: schedule 40, to ASTM A53/A53M.
- .2 Copper pipe fittings, screwed, flanged or soldered:
 - .1 Cast copper fittings: to ASME B16.18.
 - .2 Wrought copper fittings: to ASME B16.22.

2.4 VALVES

- .1 TSSA approved, lubricated plug type.

2.5 PRV-1

- .1 Capacity: to meet WH-1 requirements.
- .2 Upstream pressure: 6.89 kPa
- .3 Downstream pressure: 1.74 kPa
- .4 Unit to be vent limited for indoor use, and not require a vent line.
- .5 CSA approved for use in Canada and certified to CSA 6.22/ANSI Z21.80.

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 PIPING

- .1 Install in accordance with Section 23 05 15 – Common Installation Requirements for HVAC Pipework, CSA B149.1, National Building Code, and Ontario Building Code.
- .2 Install drip points:
 - .1 At low points in piping system.
 - .2 At connections to equipment.

3.3 VALVES

- .1 Install valves with stems upright or horizontal unless otherwise approved by Departmental Representative.
- .2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

3.4 CLEANING

- .1 Clean in accordance with Section 22 05 00 – Common Work Results For Mechanical.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 25 05 01 – EMCS: General Requirements

1.2 DEFINITIONS

- .1 For additional acronyms and definitions refer to Section 25 05 01 – EMCS: General Requirements.
- .2 AEL: ratio between total test period less any system downtime accumulated within that period and test period.
- .3 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:
 - .1 Outage of main power supply in excess of back-up power sources, provided that:
 - .1 Automatic initiation of back-up was accomplished.
 - .2 Automatic shut-down and re-start of components was as specified.
 - .2 Failure of communications link, provided that:
 - .1 Controller automatically and correctly operated in stand-alone mode.
 - .2 Failure was not due to failure of any specified EMCS equipment.
 - .3 Functional failure resulting from individual sensor inputs or output devices, provided that:
 - .1 System recorded said fault.
 - .2 Equipment defaulted to fail-safe mode.
 - .3 AEL of total of all input sensors and output devices is at least 99 % during test period.

1.3 DESIGN REQUIREMENTS

- .1 Confirm with Departmental Representative that Design Criteria and Design Intents are still applicable.
- .2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 25 05 01 – EMCS: General Requirements.
- .2 Final Report: submit report to Departmental Representative.
 - .1 Include measurements, final settings and certified test results.
 - .2 Bear signature of commissioning technician and supervisor

- .3 Report format to be approved by Departmental Representative before commissioning is started.
- .4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Departmental Representative in accordance with Section 25 05 01 – EMCS: General Requirements.
- .5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide documentation, O&M Manuals, and training of O&M personnel for review by Departmental Representative before interim acceptance in accordance with Section 25 05 01 – EMCS: General Requirements.

1.6 COMMISSIONING

- .1 Do commissioning in accordance with Section 01 91 13 – General Commissioning Requirements.
- .2 Carry out commissioning under direction of and in presence of Departmental Representative.
- .3 Inform, and obtain approval from, Departmental Representative in writing at least 14 days prior to commissioning or each test. Indicate:
 - .1 Location and part of system to be tested or commissioned.
 - .2 Testing/commissioning procedures, anticipated results.
 - .3 Names of testing/commissioning personnel.
- .4 Correct deficiencies, re-test in presence of Departmental Representative until satisfactory performance is obtained.
- .5 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.
- .6 Load system with project software.
- .7 Perform tests as required.

1.7 COMPLETION OF COMMISSIONING

- .1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Departmental Representative.

1.8 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

- .1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

Part 2 Products

2.1 EQUIPMENT

- .1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.
- .2 Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.
- .3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.
- .4 Locations to be approved, readily accessible and readable.
- .5 Application: to conform to normal industry standards.

Part 3 Execution

3.1 PROCEDURES

- .1 Test each system independently and then in unison with other related systems.
- .2 Commission each system using procedures prescribed by the Departmental Representative.
- .3 Commission integrated systems using procedures prescribed by Departmental Representative.
- .4 Debug system software.
- .5 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.
- .6 Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

3.2 FIELD QUALITY CONTROL

- .1 Pre-Installation Testing.
 - .1 General: consists of field tests of equipment just prior to installation.
 - .2 Testing may be on site or at Contractor's premises as approved by Departmental Representative.
 - .3 Configure major components to be tested in same architecture as designed system. Include BECC equipment and 2 sets of Building Controller's including MCU's, LCU's, and TCU's.
 - .4 Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).
 - .5 Additional instruments to include:
 - .1 DP transmitters.
 - .2 VAV supply duct SP transmitters.

- .3 DP switches used for dirty filter indication and fan status.
- .6 In addition to test equipment, provide inclined manometer, digital micro-manometer, milli-amp meter, source of air pressure infinitely adjustable between 0 and 500 Pa, to hold steady at any setting and with direct output to milli-amp metre at source and to BECC.
- .7 After setting, test zero and span in 10% increments through entire range while both increasing and decreasing pressure.
- .8 Departmental Representative to mark instruments tracking within 0.5% in both directions as "approved for installation".
- .9 Transmitters above 0.5% error will be rejected.
- .10 DP switches to open and close within 2% of setpoint.
- .2 Completion Testing.
 - .1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.
 - .2 Include following activities:
 - .1 Test and calibrate field hardware including stand-alone capability of each controller.
 - .2 Verify each A-to-D convertor.
 - .3 Test and calibrate each AI using calibrated digital instruments.
 - .4 Test each DI to ensure proper settings and switching contacts.
 - .5 Test each DO to ensure proper operation and lag time.
 - .6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.
 - .7 Test operating software.
 - .8 Test application software and provide samples of logs and commands.
 - .9 Verify each CDL including energy optimization programs.
 - .10 Debug software.
 - .11 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and engineering units. Include space on commissioning form for technician and Departmental Representative. This document will be used in final startup testing.
 - .3 Final Startup Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Departmental Representative and provide:
 - .1 1 technical personnel capable of re-calibrating field hardware and modifying software.
 - .2 Detailed daily schedule showing items to be tested and personnel available.
 - .3 Departmental Representative's acceptance signature to be on executive and applications programs.
 - .4 Commissioning to commence during final startup testing.

- .5 O&M personnel to assist in commissioning procedures as part of training.
- .6 Commissioning to be supervised by qualified supervisory personnel and Departmental Representative.
- .7 Commission systems considered as life safety systems before affected parts of the facility are occupied.
- .8 Operate systems as long as necessary to commission entire project.
- .9 Monitor progress and keep detailed records of activities and results.
- .4 Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.
 - .1 Prior to beginning of 30 day test demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.
 - .1 Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.
 - .2 Test to last at least 30 consecutive 24 hour days.
 - .3 Tests to include:
 - .1 Demonstration of correct operation of monitored and controlled points.
 - .2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.
 - .4 System will be accepted when:
 - .1 EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.
 - .2 Requirements of Contract have been met.
 - .5 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.
 - .6 Correct defects when they occur and before resuming tests.
- .5 Departmental Representative to verify reported results.

3.3 ADJUSTING

- .1 Final adjusting: upon completion of commissioning as reviewed by Departmental Representative, set and lock devices in final position and permanently mark settings.

3.4 DEMONSTRATION

- .1 Demonstrate to Departmental Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs in accordance with Section 01 79 00 – Demonstration and Training.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 00 – Common Work Results For Mechanical
- .2 Section 25 01 11 – EMCS: Start-up, Verification and Commissioning
- .3 Section 25 05 54 – EMCS: Identification

1.2 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
 - .1 ASHRAE 135-2016, BACNET - Data Communication Protocol for Building Automation and Control Network.
- .2 Consumer Electronics Association (CEA).
 - .1 CTA-709.1-D-2014, Control Network Protocol Specification.
- .3 Institute of Electrical and Electronics Engineers (IEEE).
 - .1 IEEE 260.1-2004, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).
- .4 The Instrumentation, Systems and Automation Society (ISA).
 - .1 ISA 5.5-1985, Graphic Symbols for Process Displays.

1.3 ABBREVIATIONS AND ACRONYMS

- .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 Centre.
 - .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 Name: composed of two parts, point identifier and point expansion.
 - .1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide 25 character field for each point identifier. "System" is system that point is located on.

- .1 Area descriptor: building or part of building where point is located.
 - .2 System descriptor: system that point is located on.
 - .3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms. Database must provide 25 character field for each point identifier.
- .2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.
- .3 Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.
 - .1 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.
- .3 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).
 - .5 Pulse inputs.
- .4 Symbols and engineering unit abbreviations utilized in displays: to ISA 5.5.
 - .1 Printouts: to IEEE 260.1.
 - .2 Refer also to Section 25 05 54 – EMCS: Identification.

1.5 SYSTEM DESCRIPTION

- .1 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 OWS(s).
 - .4 Data communications equipment necessary to effect EMCS data transmission system.
 - .5 Field control devices.
 - .6 Software/Hardware complete with full documentation.
 - .7 Complete operating and maintenance manuals.
 - .8 Training of personnel.
 - .9 Acceptance tests, technical support during commissioning, full documentation.
 - .10 Wiring interface co-ordination of equipment supplied by others.
 - .11 Miscellaneous work as specified in these sections and as indicated.
- .2 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 and emergency power to EMCS as indicated.
- .3 Language Operating Requirements:
 - .1 Provide English operator selectable access codes.
 - .2 Use non-linguistic symbols for displays on graphic terminals wherever possible. Other information to be in English.
 - .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 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-definitions).
 - .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 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 22 05 00 – Common Work Results For Mechanical.
- .2 Submit for review:
 - .1 Equipment list and systems manufacturers at time of tender within 10 days after award of contract.
 - .2 List existing field control devices to be re-used included in tender, along with unit price.

1.7 QUALITY ASSURANCE

- .1 Have local office within 50 km of 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:

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 22 05 00 – Common Work Results For Mechanical.

1.9 EXISTING CONTROL COMPONENTS

- .1 Utilize piping and existing control wiring where indicated.
- .2 Re-use field control devices that are usable in their original configuration provided that they conform to applicable codes, standards specifications.
 - .1 Do not modify original design of existing devices without written permission from Departmental Representative.
 - .2 Provide for new, properly designed device where re-usability of components is uncertain.
- .3 Inspect and test existing devices intended for re-use within 30 days of award of contract, and prior to installation of new devices.
 - .1 Furnish test report within 40 days of award of contract listing each component to be re-used and indicating whether it is in good order or requires repair by Departmental Representative.
 - .2 Failure to produce test report will constitute acceptance of existing devices by contractor.
- .4 Non-functioning items:
 - .1 Provide with report specification sheets or written functional requirements to support findings.
 - .2 Departmental Representative will repair or replace existing items judged defective yet deemed necessary for EMCS.
- .5 Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.
- .6 Assume responsibility for controls to be incorporated into EMCS after written receipt of approval from Departmental Representative.
 - .1 Be responsible for items repaired or replaced by Departmental Representative.
 - .2 Be responsible for repair costs due to negligence or abuse of equipment.
 - .3 Responsibility for existing devices terminates upon final acceptance of applicable portions of EMCS as approved by Departmental Representative.

- .7 Remove existing controls not re-used or not required. Place in approved storage for disposition as directed.

1.10 AS-BUILTS

- .1 At time of Substantial Completion, as part of project closeout document submissions, provide 1 copy of detailed shop drawings provided earlier in project 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 as specified in Section 25 01 11 – EMCS: Start-up, Verification and Commissioning.
 - .9 Basic system design and full documentation on system configuration.
- .2 Submit for final review by Departmental Representative.
- .3 Provide before acceptance 1 physical and 1 electronic copy incorporating changes made during final review.

1.11 O&M MANUALS

- .1 Submit O&M material as part of project O&M manual in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Custom O&M documents to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.
- .3 Provide 1 physical and 1 electronic copy prior to system or equipment tests
- .4 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.
- .5 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.
- .6 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.
- .7 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 new and existing 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.
- .8 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.
- .9 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.
- .10 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.

Part 2 Products

2.1 EQUIPMENT

- .1 Data Communication Protocol and Control Network Protocol: to ASHRAE STD 135 and CTA 709.1.
- .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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 25 05 01 – EMCS: General Requirements

1.2 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA Group).
 - .1 CSA C22.1-18, The Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

- .1 For acronyms and definitions refer to Section 25 05 01 – EMCS: General Requirements.

1.4 SYSTEM DESCRIPTION

- .1 Language Operating Requirements: provide identification for control items in English.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 25 05 01 – EMCS: General Requirements supplemented and modified by requirements of this Section.
- .2 Submit to Departmental Representative for approval samples of nameplates, identification tags and list of proposed wording.

Part 2 Products

2.1 NAMEPLATES FOR PANELS

- .1 Identify by Plastic laminate, 3 mm thick Melamine, matt white finish, square corners.
- .2 Sizes: 25 x 67 mm minimum.
- .3 Lettering: minimum 7 mm high, black.
- .4 Inscriptions: machine engraved to identify function.

2.2 NAMEPLATES FOR FIELD DEVICES

- .1 Identify by plastic encased cards attached by plastic tie.
- .2 Sizes: 50 x 100 mm minimum.
- .3 Lettering: minimum 5 mm high produced from laser printer in black.
- .4 Data to include: point name and point address.
- .5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

2.3 NAMEPLATES FOR ROOM SENSORS

- .1 Identify by stick-on labels using point identifier.
- .2 Location: as directed by Departmental Representative.
- .3 Letter size: to suit, clearly legible.

2.4 WARNING SIGNS

- .1 Equipment including motors, starters under remote automatic control: supply and install orange coloured signs warning of automatic starting under control of EMCS.
- .2 Sign to read: "Caution: This equipment is under automatic remote control of EMCS" as reviewed by Departmental Representative.

2.5 WIRING

- .1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.
- .2 Colour coding: to CSA C22.1
- .3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

2.6 CONDUIT

- .1 Colour code EMCS conduit.
- .2 Pre-paint box covers and conduit fittings.
- .3 Coding: use fluorescent orange paint and confirm colour with Departmental Representative during "Preliminary Design Review".

Part 3 Execution

3.1 NAMEPLATES AND LABELS

- .1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

3.2 EXISTING PANELS

- .1 Correct existing nameplates and legends to reflect changes made during Work.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 25 05 54 – EMCS: Identification

1.2 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C2-2017, National Electrical Safety Code.
- .2 CSA Group (CSA)
 - .1 CSA C22.1-18, Canadian Electrical Code, Part I Safety Standard for Electrical Installations
- .3 National Fire Protection Association (NFPA):
 - .1 NFPA 70-2020, National Electrical Code.

1.3 SYSTEM DESCRIPTION

- .1 Electrical:
 - .1 Provide power wiring from existing power panels to EMCS field panels. Circuits to be for exclusive use of EMCS equipment. Panel breakers to be identified on panel legends tagged and locks applied to breaker switches.
 - .2 Hard wiring between field control devices and EMCS field panels.
 - .3 Communication wiring between EMCS field panels and OWS's including main control centre BECC.
 - .4 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.
- .2 Mechanical:
 - .1 Pipe Taps Required For EMCS equipment will be supplied and installed by EMCS Contractor.
 - .2 Wells and Control Valves Shall Be Supplied by EMCS Contractor and Installed by EMCS Contractor.
 - .3 Installation of air flow stations, dampers, and other devices requiring sheet metal trades to be mounted by EMCS Contractor. Costs to be carried by designated trade.

1.4 PERSONNEL QUALIFICATIONS

- .1 Qualified supervisory personnel to:
 - .1 Continuously direct and monitor all work.
 - .2 Attend site meetings.

Part 2 Products

2.1 SPECIAL SUPPORTS

- .1 Structural grade steel, primed and painted after construction and before installation.

2.2 WIRING

- .1 As per requirements of Division 26.
- .2 For 70V and above copper conductor with chemically cross-linked thermosetting polyethylene insulation rated RW90 and 600V. Colour code to CSA 22.1.
- .3 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. All other cases use FT4 wiring.
- .4 Sizes:
 - .1 120V Power supply: to match or exceed breaker, size #12 minimum.
 - .2 Wiring for safeties/interlocks for starters, motor control centres, to be stranded, #14 minimum.
 - .3 Field wiring to digital device: #18 AWG.
 - .4 Analog input and output: shielded #18 minimum solid copper. Wiring must be continuous without joints.
 - .5 More than 4 conductors: #22 minimum solid copper.
- .5 Terminations:
 - .1 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

2.3 CONDUIT

- .1 As per requirements of Division 26.

2.4 WIRING DEVICES, COVER PLATES

- .1 Conform to CSA.

2.5 SUPPORTS FOR CONDUIT, FASTENINGS, EQUIPMENT

- .1 Solid masonry, tile and plastic surfaces: lead anchors or nylon shields.
 - .1 Hollow masonry walls, suspended drywall ceilings: toggle bolts.
- .2 Exposed conduits or cables:
 - .1 50 mm diameter and smaller: one-hole steel straps.
 - .2 Larger than 50 mm diameter: two-hole steel straps.
- .3 Suspended support systems:
 - .1 Individual cable or conduit runs: support with 6 mm diameter threaded rods and support clips.

- .2 Two or more suspended cables or conduits: support channels supported by 6 mm diameter threaded rod hangers.

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.

3.2 SUPPORTS

- .1 Install special supports as required and as indicated.

3.3 ELECTRICAL GENERAL

- .1 Do complete installation in accordance with requirements of:
 - .1 Division 26, this specification.
 - .2 CSA 22.1 Canadian Electrical Code.
 - .3 NFPA 70.
 - .4 ANSI C2.
- .2 Fully enclose or properly guard electrical wiring, terminal blocks, high voltage above 70 V contacts and mark to prevent accidental injury.
- .3 Conform to manufacturer's recommendations for storage, handling and installation.
- .4 Check factory connections and joints. Tighten where necessary to ensure continuity.
- .5 Install electrical equipment between 1000 and 2000 mm above finished floor wherever possible and adjacent to related equipment.
- .6 Protect exposed live equipment such as panel, mains, outlet wiring during construction for personnel safety.
- .7 Shield and mark live parts "LIVE 120 VOLTS" or other appropriate voltage.
- .8 Install conduits, and sleeves prior to pouring of concrete.
- .9 Holes through exterior wall and roofs: flash and make weatherproof.
- .10 Make necessary arrangements for cutting of chases, drilling holes and other structural work required to install electrical conduit, cable, pull boxes, outlet boxes.
- .11 Install cables, conduits and fittings which are to be embedded or plastered over, neatly and closely to building structure to minimize furring.

3.4 CONDUIT SYSTEM

- .1 Communication wiring shall be installed in conduit. Provide complete conduit system to link Building Controllers to BECC. Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems. Maximum conduit fill not to exceed 40%. Design drawings do not show conduit layout.

- .2 Install conduits parallel or perpendicular to building lines, to conserve headroom and to minimize interference.
- .3 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Obtain approval from Departmental Representative before starting such work. Provide complete conduit system to link field panels and devices with main control centre. Conduit size to match conductors plus future expansion capabilities as specified.
- .4 Locate conduits at least 150 mm from parallel steam or hot water pipes and at least 50 mm at crossovers.
- .5 Bend conduit so that diameter is reduced by less than 1/10th original diameter.
- .6 Field thread on rigid conduit to be of sufficient length to draw conduits up tight.
- .7 Limit conduit length between pull boxes to less than 30 m.
- .8 Use conduit outlet boxes for conduit up to 32 mm diameter and pull boxes for larger sizes.
- .9 Fastenings and supports for conduits, cables, and equipment:
 - .1 Provide metal brackets, frames, hangers, clamps and related types of support structures as indicated and as required to support cable and conduit runs.
 - .2 Provide adequate support for raceways and cables, sloped vertically to equipment.
 - .3 Use supports or equipment installed by other trades for conduit, cable and raceway supports only after written approval Departmental Representative.
- .10 Install polypropylene fish cord in empty conduits for future use.
- .11 Where conduits become blocked, remove and replace blocked sections.
- .12 Pass conduits through structural members only after receipt of Departmental Representative's written approval.
- .13 Conduits may be run in flanged portion of structural steel.
- .14 Group conduits wherever possible on suspended or surface channels.
- .15 Pull boxes:
 - .1 Install in inconspicuous but accessible locations.
 - .2 Support boxes independently of connecting conduits.
 - .3 Fill boxes with paper or foam to prevent entry of construction material.
 - .4 Provide correct size of openings. Reducing washers not permitted.
 - .5 Mark location of pull boxes on record drawings.
 - .6 Identify AC power junction boxes, by panel and circuit breaker.
- .16 Install bonding conductor for 120 volt and above in conduit.

3.5 WIRING

- .1 Install multiple wiring in ducts simultaneously.

- .2 Do not pull spliced wiring inside conduits or ducts.
- .3 Use CSA certified lubricants of type compatible with insulation to reduce pulling tension.
- .4 Tests: use only qualified personnel. Demonstrate that:
 - .1 Circuits are continuous, free from shorts, unspecified grounds.
 - .2 Resistance to ground of all circuits is greater than 50 Megohms.
- .5 Provide Departmental Representative with test results showing locations, circuits, results of tests.
- .6 Remove insulation carefully from ends of conductors and install to manufacturer's recommendations. Accommodate all strands in lugs. Where insulation is stripped in excess, neatly tape so that only lug remains exposed.
- .7 Wiring in main junction boxes and pull boxes to terminate on terminal blocks only, clearly and permanently identified. Junctions or splices not permitted for sensing or control signal covering wiring.
- .8 Do not allow wiring to come into direct physical contact with compression screw.
- .9 Install ALL strands of conductor in lugs of components. Strip insulation only to extent necessary for installation.

3.6 STARTERS, CONTROL DEVICES

- .1 Install and make power and control connections as indicated.
- .2 Install correct over-current devices.
- .3 Identify each wire, terminal for external connections with permanent number marking identical to diagram.
- .4 Performance Verification:
 - .1 Operate switches and controls to verify functioning.
 - .2 Perform start and stop sequences of contactors and relays.
 - .3 Check that interlock sequences, with other separate related starters, equipment and auxiliary control devices, operate as specified.

3.7 GROUNDING

- .1 Install complete, permanent, continuous grounding system for equipment, including conductors, connectors and accessories.
- .2 Install separate grounding conductors in conduit within building.
- .3 Install ground wire in all PVC ducts and in tunnel conduit systems.
- .4 Tests: perform ground continuity and resistance tests, using approved method appropriate to site conditions.

3.8 IDENTIFICATION

- .1 Refer to Section 25 05 54 – EMCS: Identification.

END OF SECTION

Part 1 General

1.1 NOT USED

.1 Not used.

Part 2 Products

2.1 LOCAL CONTROL UNIT (LCU)

.1 Re-use existing controllers in building and connect new points to spare inputs/outputs.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 25 01 11 – EMCS: Start-Up, Verification and Commissioning.
- .2 Section 25 05 01 – EMCS: General Requirements
- .3 Section 25 05 60 – EMCS: Field Installation
- .4 Section 26 05 00 – Common Work Results for Electrical.

1.2 DEFINITIONS

- .1 Acronyms and Definitions: refer to Section 25 05 01 – EMCS: General Requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 01 – EMCS: General Requirements.

1.4 EXISTING CONDITIONS

- .1 Repair surfaces damaged during execution of Work.

Part 2 Products

2.1 GENERAL

- .1 Control devices of each category to be of same type and manufacturer.
- .2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant casing, as appropriate for the application.
- .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 Devices installed in user occupied space not to exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.
- .8 Range, including temperature, humidity, pressure: to suit application. Coordinate with Departmental Representative prior to purchasing of equipment.

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 mm as indicated.

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 from following:
 - .1 Minus 50 degrees C to plus 50 degrees C, plus or minus 0.5 degrees C.
 - .2 0 to 100 degrees C, plus or minus 0.5 degrees C.
 - .3 0 to 50 degrees C, plus or minus 0.25 degrees C.
 - .4 0 to 25 degrees C, plus or minus 0.1 degrees C.
 - .5 10 to 35 degrees C, plus or minus 0.25 degrees C.

2.4 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 as required by Departmental Representative without adding additional cabinets.
- .3 Panels to be lockable with same key.

2.5 WIRING

- .1 In accordance with Section 25 05 60 – EMCS: Field Installation.

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: 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 Electrical:
 - .1 Complete installation in accordance with Section 26 05 00 – Common Work Results for Electrical.
 - .2 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.
 - .3 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 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 TESTING AND COMMISSIONING

- .1 Calibrate and test field devices for accuracy and performance in accordance with Section 25 01 11 – EMCS: Start-up, Verification and Commissioning.

END OF SECTION

Part 1 General

1.1 SEQUENCING

- .1 The contractor shall update the BAS graphics at the operator workstation to display and permit adjustments of the sequences and points below:
- .2 Sequence of operations for booster pump system (P-1, P-2, P-3) as follows:
 - .1 The BAS shall start/stop the pumpset.
 - .2 The following points shall be monitored:
 - .1 General alarm
 - .2 VFD speeds
 - .3 System on/off status
- .3 Hot water recirculation pumps (P-4, P-5) shall not be connected to the BAS.
- .4 Sequence of operations for main building water heater system (WH-1) as follows:
 - .1 The BAS shall enable/disable the water heater.
 - .2 The BAS shall control the water heater temperature setpoint.
 - .3 The following points shall be monitored:
 - .1 General alarm
 - .2 Water heater tank temperature
- .5 Building 15 water heater (WH-2) shall not be connected to the BAS.
- .6 The BAS shall monitor the following temperatures via temperature sensors in Mechanical Room 0003:
 - .1 Tempered water (TW) supply
 - .2 Domestic hot water (DHW) supply from WH-1
 - .3 Domestic hot water (DHW) supply after mixing valve
 - .4 Domestic hot water return (DHWR), upstream of P-4
- .7 The BAS shall monitor the following temperatures via temperature sensors in BLDG 15, Mechanical Room 2201:
 - .1 Tempered water (TW) supply
 - .2 Domestic hot water (DHW) supply at WH-2
 - .3 Domestic hot water (DHW) supply after mixing valve
 - .4 Domestic hot water return (DHWR), upstream of P-5

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 REFERENCE STANDARDS

- .1 Electrical Safety Authority (ESA) requirements and local applicable codes and regulation.
 - .1 Electrical Safety Authority (ESA) Bulletins
- .2 CSA Group
 - .1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations
 - .2 Ontario Electrical Safety Code (OESC) 27th Edition/2018 and Supplementary Bulletins for the Most Stringent.
 - .3 CAN3-C235-83(R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop drawings:
 - .1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
 - .2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .3 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
 - .4 Submit required number of copies of 600 x 600 mm minimum size drawings and product data to authority having jurisdiction.
 - .5 If changes are required, notify Departmental Representative of these changes before they are made.
- .4 Certificates:
 - .1 Provide CSA/ULC certified equipment and material.
 - .2 Where CSA/ULC certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

.5 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

.1 Contractor is responsible for this cost to facilitate listed above.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 – Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements and with manufacturer's written instructions.

.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 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates, labels for control items in English and French.

.4 Use one nameplate, label for each language.

2.2 MATERIALS AND EQUIPMENT

.1 Provide equipment and material in accordance with Section 01 61 00 – Common Product Requirements.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction

before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

- .3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: Control devices except for conduit, wiring and connections below 50V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.4 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction.
- .2 Porcelain enamel decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates labels as follows:
- .1 Nameplates: plastic laminate lamicaid 3 mm, black face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
- .2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. ____" as directed by Departmental Representative.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.
- .10 Motor Control Centers: provide nameplate for each bucket.

2.7 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered, 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 coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Prime	Auxiliary	
up to 250 V	Yellow	
up to 600 V	Yellow	Green

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

3.3 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 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 specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1200 mm.
 - .2 Receptacles in mechanical rooms: 1400mm.

3.5 FIELD QUALITY CONTROL

- .1 Conduct following tests in accordance with Section 01 45 00 – Quality Control.
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Motors and associated control equipment including sequenced operation of systems where applicable.
 - .4 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .2 Departmental Representative reserves the right to be present during testing. Inform Departmental Representative 10 days in advance.
- .3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .4 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 PART 1 - ACTION AND INFORMATIONAL 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.

3.6 SYSTEM STARTUP

- .1 Instruct Departmental Representative in operation, care and maintenance of systems, system equipment and components.

3.7 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: in accordance with Section 01 74 20 – Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 05 34 – Conduits, Conduit Fastenings and Fittings

1.2 PRODUCT DATA

- .1 Provide product data in accordance with Section 01 33 00 – Submittal Procedures.

1.3 QUALITY ASSURANCE

- .1 Refer to Section 26 05 00 – Common Work Results for Electrical.

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Jacketed.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

- .1 Cable Colour Coding: to Section 26 05 00 – Common Work Results for Electrical.
- .2 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .3 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Fittings.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.2 No.41-13(R2017), Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).
 - .2 CSA C22.2 No.65-18, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for connectors and terminations and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials as specified in accordance with Section 01 74 20 – Waste Management and Disposal.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper long barrel and short barrel compression connectors to CSA C22.2 No.65 as required sized for conductors.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for connectors and terminations installation in accordance with manufacturer's written instructions.

- .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2 No. 41.

3.3 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 reuse and/or recycling in accordance with Section 01 74 20 – Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

Part 2 Products

2.1 EQUIPMENT

- .1 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .2 Insulated grounding conductors: green, copper conductors, size as indicated.
- .3 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 Bonding jumpers, straps.
 - .5 Pressure wire connectors.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .7 Bond single conductor, metallic armoured cables to cabinet at supply end.

3.3 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list: Frames of motors, motor control centres, starters, control panels, building steel work.

3.4 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Perform tests before energizing electrical system.
- .3 Disconnect ground fault indicator (if applicable) during tests.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements and with manufacturer's written instructions.
- .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 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect hangers and supports from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hangers and supports installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Secure equipment to hollow masonry, tile and plaster surfaces with lead anchors.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .6 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .7 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .8 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .9 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .11 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .12 Apply a cathodic zinc rich coating paint to all new side cut on U-channels and threaded rods.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 00 – Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA C22.1-18, Canadian Electrical Code, Part I, Safety Standard for Electrical Installations (24th Edition)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings: in accordance with Section 01 33 00 – Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 20 – Waste Management and Disposal.

Part 2 Products

2.1 JUNCTION AND PULL BOXES

- .1 Construction: welded steel enclosure.
- .2 Covers Flush Mounted: 25 mm minimum extension all around.
- .3 Covers Surface Mounted: screw-on turned edge covers.

Part 3 Execution

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
- .3 Install terminal block as indicated in Type T cabinets.

- .4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.2 IDENTIFICATION

- .1 Equipment Identification: to Section 26 05 00 – Common Work Results for Electrical.
- .2 Identification Labels: size 2 indicating voltage and phase and system name or as indicated.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and/or recycling in accordance with Section 01 74 20 – Waste Management and Disposal.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 102 mm square or larger outlet boxes as required.
- .2 Gang boxes where wiring devices are grouped.
- .3 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 CONDUIT BOXES

- .1 Cast aluminum boxes type FS with factory-threaded hubs and mounting feet for surface wiring of devices.

2.3 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 35mm 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 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .4 Vacuum clean interior of outlet boxes before installation of wiring devices.

- .5 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 NO 18.1 (R2013), Metallic Outlet Boxes.
 - .2 CSA C22.2 NO 18.3 (R2012), Conduit, Tubing and Cable Fitting.
 - .3 CSA C22.2 NO 18.4 (R2015), Hardware for the Support of Conduit, Tubing and Cable.
 - .4 CSA C22.2 No. 83-M1985(R2017), Electrical Metallic Tubing.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20 – Waste Management and Disposal.
- .2 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 CONDUITS

- .1 Electrical metallic tubing (EMT): to CSA C22.2 NO 18.3.

2.2 CONDUIT FASTENINGS

- .1 Fastening to CSA C22.2 NO 18.4.
 - One-hole steel straps to secure surface conduits 50 mm and smaller.
- .2
 - .1 Two-hole steel straps for conduits larger than 50 mm.
 - Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.
- .5

2.3 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, CSA C22.2 NO 18.3 manufactured for use with conduit specified.
- .2 Coating: same as conduit.
- .3 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- .4 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.

2.4 FISH CORD

- .1 Polypropylene.

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 datasheets.

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in elevator shaft and mechanical and electrical service rooms.
- .3 Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical injury.
- .4 Use flexible metal conduit for work in movable metal partitions and connection to motors in dry areas.
- .5 Minimum conduit size: 19 mm.
- .6 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .7 Mechanically bend steel conduit over 19 mm diameter.
- .8 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .9 Dry conduits out before installing wire.
- .10 Install polypropylene fish cord in empty conduits.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on surface channels.

- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 00 – Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical

1.2 REFERENCE STANDARDS

- .1 CSA International
 - .1 CSA C22.2 No.42.1-13(R2017), Cover Plates for Flush-Mounted Wiring Devices (Bi-National Standard, with UL 514D).
 - .2 CSA C22.2 No.55-15, Special Use Switches
 - .3 CSA C22.2 No.111-18, General-Use Snap Switches (Bi-national standard, with UL 20).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .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 Store materials off ground, indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wiring devices from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in accordance with Section 01 74 20 – Waste Management and Disposal.

Part 2 Products

2.1 SWITCHES

- .1 20 A, 120/277 V, single pole, Industrial Grade HP rated switches to: CSA C22.2 No.55 and CSA C22.2 No.111.
- .2 Manually-operated general purpose AC switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 Ivory toggle.
- .3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity.
- .4 Switches of one manufacturer throughout project.

2.2 COVER PLATES

- .1 Cover plates for wiring devices to: CSA C22.2 No.42.1.
- .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .3 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .4 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

2.3 SOURCE QUALITY CONTROL

- .1 Cover plates from one manufacturer throughout project.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.
 - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .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.

- .3 Mount toggle switches at height as indicated in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Cover plates:
 - .1 Install suitable common cover plates where wiring devices are grouped.
 - .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.3 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 reuse and recycling in accordance with Section 01 74 20 – Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00- Common Work Results for Electrical.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Provide fuse performance data characteristics for each fuse type and size above 100A.
- .3 Shop Drawings:
 - .1 Provide shop drawings in accordance with Section 01 33 00- Submittal Procedures.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Ship fuses in original containers.
- .2 Store fuses in original containers in storage cabinet and moisture free location.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20- Waste Management and Disposal.

1.4 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00- Closeout Submittals.
- .2 Six spare fuses of each type and size installed up to and including 600 A.

Part 2 Products

2.1 FUSES - GENERAL

- .1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.
- .2 Fuses: product of one manufacturer.

2.2 FUSE TYPES

- .1 Class L fuses.
 - .1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Type L2, fast acting.
- .2 Class J fuses.

- .1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
- .2 Type J2, fast acting.
- .3 Class R -R fuses.
 - .1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.
 - .2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.
- .4 Class C fuses.

2.3 FUSE STORAGE CABINET

- .1 Fuse storage cabinet, manufactured from 2.0 mm thick aluminum, 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door finished in accordance with Section 26 05 00- Common Work Results for Electrical.

Part 3 Execution

3.1 INSTALLATION

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to physically matched mounting devices.
 - .1 Install rejection clips for Class R fuses.
- .3 Ensure correct fuses fitted to assigned electrical circuit.
- .4 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.
- .5 Install spare fuses in fuse storage cabinet.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA C22.2 No. 5-16, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Include time-current characteristic curves for breakers with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage 600V or as indicated.
- .4 Certificates:
 - .1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.
 - .1 Production certificate of origin must be submitted to Departmental Representative for approval.
 - .2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.
 - .3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.
 - .4 Production certificate of origin must contain:
 - .1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.
 - .2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.
 - .3 Contractor's name and address and person responsible for project.
 - .4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.
 - .5 Name and address of building where circuit breakers will be installed:
 - .1 Project title.

- .2 End user's reference number.
- .3 List of circuit breakers.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements with manufacturer's written instructions.
- .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 Store circuit breakers in dry location, indoors off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect circuit breakers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse by manufacturer and return of packaging materials, crates, pallets, padding, in accordance with Section 01 74 20- Waste Management and Disposal.

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers: to CSA C22.2 No. 5
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 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.
- .5 Circuit breakers with interchangeable trips as indicated.
- .6 Unless otherwise indicated on drawings, circuit breakers to have minimum 14,000A symmetrical rms interrupting capacity rating for 600/347V systems, and 10,000A for 120/208V systems.

2.2 OPTIONAL FEATURES

- .1 Include:
 - .1 Under-voltage release.
 - .2 On-off locking device.
 - .3 Handle mechanism.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install circuit breakers as indicated.

3.3 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 11- Cleaning.
- .3 Waste Management: separate waste materials for recycling and reuse in accordance with Section 01 74 20- Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00- Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CAN/CSA-C22.2 No.4-16 , Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162-2004 and UL 98).
 - .2 CSA C22.2 No.39-13 (R2017), Fuseholder Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for disconnect switches - fused and non-fused and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements with manufacturer's written instructions.
- .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 Store materials indoors, off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect disconnect switches - fused and non-fused from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, packaging materials, padding, in accordance with Section 01 74 20- Waste Management and Disposal.

Part 2 Products

2.1 DISCONNECT SWITCHES

- .1 Horsepower rated, Fusible, Non-fusible, disconnect switch in CSA enclosure size.
- .2 Provision for padlocking in on-off switch position by locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.

- .4 Fuses: size as indicated, in accordance with Section 26 28 13.01- Fuses - Low Voltage.
- .5 Fuseholders: to CSA C22.2 No.39 relocatable and suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for disconnect switches - fused and non-fused installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install disconnect switches complete with fuses if applicable.

3.3 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 and reuse in accordance with Section 01 74 20- Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results for Electrical

1.2 REFERENCE STANDARDS

- .1 International Electrotechnical Commission (IEC)
 - .1 IEC 947-4-1-2009, Part 4: Electromechanical contactors and motor-starters.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Provide shop drawings: in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Submit drawings stamped and signed by the Contractor.
 - .2 Provide shop drawings for each type of starter to indicate:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout and components.
 - .4 Enclosure types.
 - .5 Wiring diagram.
 - .6 Interconnection diagrams.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Submit operation and maintenance data for each type and style of motor starter for incorporation into maintenance manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

- .3 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials, crates, padding, pallets in accordance with Section 01 74 20 – Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Starters: to IEC 947-4-1 with AC4 utilization category.

2.2 MANUAL MOTOR STARTERS

- .1 Three or Single phase manual motor starters as required of size, type, rating, and enclosure type as indicated, with components as follows:
 - .1 Switching mechanism, quick make and break.
 - .2 One overload heater per phase, manual reset, trip indicating handle.
- .2 Accessories:
 - .1 Toggle switch: heavy duty labelled as indicated.
 - .2 Indicating light: heavy duty type and colour as indicated.
 - .3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FINISHES

- .1 Apply finishes to enclosure in accordance with Section 26 05 00 – Common Work Results for Electrical.

2.4 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.
- .3 Magnetic starter designation label, white plate, black letters, size as per Section 26 05 00 – Common Work Results for Electrical.

Part 3 Execution

3.1 INSTALLATION

- .1 Install starters and control devices top at 1500mm in accordance with manufacturer's instructions.
- .2 Install and wire, starters and controls as indicated.
- .3 Confirm motor nameplate and adjust overload device to suit.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical and manufacturer's instructions.

- .2 Operate switches and contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 00 – Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Separate waste materials for recycling and/or reuse in accordance with Section 01 74 20 – Waste Management and Disposal.

END OF SECTION

**Designated Substances Survey
Agriculture and Agri-Food Canada
London Facility
1391 Sandford Street
AAFC Project No. 515896L**

Prepared for:

Agriculture and Agri-Food Canada
1391 Sandford Street
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Attention: Mr. Demetre Bomis

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Figures: Asbestos and Lead Paint Sampling Location Plans

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Appendix A: Asbestos Sample Results

Appendix B: Paint Sample Results

Appendix C: Wipe and Trap Sample Results

Appendix D: Ballast Survey Results

1. Introduction

Trow Associates Inc. (Trow) was retained by Agriculture and Agri-Food Canada (AAFC), with authorization from Mr. Demetre Bomis, to carry out a designated substances survey in addition to a PCB survey, for the AAFC facility located at 1391 Sanford Street in London, Ontario, hereinafter referred to as the 'Site'. The purpose of the project was to examine the buildings for designated substances prior to renovation activities. The survey was limited to the following buildings: 10 (garage), 11 (field laboratory), 12 (implement barn), 14 (office/laboratory), 15 (mass production), 16 (garage) and 17 (pesticide handling).

Section 30.(1) of the Occupational Health and Safety Act states that before beginning a project, the owner shall determine whether any designated substances are present at the project site and shall prepare a list of all designated substances that are present at the site. The following regulations pertain to the various designated substances in the Act:

- Acrylonitrile – R.R.O. 1990, Reg. 835 amended to O.Reg. 101/04
- Arsenic – R.R.O. 1990, Reg. 836 amended to O.Reg. 102/04
- Asbestos – R.R.O. 1990, Reg. 837 amended to O.Reg. 279/05
- Asbestos on Construction Projects and in Buildings and Repair Operations – O'Reg 278/05
- Benzene – R.R.O. 1990, Reg. 839 amended to O.Reg. 105/04
- Coke Oven Emissions – R.R.O. 1990, Reg. 840 amended to O.Reg. 106/04
- Ethylene Oxide – R.R.O. 1990, Reg. 841 amended to O.Reg. 107/04
- Isocyanates – R.R.O. 1990, Reg. 842 amended to O.Reg. 108/04
- Lead – R.R.O. 1990, Reg. 843 amended to O.Reg. 109/04
- Mercury – R.R.O. 1990, Reg. 844 amended to O.Reg. 110/04
- Silica – R.R.O. 1990, Reg. 845 amended to O.Reg. 606/05
- Vinyl Chloride – R.R.O. 1990, Reg. 846 amended to O.Reg. 112/04

2. Approach to Work

The audit on the subject site concentrated on the interior/exterior conditions of the Site. The audit consisted of six (6) activities that included the following:

- 1) Asbestos Survey
- 2) Lead Survey
- 3) Mercury
- 4) Other designated substances
- 5) PCB Survey
- 6) Halon Survey

The site work was carried out by Mr. Scott Aziz, Mr. Barry Webster and Mr. Ron Davis of Trow Associates Inc. between October 24 and December 7, 2005. The following are descriptions of the methodologies used to complete the Designated Substances Survey:

2.1 Asbestos Survey

Asbestos is a generic name that has been given to a group of naturally occurring mineral fibers. In the past, asbestos was commonly used as a component of materials such as insulation, fireproofing, and acoustic or decorative panels. Although there are many types of asbestos, the three main forms in Ontario are chrysotile, amosite, and crocidolite.

Recently, it has been recognized that hazardous situations may exist in buildings where asbestos-containing materials are found. This is especially true where asbestos fibres may become airborne as a result of material aging, physical damage, water damage, or air movement. In contrast, there is little reason for concern if the asbestos is in good condition, has not been damaged, and is not in an accessible location.

Potential asbestos sources such as pipe insulation and pipe fittings were reviewed visually by the Trow inspector. In addition to collecting samples, the condition, accessibility and friability of the suspected material were noted.

Fifteen (15) bulk samples of suspected materials were collected (see Figures 1, 2, 3 and 4 for sample locations), where necessary, using wetting techniques and sampling tools. The bulk samples collected were placed in sealable plastic bags and labeled before being sent to MACCK Industrial Hygiene Inc. for analysis. The laboratory test results for asbestos are included in Appendix A.

2.2 Lead Paint

Six (6) paint samples were taken from the building components and submitted to ENTECH for lead content testing. Samples were recovered from the interior walls, floors, door frames, mechanical equipment etc. The specific locations where these samples were taken are shown on Figure 1.

Although there is no existing governmental regulations for the control of lead in construction materials, the Hazardous Products Act Guidelines for lead in paint are used for handling purposes. In accordance with these guidelines up to 5000 $\mu\text{g/g}$ (parts per million) of lead content in paint is permitted.

2.3 Mercury

Mercury is a metal that takes the phase of a liquid at normal temperatures. When heated it readily becomes a vapour. Ministry of Labour workplace standards for mercury exposure are based on vapour concentrations. Environmental exposure to mercury is associated with birth defects and interference with motor development. The so-called Minamata Disease was first described in the late 1940's in Japan. This resulted from people eating fish from a bay into which industry had discharged elemental mercury through sewage. Mercury can enter the body through ingestion, inhalation or absorption through the skin.

Mercury is an essential ingredient in fluorescent lights and high intensity discharge (HID) lamps. A typical fluorescent lamp is composed of a phosphor-coated glass tube with electrodes at each end. A four foot fluorescent tube usually contains between 10 and 40 milligrams of mercury of which only a small amount is in vapour form.

The London facility contains laboratory areas and therefore the presence of mercury was suspected. Sources of mercury in laboratories can come from broken mercury containing instruments such as thermometers, manometers and barometers, as well as spills occurring during experiments using liquid mercury.

Seven wipe samples from the lab benches, sinks and floors were collected and submitted for mercury analysis.

Thermostats on the property were visually reviewed for the presence of mercury.

2.4 Other Designated Substances

A visual survey of the Site was made to determine if any other designated substances including acrylonitrile, benzene, coke oven emissions, arsenic, ethylene oxide and/or isocyanates, silica and vinyl chloride, are present.

Silica is a component of many construction materials including abrasives used for sandblasting, bricks, concrete, concrete block, cement, mortar, granite, slate, rock and stone, sand, topsoil, asphalt aggregate etc.

Arsenic is a naturally occurring element in the environment. Arsenic has many industrial uses such as hardening of copper and lead alloys, pigmentation in paints and fireworks, and the manufacture of glass, cloth, and electrical semiconductors. Arsenic is also used extensively in the production of agricultural pesticides, herbicides, insecticides, desiccants, wood preservatives and feed additives. The wipe samples from the lab benches, sinks and floors were submitted for arsenic analysis.

2.5 PCB Survey

A visual survey of the premises was conducted to determine if any electrical components contain PCBs. Our investigation included the review of fluorescent light ballasts at random locations throughout the buildings.

The investigation for PCBs in the fluorescent lamp ballasts involved an examination of relevant data from the stamped manufacturer's label to determine if the ballast is PCB-type. The information was cross-referenced with the Environment Canada's publication, "Identification of Fluorescent lamp Ballasts Containing PCBs", April 1986. A total of ten (10) ballasts were examined in the buildings.

3. Results and Findings

3.1 Asbestos Survey

Friable Asbestos

Pipe Fittings and Pipe Insulation

Most of the piping and pipe fittings observed in the buildings were insulated with fiberglass. No suspected asbestos containing pipe insulation or fittings were observed. No samples of the fiberglass pipe insulation were submitted for analysis.

Ceiling Tile

Three samples of fibrous ceiling tile were recovered from the buildings for analysis (ie. AC-LN-AS2, AC-LN-AS2-2 and AC-LN-AS2-3). The sample of ceiling tile tested was found to be non-asbestos.

Sprayed Fireproofing/Insulation

Three samples of sprayed fireproofing/insulation were recovered from the ceiling of Building 14 for analysis (ie. AC-LN-AS3, AC-LN-AS3-2, AC-LN-AS3-3). The sample of sprayed fireproofing/insulation tested was found to be non-asbestos.

Non-Friable Asbestos

Floor Tile

Three samples of 12" x 12" brown floor tile were recovered from the buildings (Sample AC-LN-AS4, AC-LN-AS4-2, AC-LN-AS4-3) and was found to be non-asbestos.

Plaster

Three samples of textured ceiling plaster were recovered from Building 14 (Sample AC-LN-AS1, AC-LN-AS1-2, AC-LN-AS1-3) and three samples of wall plaster were recovered from Building 11 (Sample AC-LN-AS5, AC-LN-AS5-2, AC-LN-AS5-3). The samples of plaster were tested and found to be non-asbestos.

3.2 Lead

3.2.1 Wipe/Drain Trap Samples

Wipe tests were recovered from the various laboratories in the buildings including the floors, drains, sinks etc. and were submitted for total lead analysis.

The lead content of the six wipe tests ranged from 1.06 micrograms per square foot to 6.88 ug/ft². The lead content in the drain trap samples ranged from 0.025 to 0.159 mg/l.

Based on the analytical results and the visual inspection of the labs, lead is unlikely to be an issue on this project.

3.2.2 Paint Samples

Six (6) paint samples were taken from the building components and submitted to ENTECH for lead content testing. Samples were recovered from the interior walls, floors, door frames, window sills, duct work etc.

All six paint samples recovered had relatively low lead concentrations ranging from 3.0 to 785 ppm. These levels are in accordance with the Hazardous Products Act Guidelines for lead in paint.

The lead results are presented in Appendix B.

3.3 Mercury

3.3.1 Wipe/Drain Trap Samples

The visual examination of the laboratories did not reveal the obvious presence of beads of liquid mercury on the floors.

The mercury content of the six wipe tests ranged from <0.05 micrograms per square foot to 0.09 ug/ft². The mercury content in the drain trap samples ranged from 0.0007 to 0.0025 mg/l.

Based on the analytical results and the visual inspection of the labs, mercury is unlikely to be an issue on this project.

On the basis of visual observations, mercury is suspected to be present in the thermostats located throughout the buildings.

3.3.2 Fluorescent Lights

The building contains a significant number of fluorescent lights which would contain varying amounts of mercury depending on lamp type, date of manufacture, manufacturing plant and manufacturer. A four foot fluorescent tube usually contains between 10 and 40 milligrams of mercury.

3.4 Arsenic

Wipe tests were recovered from the various laboratories in the buildings including the floors, drains, sinks etc. and were submitted for analysis of arsenic.

No arsenic was detected on any of the six wipe test samples submitted for analysis (ie. < 1 ug/ft²). The arsenic content in the drain trap samples ranged from 0.007 to 0.028 mg/l.

Based on the analytical results and the visual inspection of the labs, arsenic is unlikely to be an issue on this project.

3.5 Other Designated Substances

There is no reason to believe that the following substances are present in the construction materials of the building in sufficient quantities to exceed the Ministry of Labour exposure limits:

- Silica (could be present in the mortar, bricks or concrete blocks)
- Vinyl Chloride (could be present in paints, plastic, etc.)
- Coke Oven Emissions - None
- Isocyanates (could be present in paints, plastics, foam insulation, etc.)
- Ethylene Oxide -None
- Benzene (could be present in laboratory chemicals and oils associated with mechanical devices)
- Acrylonitrile (could be present in plastics)

3.6 PCB Survey

Polychlorinated biphenyl's, more commonly referred to as PCB's, are typically found in transformers and other electrical equipment containing insulating fluids. By definition, PCB liquid, solid and equipment means materials containing more than 50 parts per million (ppm) PCB's. Materials containing lower than 50 ppm PCB concentration are not classified as PCB waste under provincial and federal regulations. The management of PCB waste is regulated by Waste Management - PCB's Regulation, Ontario Regulation 362.

The use of PCB's in electrical equipment has been banned since 1977, however, light ballasts manufactured prior to 1977 may contain PCB's. Currently there are no approved facilities in Ontario which accommodate the permanent disposal or destruction of PCB ballasts in quantity. However, there is a mobile destruction unit, but this is used for PCB transformer oils. Presently, Ontario Regulation 362 requires that PCB wastes be stored in a secure registered storage facility on-site until such time that a means of disposal or destruction is approved in Ontario.

Ballasts

The buildings examined for the DSS were generally constructed after 1985 and would not contain PCB ballasts. Visual examination of manufacturing dates and serial numbers of fluorescent light ballasts in the buildings indicated that all ten ballasts reviewed are not likely to contain PCBs. As a precaution ballasts should be removed and stockpiled prior to renovation/demolition activities. The ballasts can then be sorted into PCB and non-PCB piles for subsequent disposal. The ballast survey results are presented in Appendix D.

4. Conclusions and Recommendations

On the basis of our walk-through examination of the building and random testing of suspected materials the following conclusions and recommendations are presented:

4.1 Asbestos

- No Friable ACM materials were identified
- No Non-friable ACM materials were identified

4.2 Lead

- The ten paint samples recovered had relatively low lead concentrations ranging from 3.0 to 785 ppm. These levels are in accordance with the Hazardous Products Act Guidelines for lead in paint.

Based on the relatively low lead concentrations detected on the building components no remedial work is required at this time. Precautions should always be taken to minimize the release of dust during the removal of building components containing lead paint. Protective clothing and respirators are to be employed when using power equipment or sanding techniques.

- The lead content of the six wipe tests ranged from 1.06 micrograms per square foot to 6.88 ug/ft². Based on the analytical results and the visual inspection of the labs, lead is unlikely to be an issue on this project.

4.3 Mercury

- Wipe tests from the seven samples ranged from <0.05 micrograms per square foot to 0.09 ug/ft². Based on the analytical results and the visual inspection of the labs, mercury is unlikely to be an issue on this project.
- The building contains a significant number of fluorescent lights which would contain varying amounts of mercury depending on lamp type, date of manufacture, manufacturing plant and manufacturer.

If fluorescent lights are removed for replacement or during renovation activities the lights should be stored carefully to prevent accidental breakage and sent for recycling.

4.4 Other Designated Substances

- Other designated substances such as acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, silica or vinyl chloride are not suspected in the building. Such substances are found generally in paints, plastics, etc., with the exception of coke oven emissions and silica. Silica is present in concrete materials.
- No arsenic was detected on any of the wipe test samples submitted for analysis (ie. $< 1 \text{ ug/ft}^2$).
- Silica is a component of many construction materials and could be present bricks, concrete, concrete block, cement, mortar, asphalt aggregate etc.

Precautions should be taken to minimize the release of silica dust during the breaking or cutting of building components suspected to contain silica. Protective clothing and respirators are to be employed particularly when using power equipment.

4.5 PCBs

- The buildings examined for the DSS were generally constructed after 1985 and would not contain PCB ballasts. Visual examination of manufacturing dates and serial numbers of fluorescent light ballasts in the buildings indicated that all ten ballasts reviewed are not likely to contain PCBs.

As a precaution ballasts not labeled as Non-PCB should be removed and stockpiled prior to demolition/renovation. The ballasts can then be sorted into PCB and non-PCB piles for subsequent disposal. All ballasts suspected of containing PCBs which are encountered should be handled in accordance with O.R. 362.

5. General Limitations

The services performed and outlined herein were based in part, upon visual observations of the Site and attendant structures. Our opinion cannot be extended to portions of the Site that were unavailable for direct observation by objects or coverings at the time of our observations.

Any of our observations relating to hazardous and toxic materials and asbestos in the environment at the Site are described in this report. Where testing was performed, it was executed in accordance with our contract for these services. It should be noted that other compounds or materials not tested for may be present in the environment.


The objective of this report was to audit the environmental conditions at the Site within the context of our contract with respect to existing regulations within the applicable jurisdiction. Compliance of past and current owners with applicable local, provincial and federal government laws and regulations was not included in our contract for services.

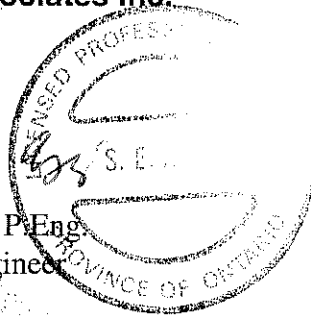
The conclusions of this report are based, in part, on the information provided by others and any testing and analyses described in the report. The possibility remains that unexpected environmental conditions may be encountered at the Site locations not explored. Should such an event occur, Trow should be notified in order that we may determine if modifications to our conclusions are necessary.

This report has been prepared in accordance with generally accepted environmental study and/or engineering practices. No other warranties, either expressed or implied, are made as to the professional services provided under the terms of our contract and included in this report.

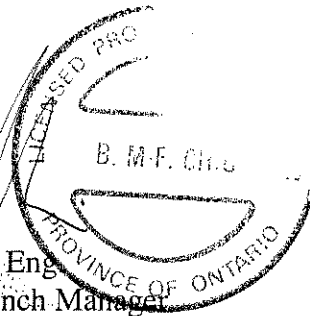
We trust the above report meets with your approval. Should you have any questions, please do not hesitate to contact us.

Trow Associates Inc.


Scott Aziz, P. Eng.
Project Engineer



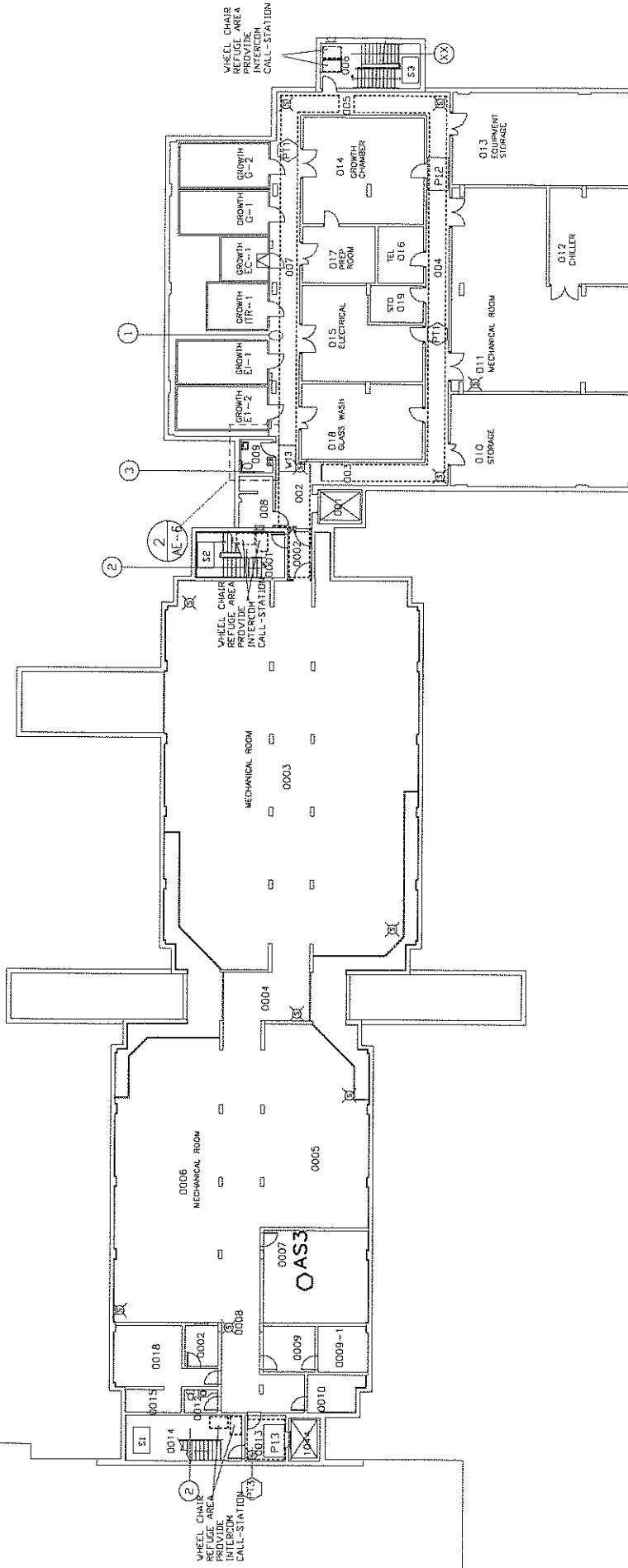

Bo Chiu, P. Eng.
London Branch Manager



Distribution:

SA/BC/LNEN00008223Arep

Figures 1-4: Asbestos, Lead Paint and Mercury Sampling Location Plans



LEGEND

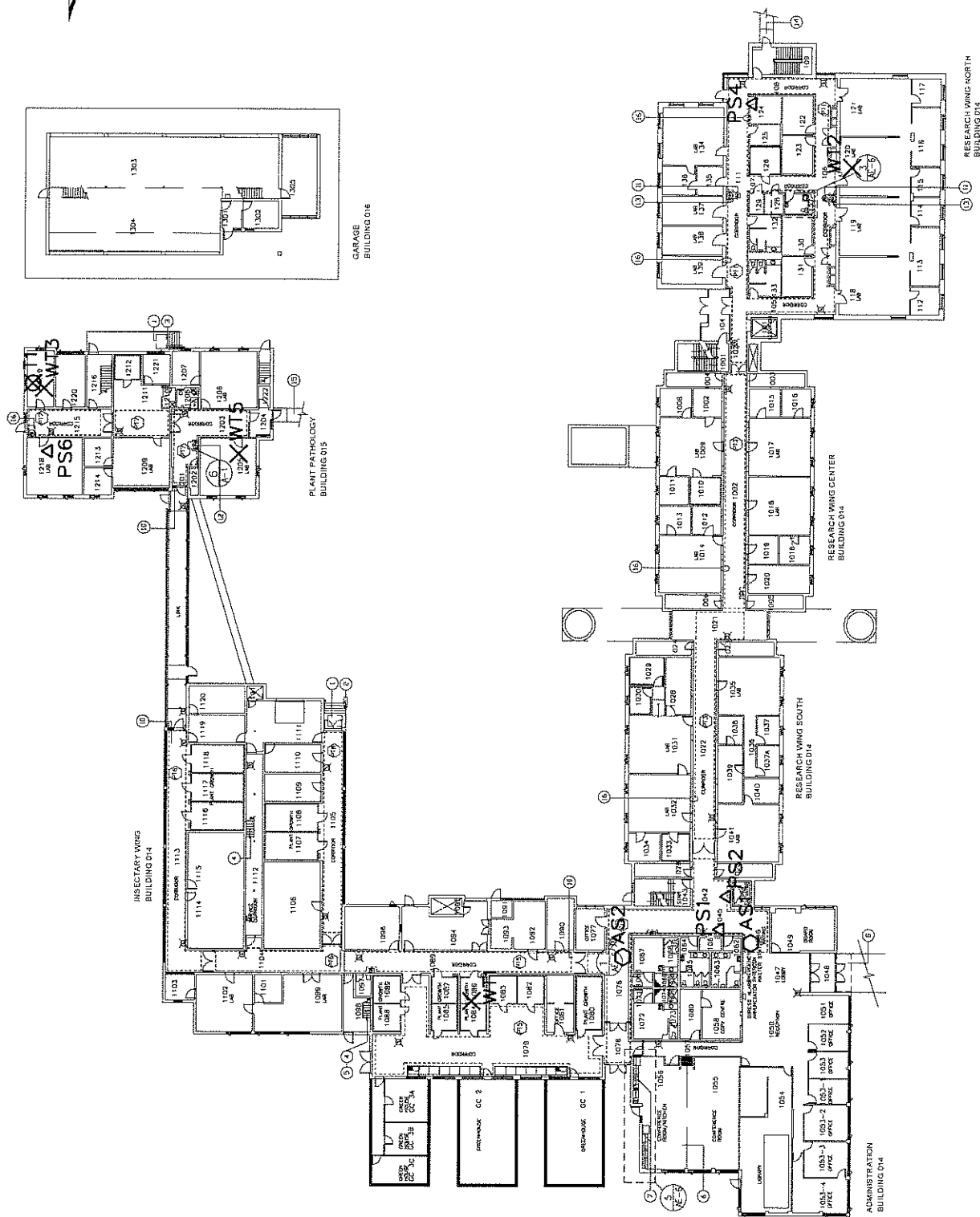
- X WT1 Wipe Sample Location
- Ø T1 Drain/Trap Sample Location
- AS1 Asbestos Sample Location (Non-Asbestos)
- Δ PS1 Lead Paint Sample Location (<5000PPM Total Lead)

PROJECT	AAFCC Harrow Facility
COUNTY	Agriculture & Agri-Food Canada
FILE	BLDG 14 - BASEMENT - SAMPLE LOCATIONS
DATE	JANUARY 2006
SCALE	NOT TO SCALE
PROJECT NO.	LNEN00008223A
REV	1



Trow Associates Inc.

15 Cuddy Boulevard, London, Ontario N6V 3Y3



LEGEND

X WT1 Wipe Sample Location

⊗ T1 Drain/Trap Sample Location

○ AS1 Asbestos Sample Location (Non-Asbestos)

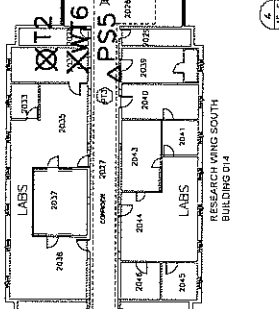
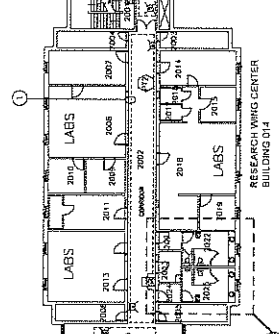
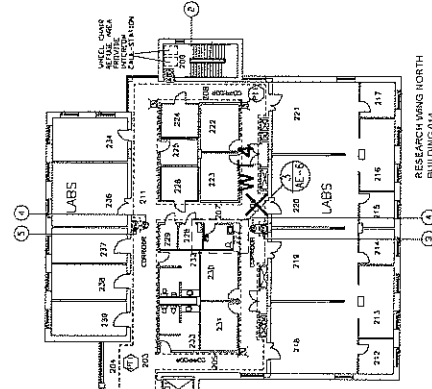
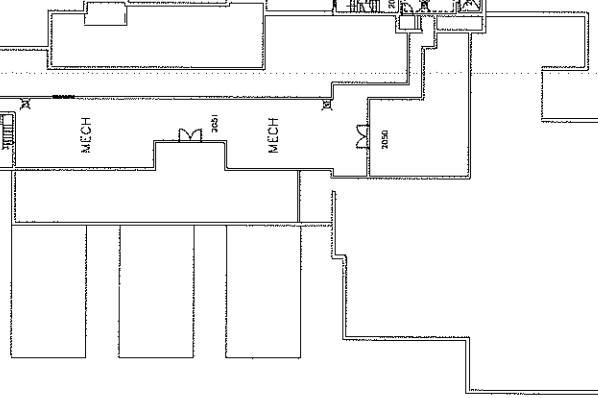
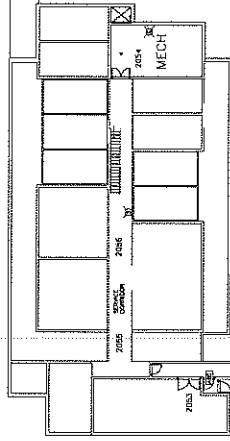
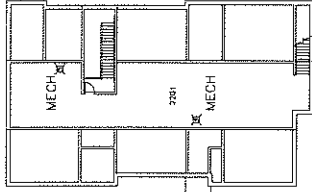
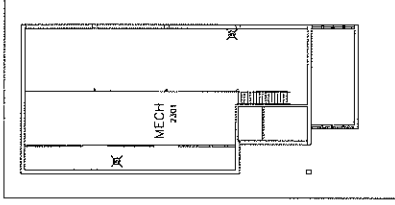
△ PS1 Lead Paint Sample Location (<5000PPM Total Lead)

PROJECT	AAF Harrow Facility
CLIENT	Agriculture & Agri-Food Canada
TITLE	BLDG 14 - 2nd FLOOR - SAMPLE LOCATIONS
DATE	JANUARY 2006
SCALE	NOT TO SCALE
DRAWN BY	TROW
CHECKED BY	LNEN00006223A
PROJECT NO.	2



Trow Associates Inc.

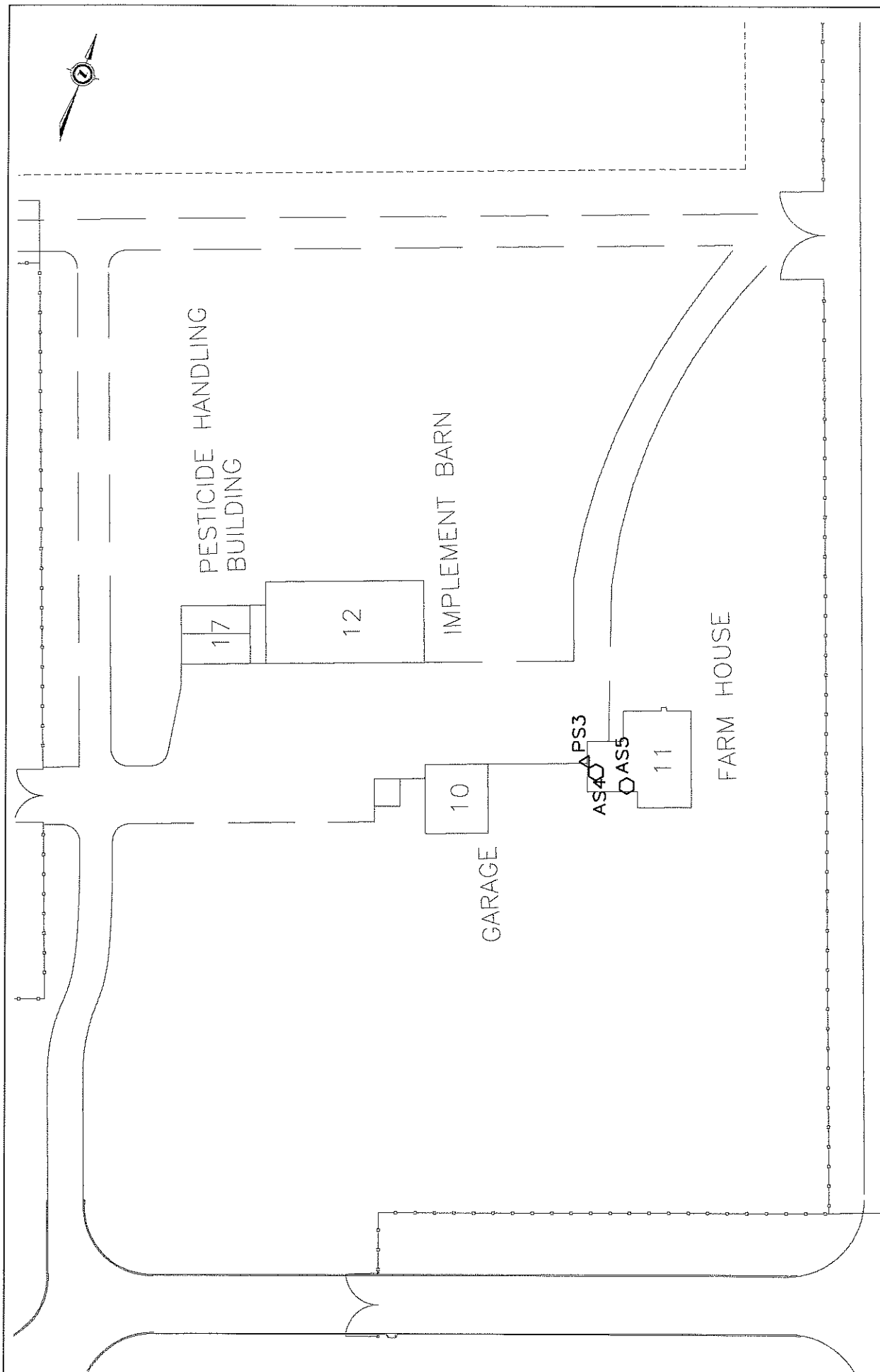
15 Cuddy Boulevard, London, Ontario N5V 3Y3



LEGEND


- X WT1 Wipe Sample Location
- ⊗ T1 Drain/Trap Sample Location
- AS1 Asbestos Sample Location (Non-Asbestos)
- △ PS1 Lead Paint Sample Location (<5000PPM Total Lead)

PROJECT	AFC Harrow Facility		
CLIENT	Agriculture & Agri-Food Canada		
FILE	BLDG 14 - 1st FLOOR - SAMPLE LOCATIONS		
	Trow Associates Inc.		
	15 Cuddy Boulevard, London, Ontario, N6V 3Y3		
DATE	JANUARY 2006	NOT TO SCALE	3
PROJECT NO.	LNEN00008223A		



LEGEND

- X WT1 Wipe Sample Location
- ⊗ T1 Drain/Trap Sample Location
- AS1 Asbestos Sample Location (Non-Asbestos)
- △ PS1 Lead Paint Sample Location (<5000PPM Total Lead)

PROJECT	AAFC Harrow Facility				
CLIENT	Agriculture & Agri-Food Canada				
TITLE	BLDGS 10 to 12 -- SAMPLE LOCATIONS				
<div><div>Trow Associates Inc. 15 Cuddy Boulevard, London, Ontario N6V 3Y3</div></div>					
DATE	JANUARY 2006	SCALE	NOT TO SCALE		REV.
			LNEN00008223A		4

Appendix A: Asbestos Sample Results

ASBESTOS SAMPLE RESULTS – London

Sample Number	Sample Location	Sample Description	Results	Friable/Non-Friable	Condition of Asbestos	Accessibility	Action Recommended
AC-LN-AS1	Bldg 14 – Main Entrance	Ceiling Plaster	No asbestos detected	N/A	N/A	N/A	N/A
AC-LN-AS1-2	Bldg 14 – Main Entrance	Ceiling Plaster	No asbestos detected	N/A	N/A	N/A	N/A
AC-LN-AS1-3	Bldg 14 – Main Entrance	Ceiling Plaster	No asbestos detected	N/A	N/A	N/A	N/A
AC-LN-AS2	Bldg 14-D Insect Production	Ceiling Tile	No asbestos detected	N/A	N/A	N/A	N/A
AC-LN-AS2-2	Bldg 14-D Insect Production	Ceiling Tile	No asbestos detected	N/A	N/A	N/A	N/A
AC-LN-AS2-3	Bldg 14-D Insect Production	Ceiling Tile	No asbestos detected	N/A	N/A	N/A	N/A
AC-LN-AS3	Bldg 14-007 Electrical Equipment Room	Sprayed Insulation (ceiling)	No asbestos detected	N/A	N/A	N/A	N/A
AC-LN-AS3-2	Bldg 14-007 Electrical Equipment Room	Sprayed Insulation (ceiling)	No asbestos detected	N/A	N/A	N/A	N/A
AC-LN-AS3-3	Bldg 14-007 Electrical Equipment Room	Sprayed Insulation (ceiling)	No asbestos detected	N/A	N/A	N/A	N/A
AC-LN-AS4	Bldg 11 – 2 nd Floor	Sheet Vinyl Flooring	No asbestos detected	N/A	N/A	N/A	N/A
AC-LN-AS4-2	Bldg 11 – 2 nd Floor	Sheet Vinyl Flooring	No asbestos detected	N/A	N/A	N/A	N/A
AC-LN-AS4-3	Bldg 11 – 2 nd Floor	Sheet Vinyl Flooring	No asbestos detected	N/A	N/A	N/A	N/A
AC-LN-AS5	Bldg 11 – Basement	Wall Plaster	No asbestos detected	N/A	N/A	N/A	N/A
AC-LN-AS5-2	Bldg 11 – Basement	Wall Plaster	No asbestos detected	N/A	N/A	N/A	N/A
AC-LN-AS5-3	Bldg 11 – Basement	Wall Plaster	No asbestos detected	N/A	N/A	N/A	N/A

Notes:

- 1) All areas where friable asbestos-containing materials (ACM) are damaged require ACM removal or repair.
- 2) This table is to be read in conjunction with Trow report number LNE00008223A and requires interpretational assistance by Trow before use by others.

Appendix B: Paint Sample Results - Lead and Mercury

LEAD-BASED PAINT SAMPLE RESULTS – London				
Sample Number	Sample Location	Sample Colour Description	Lead Conc. (ppm)	Mercury Conc. (ppm)
AC-LN-PS1	Bldg 14 – main entrance, Walls	White	2.95	-----
AC-LN-PS2	Bldg 14 – main entrance, Trim	Yellow	785	-----
AC-LN-PS3	Bldg 11 – 2 nd Floor, Sill	White	98.4	-----
AC-LN-PS4	Bldg 14-124 Xray & Film, Trim	Beige	69.1	-----
AC-LN-PS5	Bldg 14-2039, Door Frame	Brown	553	-----
AC-LN-PS6	Bldg 15-1281 – Soil Lab, Beam	White	5.83	-----

Notes:

Bold denotes exceedence of 5000ppm Total Lead

Appendix C: Wipe and Trap Sample Results

WIPE SAMPLE RESULTS – London				
Sample Number	Sample Location	Lead Conc. (µg/ft ²)	Mercury Conc. (µg/ft ²)	Arsenic Conc. (µg/ft ²)
AC-LN-WT1	14-1085 Plant Growth Room	3.34	<0.05	<1
AC-LN-WT2	14-120 Plant Seed Development	1.06	0.09	<1
AC-LN-WT3	15-1219 Extraction and Cleanup	1.71	<0.05	<1
AC-LN-WT4	14-206 Microbacteriology	6.88	<0.05	<1
AC-LN-WT5	15-1205 Microbiology	1.50	<0.05	<1
AC-LN-WT6	14-2032 Extraction	1.35	0.06	<1

Notes:

TRAP SAMPLE RESULTS – London				
Sample Number	Sample Location	Lead Conc. (mg/l)	Mercury Conc. (mg/l)	Arsenic Conc. (mg/l)
AC-LON-T1	Building # 15-1219 Extractions and Cleanup	0.159	0.0007	0.028
AC-LON-T2	Building # 14-2032 Extractions	0.025	0.0025	0.007

Notes:

Appendix D: Ballast Survey Results

BALLAST SURVEY SUMMARY				
Sample Description (Brand)	Model Number	Number Observed	PCB	Non-PCB
CGE Gold Label	17A240E	3		Yes
Philips	RQM 2540 TPC	7		Yes

AGRICULTURE AND AGRI-FOOD CANADA

ASBESTOS SURVEY REPORT

LONDON RESEARCH AND DEVELOPMENT CENTRE

1391 SANDFORD STREET, LONDON, ONTARIO

MARCH 21, 2018





**ASBESTOS SURVEY
REPORT**

**LONDON RESEARCH AND
DEVELOPMENT CENTRE
1391 SANDFORD STREET,
LONDON, ON**

AGRICULTURE AND AGRI-FOOD CANADA

FINAL REPORT

PSPC PROJECT NO.: R.095602.001
WSP PROJECT NO.: 181-00742-00
DATE: MARCH 2018

WSP CANADA INC.
100 COMMERCE VALLEY DRIVE WEST
THORNHILL, ONTARIO L3T 0A1

T: 905-882-1100
F: 905-882-0055

WSP.COM



March 21, 2018

Public Services and Procurement Canada
4900 Yonge Street
Toronto, ON, M2N 6A6

Attn: *Maegan Harrison, Senior Environmental Specialist*
Environmental Services, Ontario Region

Subject: Asbestos Survey Report

Dear Ms. Harrison:

WSP Canada Inc. (WSP) was retained by Public Services and Procurement Canada (PSPC) on behalf of Agriculture and Agri-Food Canada (AAFC) to carry out an Asbestos Survey for ten (10) buildings at the London Research and Development Centre, located at 1391 Sandford Street, in London, Ontario (the “subject property”).

The purpose of this assignment is to report WSP’s survey findings for each building and to provide PSPC/AAFC with relevant recommendations for the management and/or removal of asbestos-containing materials at the subject property.

The following report discusses the methodologies and findings of this survey.

We trust that the attached report is satisfactory for your purposes at this time. Please contact the undersigned should you have any questions or concerns.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Sh Heikkila'.

Stephen Heikkila, P.Eng.
Project Manager, Environment

A handwritten signature in black ink, appearing to read 'MS St-Germain'.

Marc St-Germain, P.Eng.
Senior Project Engineer, Environment

swh/cl

WSP ref.: 181-00742-00



EXECUTIVE SUMMARY

WSP Canada Inc. (WSP) was retained by Public Services and Procurement Canada (PSPC) on behalf of Agriculture and Agri-Food Canada (AAFC) to carry out an Asbestos Survey for ten (10) buildings at the London Research and Development Centre, located at 1391 Sandford Street, in London, Ontario (the “subject property”).

The survey was conducted by WSP on January 29th, 30th, and 31st, 2018. The subject buildings considered in WSP’s asbestos survey of the subject property included:

- Building 10 – Garage
- Building 11 – Field Laboratory (House)
- Building 12 – Implement Barn
- Building 13 – Pumphouse
- Building 14 – Office/Laboratory Building
- Building 15 – Mass Production
- Building 16 – Garage
- Building 17 – Pesticide Handling Building
- Building 18 – Multi-Purpose Facility
- Building 19 – Pole Barn

This survey is required to meet AAFC’s employer responsibilities under the *Canada Labour Code (The Code)* and to satisfy a building owner’s requirements under Section 30 of the *Ontario Occupational Health & Safety Act (OHSA)* which requires building owners to determine if there are any Designated Substances present, prior to commencement of a project, which may involve Construction, Renovation or Demolition (CRD) related activities. This information allows workers to take appropriate steps to prevent accidental exposure to these harmful substances.

The objectives of this survey were as follows:

- Develop an up-to-date inventory, and gain a better understanding of the asbestos-containing materials that are present in the subject property;
- Document their locations, applications, concentrations, quantities, and conditions in the subject building in order to provide workers, and prospective contractors, with adequate information to prevent accidental exposures; and
- Provide recommendations for the safe removal, handling and disposal of the identified asbestos-containing materials, as necessary.

WSP’s asbestos survey identified a number of asbestos-containing materials throughout the subject property. Details regarding the locations, concentrations, quantities, conditions, and recommended remedial actions for asbestos-containing materials found within each building are presented separately and can be found in Appendices A to J. In addition, a complete list of the suspect building materials from which bulk samples were collected, and subsequently identified as “non-asbestos” can also be found within the aforementioned appendices.

Below is a summary of the findings for each of the subject buildings included in the survey:



Table 1 – Asbestos Survey Findings at London Research and Development Centre

BUILDING NO.	BUILDING NAME	AREA (M ²)	YEAR OF CONSTRUCTION	ACM IDENTIFIED?	CONFIRMED ACM
10	Garage	54	1986	No	– None confirmed
11	Field Laboratory (House)	257	1890	Yes	– Exterior white caulking around doors and windows
12	Implement Barn	166	1986	No	– None confirmed
13	Pumphouse	7	1987	No	– None confirmed
14	Office/Laboratory Building	5,358	1988, 2001, 2015	Yes	<ul style="list-style-type: none"> – Grey/black window glazing around rooms 1039, 2043, and 2037 – Interior door black window glazing, wooden doors within 1988 phase – Interior white/grey/brown window glazing, 1988 phase – Exterior window glazing, 1988 phase
15	Mass Production	440	1988	Yes	– Interior door window glazing, wooden doors
16	Garage	400	1988	Yes	<ul style="list-style-type: none"> – Interior door window glazing – Exterior window glazing
17	Pesticide Handling Building	20	2002	No	– None confirmed
18	Multi-Purpose Facility	165	2004	No	– None confirmed
19	Pole Barn	267	2013	No	– None confirmed

1. Details regarding the locations, concentrations, quantities, conditions, and recommended remedial actions for asbestos-containing materials found within each building are presented separately and can be found in Appendices A to J.

RECOMMENDATIONS

As the survey was non-destructive in nature, suspect materials may be present within concealed building materials, gaskets on cast iron storm drains, or present on the roofs, such as caulking, mastics, tar, etc., and should be presumed to contain asbestos if observed. Prior to disturbance of suspect ACM, samples should be collected and analyzed to confirm the presence or absence of asbestos.

All actions and procedures recommended for the management of the identified asbestos-containing materials at the London Research and Development Centre are designated as Action 7 – Routine surveillance of ACM in good condition. The recommendations are based on the requirements of *Ontario Regulation 278/05*, as well as PSPC's *Asbestos Management Standard*.

Removal of all asbestos-containing materials must be conducted before any renovation activities that may damage these materials. Removal must be conducted in accordance with the *Occupational Health and Safety Act (OSHA)* regarding worker protection, to avoid the inhalation or ingestion of asbestos fibres, as well as the *Canada Occupational Health & Safety Regulations (SOR/86-304)* under the *Canada Labour Code (The Code)*. Confirmation that



the asbestos removal has been conducted in accordance with the aforementioned acts and regulations is recommended prior to any contract work in areas proposed for renovation.

The positive identification of asbestos-containing materials within the subject property requires the preparation and establishment of an Asbestos Management Plan for the building, in accordance with *O. Reg. 278/05* and *SOR/86-304*, if the ACM is to remain in place.

If during renovation or demolition, additional materials suspected of containing asbestos are encountered, they must be handled in accordance with the appropriate guidelines and regulations. It should be noted that asbestos may be present in the enclosed spaces not accessible at the time of the site visit.

Complete commentary for each building will be discussed in the report to follow. This executive summary is not intended to substitute for the complete report, nor does it discuss certain specific issues documented within the report.

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B	BUILDING 12 - IMPLEMENT BARN
C	BUILDING 13 - PUMPHOUSE
D	BUILDING 14 - OFFICE/LABORATORY BUILDING
E	BUILDING 15 - MASS PRODUCTION
F	BUILDING 17 - PESTICIDE HANDLING BUILDING
G	BUILDING 18 - MULTI PURPOSE FACILITY



H	BUILDING 19 - POLE BARN
I	BUILDING 10 - GARAGE
J	BUILDING 16 - GARAGE
K	PSPC ASBESTOS MANAGEMENT STANDARD (2017)

1 INTRODUCTION

1.1 BACKGROUND

WSP Canada Inc. (WSP) was retained by Public Services and Procurement Canada (PSPC) on behalf of Agriculture and Agri-Food Canada (AAFC) to carry out an Asbestos Survey for ten (10) buildings at the London Research and Development Centre, located at 1391 Sandford Street, in London, Ontario (the “subject property”).

The survey was conducted by WSP on January 29th, 30th, and 31st, 2018.

A Designated Substance Survey took place at this facility in 2005 (*Designated Substances Survey Agriculture and Agri-Food Canada London Facility, 1391 Sandford Street – Trow Associates Inc.- AAFC Project No. 515896L, December 2005*). This 2018 asbestos survey completed by WSP references information provided within the 2005 Trow Associates Inc. report.

1.2 SITE DESCRIPTION

The subject property is comprised of ten (10) buildings for the purposes of this survey. The subject property is located 4.5 km west of the London International Airport and 11 km north of Highway 401 at 1391 Sandford Street, in London, ON.

Figure 1 London Research and Development Centre Site Plan



1.3 REGULATORY CONTEXT

1.3.1 FEDERAL LEGISLATION

CANADA LABOUR CODE

Since the subject property is considered a federal site, and will be accessed by federal employees, the *Canada Labour Code (Part II) (The Code)* applies. Under *The Code*, the *Canada Occupational Health and Safety Regulations (SOR/86-304)* govern the health and safety of employees working in federally-regulated industries and organizations which includes the federal government and crown corporations. *The Code* establishes responsibilities and requirements of employers, managers and supervisors who act on behalf of the employer and employees, in order to maintain safe workplaces and working environments.

Part X of *SOR/86-304* states that every employer shall keep and maintain a record of all hazardous substances that, in the work place, are used, produced, handled, or stored for use in the work place, and may either keep and maintain such a record in the work place or keep and maintain a centralized record in respect of several work places, in one work place. In addition, *SOR/86-304* details requirements for hazard investigations, sampling, medical examinations, signage/labelling, training, and the establishment of an Asbestos Exposure Management Plan.

NATIONAL JOINT COUNCIL – OCCUPATIONAL HEALTH AND SAFETY DIRECTIVE

The National Joint Council (NJC) *Occupational Health and Safety Directive (the OHS Directive)* contains enhancements to *The Code* for dealing with asbestos and materials containing asbestos. *The OHS Directive* states that departments and agencies will comply with Public Works and Government Services Canada Departmental Policy DP 057, which was recently replaced by the Public Services and Procurement Canada *Asbestos Management Standard*. This Asbestos Survey Report should be read in conjunction with the PSPC *Asbestos Management Standard* and the site-specific Asbestos Management Plan.

1.3.2 PROVINCIAL LEGISLATION (ONTARIO)

DESIGNATED SUBSTANCES

Asbestos is one of the eleven designated substances specifically identified within Section 30 of the *Occupational Health and Safety Act (OHSA)*. Each of the identified substances is governed by a consolidated regulation, *Designated Substances - Ontario Regulation 490/09 (O. Reg. 490/09)*, which defines the minimum health and safety requirements for assuring safe worker-substance interaction as well as the obligations of employers and workers in workplaces containing these substances. The regulation further stipulates the maximum concentrations of each of the respective substances to which a worker may be exposed, according to short-term exposure values and time-weighted average exposure values.

ADDITIONAL REGULATORY REQUIREMENTS FOR ASBESTOS

Among the Designated Substances, asbestos is unique in that it is governed by two regulations under *OHSA* - one for the general mining and processing operations of asbestos and one for asbestos on construction projects and in buildings and repair operations.

Ontario Regulation 278/05 (O. Reg. 278/05), made under *OHSA*, entitled “Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations” came into effect on November 1, 2005, with some sections contained therein becoming effective on November 1, 2007. This regulation revoked and replaced the previous asbestos regulation, *O. Reg. 838/90*.

O. Reg. 278/05 introduced significant changes to how asbestos management is regulated in Ontario. Many of the regulatory changes adopted by *O. Reg. 278/05* were already in wide use in industry as part of best

management practices. Noteworthy regulatory changes included modifications to asbestos survey requirements, the management of asbestos on-site, abatement operations and procedures (i.e. Type 1, 2 and 3), the use of personal protective equipment (PPE) and air monitoring requirements.

ADDITIONAL REGULATORY REQUIREMENTS FOR WASTE MANAGEMENT

The disposal of Designated Substances is regulated under the Ontario *Environmental Protection Act*, specifically *R.R.O. 1990, Regulation 347, General – Waste Management* (most recently amended by *O. Reg. 334/13*). The regulation details the minimum requirements for the appropriate transport and disposal of wastes.

1.4 SURVEY OBJECTIVES

This survey is required to meet AAFC's employer responsibilities under the *Canada Labour Code (The Code)* and to satisfy a building owner's requirements under Section 30 of the *Ontario Occupational Health & Safety Act (OHSA)*. This information allows workers to take appropriate steps to prevent accidental exposure to these harmful substances.

The objectives of this survey were as follows:

- Develop an up-to-date inventory, and gain a better understanding of the asbestos-containing materials that are present in the subject property;
- Document their locations, applications, concentrations, quantities, and conditions in the subject building in order to provide workers, and prospective contractors, with adequate information to prevent accidental exposures; and
- Provide recommendations for the safe removal, handling and disposal of the identified asbestos-containing materials, as necessary.

1.5 SCOPE OF WORK

The survey was thorough and intrusive which consisted of investigating building spaces, materials and components which are easily accessible, or those which may be accessed by moveable (non-fixed) barriers such as above suspended ceiling tiles, access doors, hatches, panels, etc.

WSP's scope of work for this project consisted of:

- A thorough visual inspection of the subject buildings and structures for Asbestos-Containing Materials;
- Collection of bulk samples of materials suspected to contain asbestos according to the requirements stipulated in *O. Reg. 278/05* and PSPC's *Asbestos Management Standard*; and
- Production of a site-specific Asbestos Survey Report and Asbestos Management Plan.

2 METHODOLOGY

2.1 ASBESTOS SURVEY METHODOLOGY

WSP's surveyor performed a systematic survey of the subject buildings and structures for the purposes of identifying asbestos-containing materials (ACM) and documenting observations made about their locations, estimated quantities and respective conditions. These observations form the basis for developing the recommendations provided within this report.

The surveyors inspected the subject buildings for the presence of friable and non-friable ACM. Examples of ACM commonly found in buildings may include:

- Sprayed insulation
- Acoustic/texture plaster
- Drywall joint compound
- Mechanical insulation
- Asbestos cement
- Piping
- Acoustic ceiling tiles
- Vinyl floor tiles and vinyl sheet flooring
- Plaster

Bulk samples were collected from suspect materials (i.e. materials known as having the potential to be asbestos-containing) and analyzed to identify or confirm the presence/absence of asbestos.

The number of bulk samples required, in order to establish whether a material is asbestos-containing according to *O. Reg. 278/05*, is summarized in Table 2.

Table 2 - Minimum Number of Bulk Samples to be collected under O. Reg. 278/05 According to Material Area, Application and Friability

TYPE OF MATERIAL	SIZE OF HOMOGENEOUS MATERIAL	MINIMUM NUMBER OF BULK SAMPLES
Surfacing material, including without limitation material that is applied to surfaces by spraying, by troweling or otherwise, such as acoustical plaster on ceilings, fireproofing materials on structural members and plaster	Less than 90 m ²	3
	90 m ² or more, but less than 450 m ²	5
	450 m ² or more	7
Thermal insulation, except as described below	Any size	3
Thermal insulation patch	Less than 2m or 0.5 m ²	1
Other material	Any size	3

Samples were collected from discrete locations with every attempt to minimize damage and to avoid testing duplicates. The following procedures for collection of samples were followed:

- The surface of the material was wetted with amended water using a spray bottle. In situations where the material could not be wetted, a plastic bag or other containment device was placed around the sampling device.
- A sample was obtained by one of two methods:
 - A sampling device was slowly pushed into the material with a twisting motion until the entire thickness was penetrated, followed by extraction of the sampling device, or;
 - A knife was cleaned and then used to excise a piece of the material.
- Each sample was placed in a clear bag with a tight closure, labelled appropriately and placed in a second, similar bag. Debris was cleaned with wet paper towels and discarded into a plastic bag.
- Damage to the material sampled was repaired with duct tape and/or filler material as needed.
- A chain of custody form was completed for all samples collected on-site and accompanied samples in transit. Asbestos bulk samples were couriered to EMSL of Mississauga, Ontario.

As per the requirements set out in Table 1 of *O. Reg. 278/05*, samples were collected and submitted for asbestos analysis as part of this survey. Fibrous glass insulation was not submitted for analysis as it can be identified visually and was never manufactured with asbestos.

In accordance with the analysis techniques required by *O. Reg. 278/05*:

- for layered materials, subsamples are taken from each individual or discrete layer and each subsample is then treated as a discrete sample; and
- if a material is found to contain greater than 0.1% asbestos, additional bulk material samples taken from the same homogeneous material are not required to be analyzed (“stop positive analysis”).

The bulk samples were submitted to an accredited, independent laboratory for analysis (accompanied by a chain of custody form) of asbestos content via US EPA Method *EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials* in accordance with the requirements of *O. Reg. 278/05*.

As per PSPC’s Statement of Work:

- the laboratory was instructed to carry out Transmission Electron Microscopy (TEM) analysis of Vinyl Floor Tiles, only if asbestos was not identified via Polarized Light Microscopy (PLM) analysis; and,
- the laboratory was instructed to carry out Polarized Light Microscopy (PLM) 1000 Point Count analysis for any sample containing between 0% and 1% asbestos, in order to meet the specified criteria of 0.1%.

As per these requirements, a total of five hundred and twelve (512) samples were analyzed by the laboratory for this assessment.

3 SITE OVERVIEW

Each of the subject property's buildings are reported separately and provided in **Appendix A to J**. Analytical results for asbestos, drawings and relevant site photographs taken during the survey are provided within those appendices.

It should be noted that asbestos-containing materials (ACM) may be concealed by existing building finishes, components or fixtures. If CRD activities uncover materials suspected to contain asbestos, all work must stop prior to the disturbance of these materials, and the suspect materials should either be sampled by a qualified person, or presumed to contain asbestos. Whether the suspect material(s) are confirmed, or presumed, to contain asbestos, they must be handled and disposed of in accordance with the appropriate and applicable guidelines and regulations including, but not limited to: *O. Reg. 278/05*, *O. Reg. 490/09* and *R.R.O. 1990, Regulation 347* (as amended). In addition, all users of the building(s) must refer to AAFC's Asbestos Management Plan for greater guidance regarding the handling procedures and management of suspected or presumed ACM.

4 LIMITATIONS

As this survey was generally non-destructive in nature, asbestos could be present in areas not accessible to the surveyor(s) for identification. Contractors and maintenance personnel should be warned of the possibility of unidentified materials when breaking into enclosed areas. Suspect friable and non-friable building materials discovered in these areas should be treated as asbestos until proven otherwise. Materials equivalent or identical in description to those listed in **Appendix A to J**, should be considered to be ACM and handled appropriately.

This report is prepared for the sole use of PSPC and AAFC, who are responsible for its distribution to any third parties. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third party. The conclusions and recommendations contained in this assessment report are based upon professional opinions with regard to the subject matter. These opinions are in accordance with currently accepted industry practices for asbestos surveys and regulatory requirements for sampling and identifying asbestos and are subject to the following inherent limitations:

1. The data and findings presented in this report are valid as of the date(s) of the investigation only. The passage of time, manifestation of latent conditions or occurrence of future events may warrant further exploration of the Site, analysis of the data, and re-evaluation of the findings, observations, and conclusions expressed in this report.
2. The findings, observations, conclusions, and recommendations expressed by WSP Canada Inc. in this report do not represent an opinion concerning compliance of any past or present owner or operator of the Site with any federal, provincial or local laws or regulations.
3. WSP Canada Inc.'s assessment presents professional opinions and findings of a scientific and technical nature. While attempts were made to relate the data and findings to applicable environmental and occupational health & safety laws and regulations, the report shall not be construed to offer legal opinion or representations as to the requirements of, nor compliance with, environmental and occupational health and safety laws, rules, regulations or policies of federal, provincial, or local governmental agencies. WSP Canada Inc. liability extends only to its client and not to other parties who may obtain this assessment report. Issues raised by the report should be reviewed by appropriate legal counsel.

APPENDIX

A

BUILDING 11 – FIELD
LABORATORY (HOUSE)



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LABORATORY CERTIFICATES OF ANALYSIS

DRAWINGS

1 OBSERVATIONS AND RESULTS

Building 11, the Field Laboratory (House), is an old farm house located at the Subject Property. The rectangular-shaped structure was reportedly constructed in 1890 and is approximately 257 m² (2,766 ft²) in area. There were renovations completed within the house in 1985/1986 and the roof was replaced in 2008. It is a two-storey house with a basement, first floor, second floor, and an attic.

The building has a brick exterior finish with a shingled roof. The interior finishes consist of drywall, vinyl linoleum sheet flooring, and fieldstone/mortar in the basement.

1.1 ASBESTOS-CONTAINING MATERIALS

The *Canada Occupational Health & Safety Regulations (SOR/86-304)* and *Ontario Regulation 278/05 (O. Reg. 278/05)* both establish definitions of asbestos-containing material (ACM), however, *O. Reg. 278/05* is more stringent. In accordance with the requirements of *O. Reg. 278/05*, homogenous materials (i.e. materials uniform in color and texture) must be considered to be asbestos-containing, if any sample which is collected from that homogeneous material, is identified to have an asbestos concentration of 0.5% or greater. However, recognizing that other provinces utilize more stringent criteria, in order to establish national consistency, AAFC considers homogeneous materials to be asbestos-containing if the asbestos concentration is 0.1% or greater.

A total of thirty-nine (39) building material samples were collected from eleven (11) homogenous building materials and submitted for laboratory analysis of asbestos content. The table below summarizes only those materials which were subsequently identified, confirmed or presumed to be asbestos-containing materials and are presented along with recommended remedial actions for each respective material.

Recommended actions for management, repair or removal of these materials, are based on the requirements and procedures specified by *O. Reg. 278/05* and PSPC's *Asbestos Management Standard*, and have been suggested based on the type of disturbance which is anticipated or likely. Alternate handling, repair and removal procedures must comply with the requirements of *O. Reg. 278/05* and PSPC's *Asbestos Management Standard*.

Table 1 – Asbestos-Containing Materials

MATERIAL DESCRIPTION & LOCATION	ASSESSMENT ¹	ACTION ²	PHOTO ³
Exterior White Caulking Approximately 100 linear meters (328 linear feet) was observed around the exterior doors and windows.	Sample ID/Concentration: B11-AS130-A [0.3% Chrysotile] Material: Non-Friable Accessibility: A (Areas of the building within reach of all building users.) Condition: Good	Action 7 Routine surveillance of ACM in good condition. Prior to demolition activities which may disturb this material, remove the material following: Type 1 abatement procedures – if the material is wetted and the work is performed using non-powered hand tools.	3

¹ For sample ID and concentration levels refer to attached Laboratory Certificates of Analysis.

² Actions and procedures recommended are based on the requirements of the PSPC *Asbestos Management Standard* and *O. Reg. 278/05*.

³ For relevant photographs taken during the survey refer to attached Site Photographs.

As the survey was non-destructive in nature, suspect materials may be present within concealed building materials or present on the roof, such as caulking, mastics, tar, etc., and should be presumed to contain

asbestos if observed. Prior to disturbance of suspect ACM, samples should be collected and analyzed to confirm the presence or absence of asbestos.

If renovation or demolition activities are likely to disturb the materials, it is required that all identified asbestos-containing materials be removed in accordance with *O. Reg. 278/05* and PSPC's *Asbestos Management Standard*. If any potential asbestos-containing materials are encountered unexpectedly, a qualified environmental consultant should be contacted to sample, monitor and/or document the removal of asbestos-containing materials, and to ensure that appropriate procedures are being followed.

1.2 SUMMARY OF BULK SAMPLES IDENTIFIED AS “NON-ASBESTOS”

The table below summarizes the results of bulk material samples collected from suspect materials during the current survey, which had either no detectable concentrations of asbestos, or had asbestos concentrations less than the AAFC required threshold limit of 0.1% (by weight), and therefore can be considered as “non-asbestos”.



Table 2 – Summary of Bulk Samples Identified as “Non-Asbestos”

MATERIAL DESCRIPTION / LOCATION	SAMPLE ID ¹
2 nd Floor sheet vinyl flooring	AC-LN-AS4 ² , AC-LN-AS4-2 ² , AC-LN-AS4-3 ²
Basement wall plaster	AC-LN-AS5 ² , AC-LN-AS5-2 ² , AC-LN-AS5-3 ²
Brick mortar/Exterior	B11-AS128-A,B,C,D,E
White caulking/Around the inner frame of the exterior windows	B11-AS129-A,B,C
Drywall joint compound/Throughout the house	B11-AS131-A,B,C,D,E
Red/maroon with fleck linoleum vinyl sheet flooring/Throughout the first floor	B11-AS132-A,B,C
Cream/beige with fleck linoleum vinyl sheet flooring/Throughout the second floor	B11-AS133-A,B,C
White caulking/Running along baseboard of stairs	B11-AS134-A,B,C
White caulking/Around the interior windows	B11-AS135-A,B,C
White caulking/Around the kitchen counter top	B11-AS136-A,B,C
Paper/On wood within attic space	B11-AS137-A,B,C
Fieldstone mortar/Basement	B11-AS138-A,B,C,D,E

¹ For sample ID and concentration levels refer to attached Laboratory Certificates of Analysis.

² Material previously sampled by Trow Associates Inc. (see *Designated Substances Survey Agriculture and Agri-Food Canada London Facility, 1391 Sandford Street – Trow Associates Inc.- AAFC Project No. 515896L, December 2005*).

SITE PHOTOGRAPHS

PHOTO NO. 1	
DATE: January 31, 2018	
DESCRIPTION: View of the front of Building 11 – Field Laboratory (House) (facing southwest).	
SAMPLE NUMBER(S): -	
PHOTO NO. 2	
DATE: January 31, 2018	
DESCRIPTION: View of the back of Building 11 – Field Laboratory (House) (facing east).	
SAMPLE NUMBER(S): -	
PHOTO NO. 3	
DATE: January 31, 2018	
DESCRIPTION: View of asbestos-containing white caulking around the exterior doors and windows.	
SAMPLE NUMBER(S): B11-AS130-A,B,C	

LABORATORY CERTIFICATES OF ANALYSIS



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Collected: 1/31/2018
Received: 2/05/2018
Analyzed: 2/13/2018

Proj: 181-00742-00 London/B11

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B11-AS128-A **Lab Sample ID:** 551801490-0001

Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	<1%	100%	None Detected	

Client Sample ID: B11-AS128-B **Lab Sample ID:** 551801490-0002

Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	<1%	100%	None Detected	

Client Sample ID: B11-AS128-C **Lab Sample ID:** 551801490-0003

Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	<1%	100%	None Detected	

Client Sample ID: B11-AS128-D **Lab Sample ID:** 551801490-0004

Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	<1%	100%	None Detected	

Client Sample ID: B11-AS128-E **Lab Sample ID:** 551801490-0005

Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	<1%	100%	None Detected	

Client Sample ID: B11-AS129-A **Lab Sample ID:** 551801490-0006

Sample Description: EXTERIOR WHITE INNER FRAME WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	None Detected	

Client Sample ID: B11-AS129-B **Lab Sample ID:** 551801490-0007

Sample Description: EXTERIOR WHITE INNER FRAME WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	None Detected	



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Client Sample ID: B11-AS129-C **Lab Sample ID:** 551801490-0008

Sample Description: EXTERIOR WHITE INNER FRAME WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	None Detected	

Client Sample ID: B11-AS130-A **Lab Sample ID:** 551801490-0009

Sample Description: EXTERIOR WHITE DOOR / WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	<1% Chrysotile	
1000 PLM PtCt Grav. Red.	2/13/2018	Gray/White	0.0%	99.7%	0.3% Chrysotile	

Client Sample ID: B11-AS130-B **Lab Sample ID:** 551801490-0010

Sample Description: EXTERIOR WHITE DOOR / WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	<1% Chrysotile	
1000 PLM PtCt Grav. Red.	2/13/2018				Positive Stop (Not Analyzed)	

Client Sample ID: B11-AS130-C **Lab Sample ID:** 551801490-0011

Sample Description: EXTERIOR WHITE DOOR / WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	<1% Chrysotile	
1000 PLM PtCt Grav. Red.	2/13/2018				Positive Stop (Not Analyzed)	

Client Sample ID: B11-AS131-A **Lab Sample ID:** 551801490-0012

Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B11-AS131-B **Lab Sample ID:** 551801490-0013

Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B11-AS131-C **Lab Sample ID:** 551801490-0014

Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	<1%	100%	None Detected	

Client Sample ID: B11-AS131-D **Lab Sample ID:** 551801490-0015

Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	<1%	100%	None Detected	



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Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B11-AS131-E **Lab Sample ID:** 551801490-0016
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White/Rust	0%	100%	None Detected	

Client Sample ID: B11-AS132-A **Lab Sample ID:** 551801490-0017
Sample Description: RED/MAROON WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown/Gray	25%	75%	None Detected	

Client Sample ID: B11-AS132-B-Linoleum **Lab Sample ID:** 551801490-0018
Sample Description: RED/MAROON WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown/Gray	33%	67%	None Detected	

Client Sample ID: B11-AS132-B-Adhesive **Lab Sample ID:** 551801490-0018A
Sample Description: RED/MAROON WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Yellow	10%	90%	None Detected	

Client Sample ID: B11-AS132-C **Lab Sample ID:** 551801490-0019
Sample Description: RED/MAROON WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown/Gray	28%	72%	None Detected	

Client Sample ID: B11-AS133-A **Lab Sample ID:** 551801490-0020
Sample Description: CREAM / BEIGE WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan/Beige	40%	60%	None Detected	

Client Sample ID: B11-AS133-B **Lab Sample ID:** 551801490-0021
Sample Description: CREAM / BEIGE WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan/Beige	40%	60%	None Detected	

Client Sample ID: B11-AS133-C **Lab Sample ID:** 551801490-0022
Sample Description: CREAM / BEIGE WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan/Beige	33%	67%	None Detected	



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Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B11-AS134-A **Lab Sample ID:** 551801490-0023
Sample Description: WHITE CAULKING ALONG STAIRWELL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	None Detected	

Client Sample ID: B11-AS134-B **Lab Sample ID:** 551801490-0024
Sample Description: WHITE CAULKING ALONG STAIRWELL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	None Detected	

Client Sample ID: B11-AS134-C **Lab Sample ID:** 551801490-0025
Sample Description: WHITE CAULKING ALONG STAIRWELL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown/Gray/White	0%	100%	None Detected	

Client Sample ID: B11-AS135-A **Lab Sample ID:** 551801490-0026
Sample Description: WHITE INTERIOR WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Beige	0%	100%	None Detected	

Client Sample ID: B11-AS135-B **Lab Sample ID:** 551801490-0027
Sample Description: WHITE INTERIOR WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Beige	0%	100%	None Detected	

Client Sample ID: B11-AS135-C **Lab Sample ID:** 551801490-0028
Sample Description: WHITE INTERIOR WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B11-AS136-A **Lab Sample ID:** 551801490-0029
Sample Description: WHITE CAULKING AROUND COUNTER TOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Beige	0%	100%	None Detected	

Client Sample ID: B11-AS136-B **Lab Sample ID:** 551801490-0030
Sample Description: WHITE CAULKING AROUND COUNTER TOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White/Beige	0%	100%	None Detected	



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Client Sample ID: B11-AS136-C **Lab Sample ID:** 551801490-0031
Sample Description: WHITE CAULKING AROUND COUNTER TOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White/Clear	0%	100%	None Detected	

Client Sample ID: B11-AS137-A **Lab Sample ID:** 551801490-0032
Sample Description: PAPER ON WOOD WITHIN ATTIC SPACE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown/Green	90%	10%	None Detected	

Client Sample ID: B11-AS137-B **Lab Sample ID:** 551801490-0033
Sample Description: PAPER ON WOOD WITHIN ATTIC SPACE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown/Green	95%	5%	None Detected	

Client Sample ID: B11-AS137-C **Lab Sample ID:** 551801490-0034
Sample Description: PAPER ON WOOD WITHIN ATTIC SPACE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown/Black	90%	10%	None Detected	

Client Sample ID: B11-AS138-A **Lab Sample ID:** 551801490-0035
Sample Description: FIELD STONE MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	<1%	100%	None Detected	

Client Sample ID: B11-AS138-B **Lab Sample ID:** 551801490-0036
Sample Description: FIELD STONE MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	<1%	100%	None Detected	

Client Sample ID: B11-AS138-C **Lab Sample ID:** 551801490-0037
Sample Description: FIELD STONE MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B11-AS138-D **Lab Sample ID:** 551801490-0038
Sample Description: FIELD STONE MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	



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EMSL Canada Order 551801490
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B11-AS138-E

Lab Sample ID: 551801490-0039

Sample Description: FIELD STONE MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Analyst(s):

Eric Budai PLM (25)
PLM 1000 PC - Gravimetric (1)
Rebecca Newman PLM (13)
Ryan Shannon PLM (2)

Reviewed and approved by:

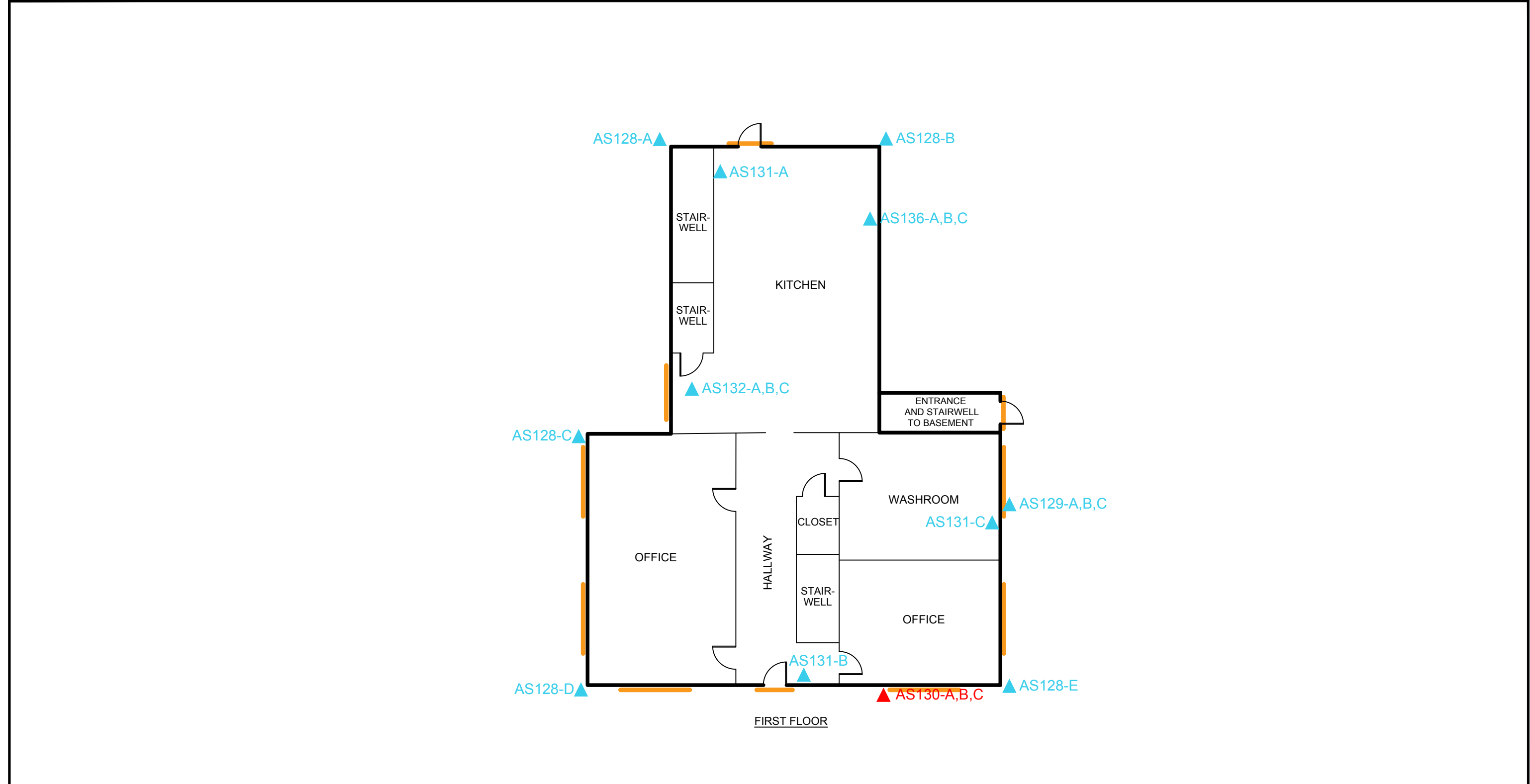
Matthew Davis or other approved signatory
or Other Approved Signatory

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 Analytical, Inc. Ann Arbor, MI NVLAP Lab Code 101048-4

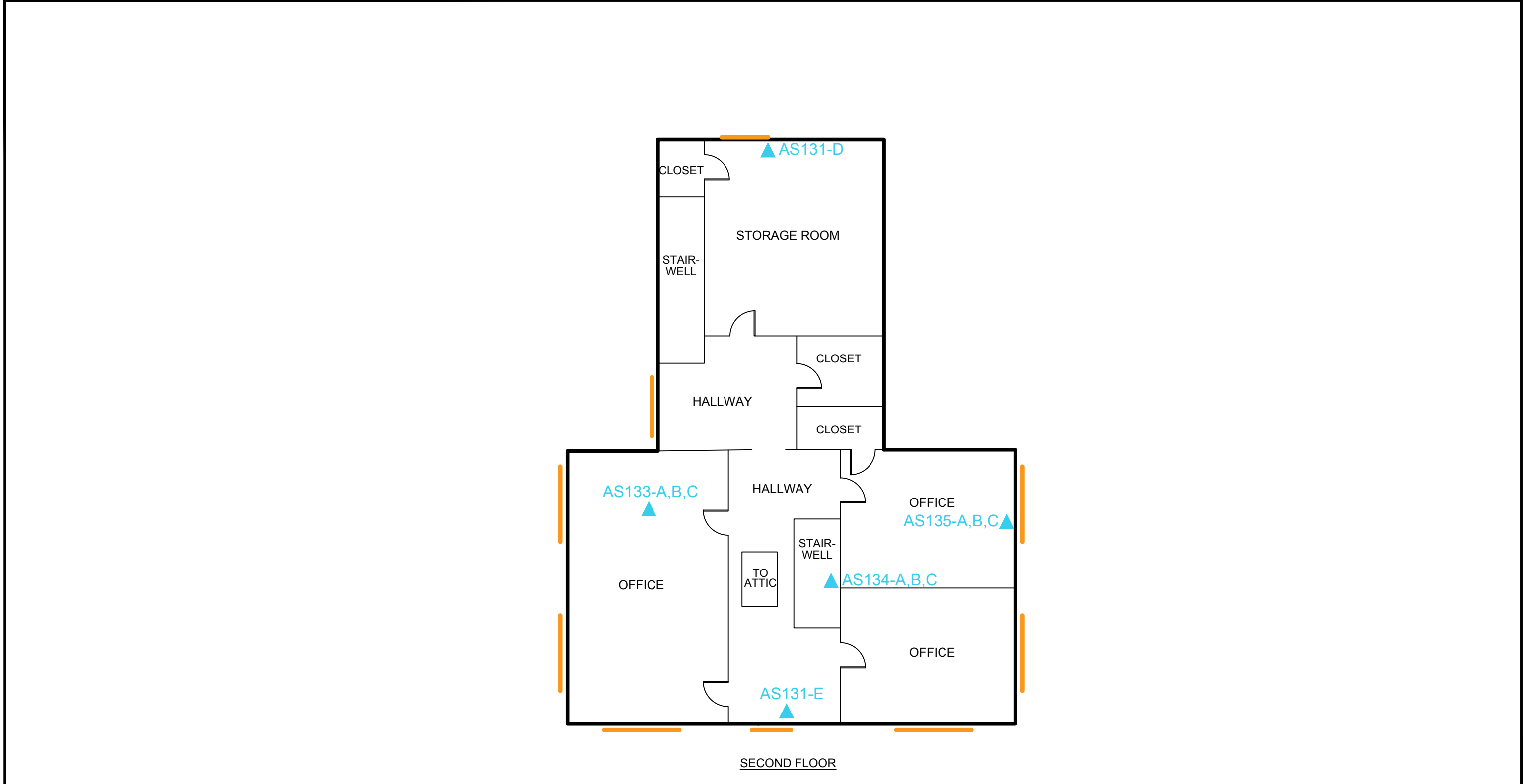
Initial report from: 02/12/2018 15:30:47

DRAWINGS



- NOTES:
- 1. Not to scale. Drawing is based on WSP's field observations.
 - 2. This drawing must be read in conjunction with associated report.
 - 3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
 - 4. Other suspect asbestos-containing materials may be present within concealed building spaces.
 - 5. The following materials were confirmed to be ACM: Exterior white caulking.

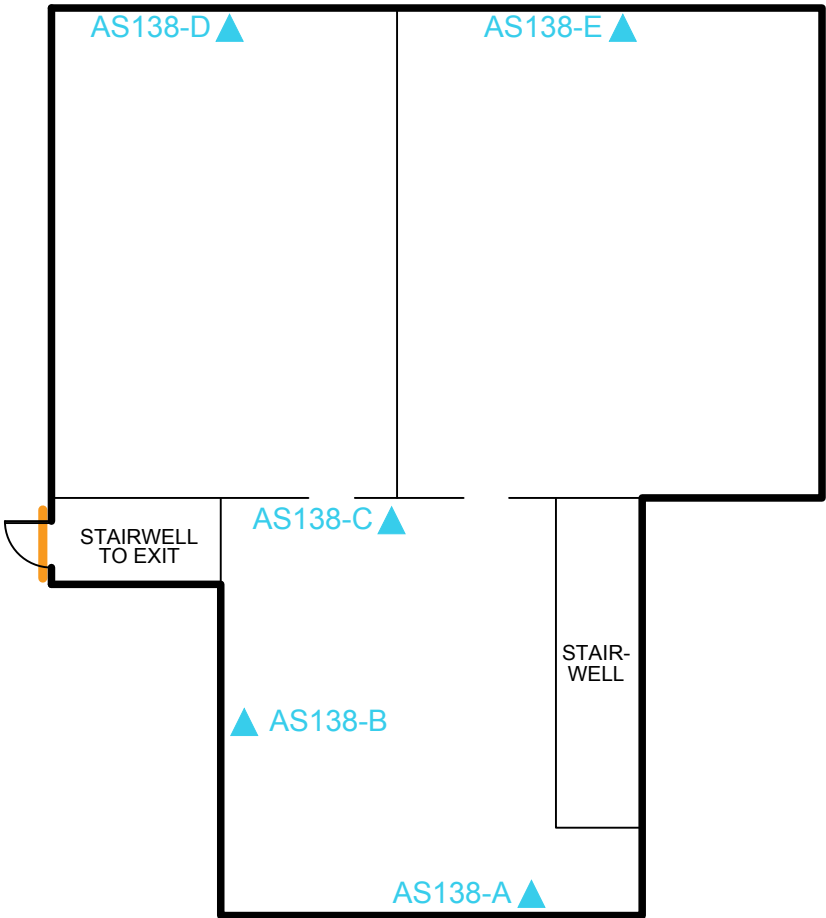
<div>LEGEND</div> <div><div><div></div></div>ASBESTOS BULK SAMPLE LOCATION</div> <div><div><div></div></div>CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION</div> <div><div><div></div></div>EXTERIOR WHITE CAULKING</div>	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA	LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 11 FIELD LABORATORY	Figure No: <div>A-1</div>
	PSPC No: R.095602.001			Site Location: 1391 SANDFORD STREET, LONDON, ONTARIO
	Date: MARCH 2018			
	Drawn By: NN			
	App'd By: SWH			



SECOND FLOOR

- NOTES:
- 1. Not to scale. Drawing is based on WSP's field observations.
 - 2. This drawing must be read in conjunction with associated report.
 - 3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
 - 4. Other suspect asbestos-containing materials may be present within concealed building spaces.
 - 5. The following materials were confirmed to be ACM: Exterior white caulking.

LEGEND <ul style="list-style-type: none">▲ ASBESTOS BULK SAMPLE LOCATION▲ CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION— EXTERIOR WHITE CAULKING	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA	LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 11 FIELD LABORATORY	Figure No: A-2
	PSPC No: R.095602.001	on behalf of AGRICULTURE AND AGRI-FOOD CANADA		
	Date: MARCH 2018	Site Location:		
	Drawn By: NN	1391 SANDFORD STREET, LONDON, ONTARIO		
	App'd By: SWH			



BASEMENT

- NOTES:
- 1. Not to scale. Drawing is based on WSP's field observations.
 - 2. This drawing must be read in conjunction with associated report.
 - 3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
 - 4. Other suspect asbestos-containing materials may be present within concealed building spaces.
 - 5. The following materials were confirmed to be ACM: Exterior white caulking.

<div>LEGEND</div> <div><div></div> ASBESTOS BULK SAMPLE LOCATION</div> <div><div></div> CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION</div> <div><div></div> EXTERIOR WHITE CAULKING</div>	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA	<div>LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS</div> <div>BUILDING 11</div> <div>FIELD LABORATORY</div>	Figure No: <div>A-3</div>
	PSPC No: R.095602.001			Site Location: 1391 SANDFORD STREET, LONDON, ONTARIO
	Date: MARCH 2018			
	Drawn By: NN			
	App'd By: SWH			



▲ AS137-A,B,C

ATTIC

- NOTES:
- 1. Not to scale. Drawing is based on WSP's field observations.
 - 2. This drawing must be read in conjunction with associated report.
 - 3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
 - 4. Other suspect asbestos-containing materials may be present within concealed building spaces.
 - 5. The following materials were confirmed to be ACM: Exterior white caulking.

<div>LEGEND</div> <div><div></div> ASBESTOS BULK SAMPLE LOCATION</div> <div><div></div> CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION</div> <div><div></div> EXTERIOR WINDOW GLAZING</div>	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA	<div>LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 11 FIELD LABORATORY</div>	Figure No: <div>A-4</div>
	PSPC No: R.095602.001			Site Location: 1391 SANDFORD STREET, LONDON, ONTARIO
	Date: MARCH 2018			
	Drawn By: NN			
	App'd By: SWH			

APPENDIX

B

BUILDING 12 – IMPLEMENT
BARN



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ATTACHMENTS

SITE PHOTOGRAPHS

LABORATORY CERTIFICATES OF ANALYSIS

DRAWINGS

1 OBSERVATIONS AND RESULTS

Building 12, the Implement Barn, is located next to Building 17 (Pesticide Handling Building) at the Subject Property. The rectangular-shaped structure was reportedly constructed in 1986 and is approximately 166 m² (1,787 ft²) in area. It is an open storage barn with small open second floor used for additional storage.

The building has wood-sided exterior walls and a metal-clad roof. The interior finishes consist of wood beams, concrete flooring, and a wood-framed mezzanine.

1.1 ASBESTOS-CONTAINING MATERIALS

The *Canada Occupational Health & Safety Regulations (SOR/86-304)* and *Ontario Regulation 278/05 (O. Reg. 278/05)* both establish definitions of asbestos-containing material (ACM), however, *O. Reg. 278/05* is more stringent. In accordance with the requirements of *O. Reg. 278/05*, homogenous materials (i.e. materials uniform in color and texture) must be considered to be asbestos-containing, if any sample which is collected from that homogeneous material, is identified to have an asbestos concentration of 0.5% or greater. However, recognizing that other provinces utilize more stringent criteria, in order to establish national consistency, AAFC considers homogeneous materials to be asbestos-containing if the asbestos concentration is 0.1% or greater.

A total of six (6) building material samples were collected from two (2) homogenous building materials and submitted for laboratory analysis of asbestos content. The table below summarizes the results of bulk material samples collected from suspect materials which had either no detectable concentrations of asbestos, or had asbestos concentrations less than the AAFC required threshold limit of 0.1% (by weight), and therefore can be considered as “non-asbestos”.


Table 1 – Summary of Bulk Samples Identified as “Non-Asbestos”

MATERIAL DESCRIPTION / LOCATION	SAMPLE ID ¹
Grey/white exterior window glazing	B12-AS119-A,B,C
White/cream interior window glazing	B12-AS120-A,B,C

¹ For sample ID and concentration levels refer to attached Laboratory Certificates of Analysis.

As the survey was non-destructive in nature, suspect materials may be present on the roof, such as caulking, mastics, tar, etc., and should be presumed to contain asbestos if observed. Prior to disturbance of suspect ACM, samples should be collected and analyzed to confirm the presence or absence of asbestos.

SITE PHOTOGRAPHS

PHOTO NO. 1	
DATE: January 31, 2018	
DESCRIPTION: View of Building 12 – Implement Barn (facing northeast).	
SAMPLE NUMBER(S): -	

LABORATORY CERTIFICATES OF ANALYSIS



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EMSL Canada Order 551801452
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Attn: Stephen Heikkila
WSP Canada Group Limited
100 Commerce Valley Drive West
Thornhill, ON L3T 0A1

Phone: (905) 882-4211
Fax: (905) 882-1857
Collected: 1/31/2018
Received: 2/05/2018
Analyzed: 2/12/2018

Proj: 181-00742-00 London

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B12-AS119-A **Lab Sample ID:** 551801452-0001

Sample Description: Grey/White Exterior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Beige	0%	100%	None Detected	

Client Sample ID: B12-AS119-B **Lab Sample ID:** 551801452-0002

Sample Description: Grey/White Exterior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Beige	0%	100%	None Detected	

Client Sample ID: B12-AS119-C **Lab Sample ID:** 551801452-0003

Sample Description: Grey/White Exterior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Beige	0%	100%	None Detected	

Client Sample ID: B12-AS120-A **Lab Sample ID:** 551801452-0004

Sample Description: White/Cream Interior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B12-AS120-B **Lab Sample ID:** 551801452-0005

Sample Description: White/Cream Interior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B12-AS120-C **Lab Sample ID:** 551801452-0006

Sample Description: White/Cream Interior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	



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EMSL Canada Order 551801452
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Analyst(s):

Shorthri Kalikutty PLM (6)

Reviewed and approved by:

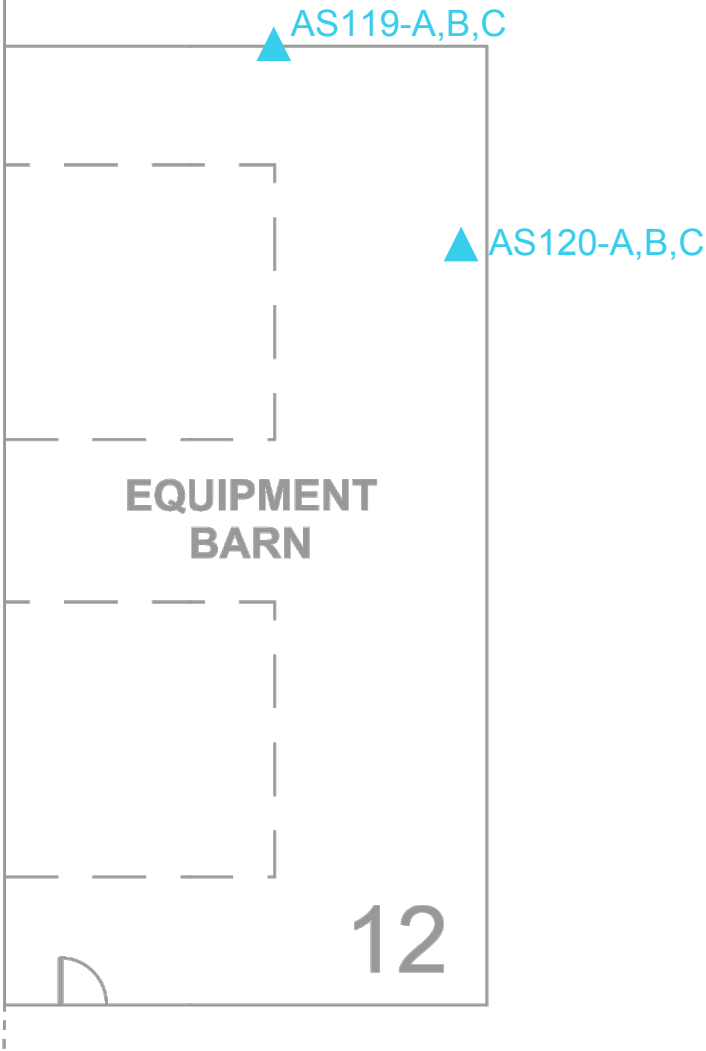
Matthew Davis or other approved signatory
or Other Approved Signatory

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. Mississauga, ON NVLAP Lab Code 200877-0

Initial report from: 02/12/2018 14:00:51

DRAWINGS



- NOTES:
- 1. Not to scale. Drawing is based on WSP's field observations.
 - 2. This drawing must be read in conjunction with associated report.
 - 3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
 - 4. Other suspect asbestos-containing materials may be present within concealed building spaces.

<div>LEGEND</div> <div><div>▲</div> ASBESTOS BULK SAMPLE LOCATION</div> <div><div>▲</div> CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION</div>	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA	<div>LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS</div> <div>BUILDING 12 IMPLEMENT BARN</div>	Figure No: <div>B-1</div>
	PSPC No: R.095602.001			Site Location: 1391 SANDFORD STREET, LONDON, ONTARIO
	Date: MARCH 2018			
	Drawn By: NN			
	App'd By: SWH			

APPENDIX

C

BUILDING 13 - PUMPHOUSE



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ATTACHMENTS

SITE PHOTOGRAPHS

DRAWINGS

1 OBSERVATIONS AND RESULTS

Building 13, the Pump House, is the smallest building located at the Subject Property. The square-shaped structure was reportedly constructed in 1987 and is approximately 7 m² (23 ft²) in area. The roof was reportedly replaced in 2008.


1.1 ASBESTOS-CONTAINING MATERIALS

The *Canada Occupational Health & Safety Regulations (SOR/86-304)* and *Ontario Regulation 278/05 (O. Reg. 278/05)* both establish definitions of asbestos-containing material (ACM), however, *O. Reg. 278/05* is more stringent. In accordance with the requirements of *O. Reg. 278/05*, homogenous materials (i.e. materials uniform in color and texture) must be considered to be asbestos-containing, if any sample which is collected from that homogeneous material, is identified to have an asbestos concentration of 0.5% or greater. However, recognizing that other provinces utilize more stringent criteria, in order to establish national consistency, AAFC considers homogeneous materials to be asbestos-containing if the asbestos concentration is 0.1% or greater.

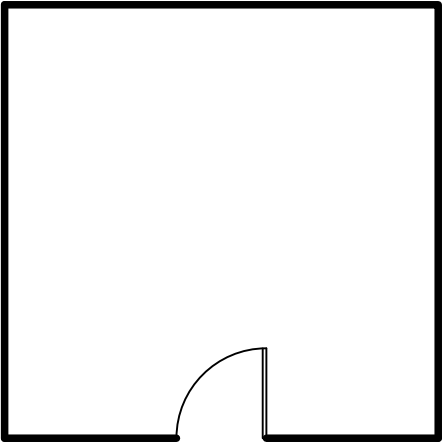
During the survey, suspected asbestos-containing materials were not observed. As such, bulk material samples were not collected for analysis of asbestos content.

As the survey was non-destructive in nature, suspect materials may be present within concealed building materials or present on the roof, such as caulking, mastics, tar, etc., and should be presumed to contain asbestos if observed. Prior to disturbance of suspect ACM, samples should be collected and analyzed to confirm the presence or absence of asbestos.

SITE PHOTOGRAPHS

PHOTO NO. 1	
DATE: January 31, 2018	
DESCRIPTION: View of Building 13 – Pump House (facing northeast).	
SAMPLE NUMBER(S): -	

DRAWINGS



- NOTES:
- 1. Not to scale. Drawing is based on WSP's field observations.
 - 2. This drawing must be read in conjunction with associated report.
 - 3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
 - 4. Other suspect asbestos-containing materials may be present within concealed building spaces.

<div>LEGEND</div> <div><div><div></div><div>ASBESTOS BULK SAMPLE LOCATION</div></div><div><div></div><div>CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION</div></div></div>	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA	LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 13 PUMPHOUSE	Figure No: C-1
	PSPC No: R.095602.001			
	Date: MARCH 2018	Site Location:		1391 SANDFORD STREET, LONDON, ONTARIO
	Drawn By: NN			
	App'd By: SWH			

APPENDIX

D

BUILDING 14 –
OFFICE/LABORATORY
BUILDING



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ATTACHMENTS

SITE PHOTOGRAPHS

LABORATORY CERTIFICATES OF ANALYSIS

DRAWINGS

1 OBSERVATIONS AND RESULTS

Building 14, the Office/Laboratory Building, is the largest building located at the Subject Property. The structure was reportedly constructed in three phases. Phase 1 was constructed in 1988, with a small addition in 1992, and is approximately 3,156 m² (33,971 ft²) in area. Phase 2 was constructed in 2001 and is approximately 890 m² (9,580 ft²) in area. Phase 3 was constructed in 2015 and is approximately 1,312 m² (14,122 ft²) in area. It is a three-storey building consisting of laboratories, offices, greenhouses, and mechanical rooms.

The building has a brick exterior with shingle and modified-bitumen roofing. The interior finishes consist of drywall, concrete block, brick, textured coatings, and acoustic ceiling tiles. Flooring materials include vinyl floor tiles, vinyl sheet flooring and concrete.

1.1 ASBESTOS-CONTAINING MATERIALS

The *Canada Occupational Health & Safety Regulations (SOR/86-304)* and *Ontario Regulation 278/05 (O. Reg. 278/05)* both establish definitions of asbestos-containing material (ACM), however, *O. Reg. 278/05* is more stringent. In accordance with the requirements of *O. Reg. 278/05*, homogenous materials (i.e. materials uniform in color and texture) must be considered to be asbestos-containing, if any sample which is collected from that homogeneous material, is identified to have an asbestos concentration of 0.5% or greater. However, recognizing that other provinces utilize more stringent criteria, in order to establish national consistency, AAFC considers homogeneous materials to be asbestos-containing if the asbestos concentration is 0.1% or greater.

A total of two-hundred and seventy-eight (278) building material samples were collected from eighty (80) homogenous building materials and submitted for laboratory analysis of asbestos content. The table below summarizes only those materials which were subsequently identified, confirmed or presumed to be asbestos-containing materials and are presented along with recommended remedial actions for each respective material.

Recommended actions for management, repair or removal of these materials, are based on the requirements and procedures specified by *O. Reg. 278/05* and PSPC's *Asbestos Management Standard*, and have been suggested based on the type of disturbance which is anticipated or likely. Alternate handling, repair and removal procedures must comply with the requirements of *O. Reg. 278/05* and PSPC's *Asbestos Management Standard*.

Table 1 – Asbestos-Containing Materials

MATERIAL DESCRIPTION & LOCATION	ASSESSMENT ¹	ACTION ²	PHOTO ³
Grey/Black Window Glazing Observed around the exterior windows of Rooms 1039, 2043, and 2037.	Sample ID/Concentration: B14-AS28-A [2% Chrysotile] Material: Non-Friable Accessibility: A <i>(Areas of the building within reach of all building users.)</i> Condition: Good	Action 7 Routine surveillance of ACM in good condition. Prior to demolition activities which may disturb this material, remove the material following: Type 1 abatement procedures – if the material is wetted and the work is performed using non-powered hand tools.	2

MATERIAL DESCRIPTION & LOCATION	ASSESSMENT ¹	ACTION ²	PHOTO ³
Interior Door Black Window Glazing Observed on all the wooden doors with windows within the 1988 phase of the building.	Sample ID/Concentration: B14-AS31-A [2% Chrysotile] Material: Non-Friable Accessibility: A <i>(Areas of the building within reach of all building users.)</i> Condition: Good	Action 7 Routine surveillance of ACM in good condition. Prior to demolition activities which may disturb this material, remove the material following: Type 1 abatement procedures – if the material is wetted and the work is performed using non-powered hand tools.	3
Interior White/Grey/Brown Window Glazing Observed on the interior windows within the green house hallway (GC-3A, GC-3B, GC-3C) within the 1988 phase of the building.	Sample ID/Concentration: B14-AS37-A [1% Chrysotile] Material: Non-Friable Accessibility: A <i>(Areas of the building within reach of all building users.)</i> Condition: Good	Action 7 Routine surveillance of ACM in good condition. Prior to demolition activities which may disturb this material, remove the material following: Type 1 abatement procedures – if the material is wetted and the work is performed using non-powered hand tools.	4
Exterior Window Glazing / 1988 Phase Observed on all the exterior windows around the 1988 phase of the building.	Sample ID/Concentration: B14-AS69-A [2% Chrysotile] Material: Non-Friable Accessibility: A <i>(Areas of the building within reach of all building users.)</i> Condition: Good	Action 7 Routine surveillance of ACM in good condition. Prior to demolition activities which may disturb this material, remove the material following: Type 1 abatement procedures – if the material is wetted and the work is performed using non-powered hand tools.	5

¹ For sample ID and concentration levels refer to attached Laboratory Certificates of Analysis.

² Actions and procedures recommended are based on the requirements of the PSPC *Asbestos Management Standard* and O. Reg. 278/05.

³ For relevant photographs taken during the survey refer to attached Site Photographs.

⁴ Material previously identified by Trow Associates Inc. (see *Designated Substances Survey Agriculture and Agri-Food Canada London Facility, 1391 Sandford Street – Trow Associates Inc.- AAFC Project No. 515896L, December 2005*).

As the survey was non-destructive in nature, suspect materials may be present within concealed building materials, gaskets on cast iron storm drains, or present on the roof, such as caulking, mastics, tar, etc., and should be presumed to contain asbestos if observed. Prior to disturbance of suspect ACM, samples should be collected and analyzed to confirm the presence or absence of asbestos.

If renovation or demolition activities are likely to disturb the materials, it is required that all identified asbestos-containing materials be removed in accordance with O. Reg. 278/05 and PSPC's *Asbestos Management Standard*. If any potential asbestos-containing materials are encountered unexpectedly, a qualified environmental consultant should be contacted to sample, monitor and/or document the removal of asbestos-containing materials, and to ensure that appropriate procedures are being followed.

1.2 SUMMARY OF BULK SAMPLES IDENTIFIED AS “NON-ASBESTOS”

The table below summarizes the results of bulk material samples collected from suspect materials during the current survey, which had either no detectable concentrations of asbestos, or had asbestos concentrations less than the AAFC required threshold limit of 0.1% (by weight), and therefore can be considered as “non-asbestos”.

Table 2 – Summary of Bulk Samples Identified as “Non-Asbestos”

MATERIAL DESCRIPTION / LOCATION	SAMPLE ID ¹
Ceiling Plaster – Main Entrance	AC-LN-AS1 ² , AC-LN-AS1-2 ² , AC-LN-AS1-3 ²
Ceiling Tile – D Insect Production	AC-LN-AS2 ² , AC-LN-AS2-2 ² , AC-LN-AS2-3 ²
Sprayed Insulation – 0007 Electrical Equipment Room	AC-LN-AS3 ² , AC-LN-AS3-2 ² , AC-LN-AS3-3 ²
2’x4’ ceiling tiles, white with length-wise fissures and pinholes/ Throughout 1988 phase	B14-AS1-A,B,C
White interior door caulking/ Throughout 1988 phase	B14-AS2-A,B,C
Drywall joint compound/ Throughout 1988 phase	B14-AS3-A,B,C,D,E,F,G
Parging cement on fibreglass insulation ends/ Various locations within the 1988 phase	B14-AS4-A,B,C
Cream with black speck linoleum vinyl sheet flooring and levelling compound/ Room 0009 and 0012 in 1988 phase	B14-AS5-A,B,C
2’x4’ ceiling tiles, white with width-wise fissures and pinholes/ Throughout 1988 phase	B14-AS6-A,B,C
Spray fireproofing/ Various locations within the 1988 phase	B14-AS7-A,B,C,D,E,F,G
Concrete block mortar/ Throughout 1988 phase	B14-AS8-A,B,C,D,E,F,G
Grey caulking around duct/ Basement of 1988 phase	B14-AS9-A,B,C
Brown duct sealant/ Various locations within the 1988 phase	B14-AS10-A,B,C
Red firestop around electrical/ Various locations within the 1988 phase	B14-AS11-A,B,C
Cementitious firestop around electrical/ Various locations within the 1988 phase	B14-AS12-A,B,C
Grey/white caulking around air handling unit/ Basement of 1988 phase of building	B14-AS13-A,B,C
Cream/white sink acoustic undercoating/ Sink in the basement shaft room of the 1988 phase	B14-AS14-A,B,C
White interior door caulking/ Basement shaft room of the 1988 phase	B14-AS15-A,B,C
Parging cement on fittings/ Basement of the 1988 phase	B14-AS16-A,B,C
Parging cement on boiler system/ Basement of the 1988 phase	B14-AS17-A,B,C
Burgundy firestop around electrical/ Various locations within the 1988 phase	B14-AS18-A,B,C
Pink firestop around electrical/ Various locations within the 1988 phase	B14-AS19-A,B,C
Interior brick mortar/ Throughout the 1988 phase	B14-AS20-A,B,C,D,E,F,G

MATERIAL DESCRIPTION / LOCATION	SAMPLE ID ¹
Brown interior door, brick and expansion joint caulking/ Throughout the 1988 phase	B14-AS21-A,B,C
Cream marble linoleum vinyl sheet flooring/ Various locations within the 1988 phase	B14-AS22-A,B,C
Cream sink acoustic undercoating/ Various locations within the 1988 phase	B14-AS23-A,B,C
Black/brown caulking around interior windows/ Throughout the 1988 phase	B14-AS24-A,B,C
Grey sink acoustic undercoating/ Various locations within the 1988 phase	B14-AS25-A,B,C
Textured ceiling/ Room 1030 within the 1988 phase	B14-AS26-A,B,C
Light grey with pattern linoleum vinyl sheet flooring/ Room 1034 in 1988 phase	B14-AS27-A,B,C
Interior texture coat/stucco/ Various locations within the 1988 phase	B14-AS29-A,B,C,D,E,F,G
Black door window glazing/ Stairwell doors throughout the 1988 phase	B14-AS30-A,B,C
2'x2' ceiling tiles, white short random fissures with pinholes/ Room 1046 in 1988 phase	B14-AS32-A,B,C
12"x12" White with dark fleck vinyl floor tiles with mastic/ Room 1058 in 1988 phase	B14-AS33-A,B,C
Drywall joint compound/ 1992 renovation	B14-AS34-A,B,C
Interior cream caulking around windows/ Rooms 1053-1 to 1053-7 in 1988 and 1992 phases	B14-AS35-A,B,C
Interior grey caulking on windows and doors/ Rooms GC3, GC3A, GC3B, GC3C in 1988 phase	B14-AS36-A,B,C
Blue/green with colour fleck linoleum vinyl sheet flooring/ Room 1081 in the 1988 phase	B14-AS38-A,B,C
Grey with colour fleck linoleum vinyl sheet flooring/ Room 1090 in the 1988 phase	B14-AS39-A,B,C
Maroon expansion joint caulking/ Various locations within the 1988 phase	B14-AS40-A,B,C
Grey/blue with grey fleck vinyl sheet flooring/ Rooms 1097, 1044 and 2048 in the 1988 phase	B14-AS41-A,B,C
Cream with beige vinyl sheet flooring/ Rooms 1099, 1101 and 1119 in the 1988 phase	B14-AS42-A,B,C
Grey duct sealant/ 2 nd Floor mechanical area and penthouse of 1988 phase	B14-AS43-A,B,C
Interior grey door caulking/ 2 nd Floor mechanical area and penthouse of 1988 phase	B14-AS44-A,B,C
Cream expansion joint caulking/ Various locations within the 1988 phase	B14-AS45-A,B,C
Concrete block mortar/ Throughout 2001 phase	B14-AS46-A,B,C,D,E,F,G
Cream with colour fleck vinyl sheet flooring/ Various locations within the 2001 phase	B14-AS47-A,B,C
Cream interior door caulking/ Throughout the 2001 phase	B14-AS48-A,B,C
Drywall joint compound/ Throughout the 2001 phase	B14-AS49-A,B,C,D,E,F,G
Cementitious fire stop/ Throughout the 2001 phase	B14-AS50-A,B,C
Cream/yellow expansion joint and around elevator caulking/ Throughout the 2001 phase	B14-AS51-A,B,C
2'x4' ceiling tiles, white short random fissures and pinholes/ Throughout the 2001 phase	B14-AS52-A,B,C
Cream sink acoustic undercoating/ Throughout the 2001 phase	B14-AS53-A,B,C
12"x12" White with fleck floor tiles with mastic/ Various locations within the 2001 phase	B14-AS54-A,B,C
Grey duct sealant/ Various locations within the 2001 phase	B14-AS55-A,B,C
Black duct sealant/ Various locations within the 2001 phase	B14-AS56-A,B,C
Grey with light fleck vinyl sheet flooring/ Various locations within the 2001 phase	B14-AS57-A,B,C
Brown caulking around entrance door and windows/ Various locations within the 2001 phase	B14-AS58-A,B,C

MATERIAL DESCRIPTION / LOCATION	SAMPLE ID ¹
Blue/green with fleck vinyl sheet flooring/ Various locations within the 2001 phase	B14-AS59-A,B,C
Blue/grey with fleck vinyl sheet flooring/ Various locations within the 2001 phase	B14-AS60-A,B,C
12"x12" Beige with fleck floor tiles and mastic/ Various locations within the 2001 phase	B14-AS61-A,B,C
Black window glazing/ Various locations within the 2001 phase	B14-AS62-A,B,C
Black door window glazing/ Various locations within the 2001 phase	B14-AS63-A,B,C
Tar paper/ Within tunnel from B14 to B15	B14-AS64-A,B,C
Tar coating/ Within tunnel from B14 to B15	B14-AS65-A,B,C
Red firestop / Various locations within the 2001 phase	B14-AS66-A,B,C
Cream and grey with fleck vinyl sheet flooring/ Various locations within the 2001 phase	B14-AS67-A,B,C
Exterior maroon expansion joint and around vent caulking/Exterior of 1988 phase	B14-AS68-A,B,C
Dark brown exterior window caulking/Exterior of 1988 phase	B14-AS70-A,B,C
Brown caulking around exhaust vents/ Exterior of 1988 phase	B14-AS71-A,B,C
Cream caulking between concrete base and brick/ Exterior of 1988 phase	B14-AS72-A,B,C
Brown/red caulking on eavestrough bases/ Exterior of 1988 phase	B14-AS73-A,B,C
Exterior texture coat/stucco / Exterior of 1988 phase	B14-AS74-A,B,C,D,E
Exterior brick mortar/ Exterior of 2001 phase	B14-AS75-A,B,C,D,E,F,G
Exterior black window glazing/ Exterior of 2001 phase	B14-AS76-A,B,C
Dark brown exterior window caulking/ Exterior of 2001 phase	B14-AS77-A,B,C
Maroon expansion joint and around vent caulking/Exterior of 2001 phase	B14-AS78-A,B,C
Tar along base between brick and concrete slab/ Exterior of 2011 phase	B14-AS79-A,B,C
Exterior brick mortar/ Exterior of 1988 phase	B14-AS80-A,B,C,D,E,F,G

¹ For sample ID and concentration levels refer to attached Laboratory Certificates of Analysis.

² Material previously sampled by Trow Associates Inc. (see *Designated Substances Survey Agriculture and Agri-Food Canada London Facility, 1391 Sandford Street – Trow Associates Inc.- AAFC Project No. 515896L, December 2005*).

SITE PHOTOGRAPHS






PHOTO NO. 1	
DATE: January 29, 2018	
DESCRIPTION: View of Building 14 – Office/Laboratory Building (facing northwest).	
SAMPLE NUMBER(S): -	
PHOTO NO. 2	
DATE: January 29, 2018	
DESCRIPTION: View of asbestos-containing window glazing around the exterior of Rooms 1039, 2043, and 2037.	
SAMPLE NUMBER(S): B14-AS28-A,B,C	
PHOTO NO. 3	
DATE: January 29, 2018	
DESCRIPTION: View of asbestos-containing window glazing around windows within all wooden doors within the 1988 phase of the building.	
SAMPLE NUMBER(S): B14-AS31-A,B,C	

PHOTO NO. 4	
DATE: January 29, 2018	
DESCRIPTION: View of asbestos-containing window glazing around the interior windows within the green house hallway before entering the room (GC-3A, GC-3B, GC-3C) within the 1988 phase of the building.	
SAMPLE NUMBER(S): B14-AS37-A,B,C	
PHOTO NO. 5	
DATE: January 29, 2018	
DESCRIPTION: View of asbestos-containing window glazing around all exterior windows of the 1988 phase.	
SAMPLE NUMBER(S): B14-AS69-A,B,C	

LABORATORY CERTIFICATES OF ANALYSIS



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EMSL Canada Order 551801387
 Customer ID: 55MMMG25
 Customer PO: 181-00742-00
 Project ID:

Attn: Stephen Heikkila
 WSP Canada Group Limited
 100 Commerce Valley Drive West
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Phone: (905) 882-4211
Fax: (905) 882-1857
Collected: 1/29/2018
Received: 2/05/2018
Analyzed: 2/14/2018

Proj: 181-00742-00 LONDON/B14

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B14-AS1-A

Lab Sample ID: 551801387-0001

Sample Description: 2 X 4 WHITE WITH LONG WISE FISSURES WITH LOTS OF PINS CEILING TILES

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	80%	20%	None Detected	

Client Sample ID: B14-AS1-B

Lab Sample ID: 551801387-0002

Sample Description: 2 X 4 WHITE WITH LONG WISE FISSURES WITH LOTS OF PINS CEILING TILES

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	80%	20%	None Detected	

Client Sample ID: B14-AS1-C

Lab Sample ID: 551801387-0003

Sample Description: 2 X 4 WHITE WITH LONG WISE FISSURES WITH LOTS OF PINS CEILING TILES

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	80%	20%	None Detected	

Client Sample ID: B14-AS2-A

Lab Sample ID: 551801387-0004

Sample Description: WHITE DOOR CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS2-B

Lab Sample ID: 551801387-0005

Sample Description: WHITE DOOR CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS2-C

Lab Sample ID: 551801387-0006

Sample Description: WHITE DOOR CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS3-A

Lab Sample ID: 551801387-0007

Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	



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Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B14-AS3-B **Lab Sample ID:** 551801387-0008
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS3-C **Lab Sample ID:** 551801387-0009
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS3-D **Lab Sample ID:** 551801387-0010
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS3-E **Lab Sample ID:** 551801387-0011
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS3-F **Lab Sample ID:** 551801387-0012
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS3-G **Lab Sample ID:** 551801387-0013
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS4A **Lab Sample ID:** 551801387-0014
Sample Description: PARGING ON FIBREGLASS ENDS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	30%	70%	None Detected	

Client Sample ID: B14-AS4B **Lab Sample ID:** 551801387-0015
Sample Description: PARGING ON FIBREGLASS ENDS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	30%	70%	None Detected	



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Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B14-AS4-C **Lab Sample ID:** 551801387-0016
Sample Description: PARGING ON FIBREGLASS ENDS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	30%	70%	None Detected	

Client Sample ID: B14-AS5-A-Linoleum **Lab Sample ID:** 551801387-0017
Sample Description: CREAM WITH BLACK SPECKS LINOLEUM VINYL FLOORING & LEVELING COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Beige	15%	85%	None Detected	

Client Sample ID: B14-AS5-A-Leveler **Lab Sample ID:** 551801387-0017A
Sample Description: CREAM WITH BLACK SPECKS LINOLEUM VINYL FLOORING & LEVELING COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS5-B **Lab Sample ID:** 551801387-0018
Sample Description: CREAM WITH BLACK SPECKS LINOLEUM VINYL FLOORING & LEVELING COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Beige	15%	85%	None Detected	

Client Sample ID: B14-AS5-C **Lab Sample ID:** 551801387-0019
Sample Description: CREAM WITH BLACK SPECKS LINOLEUM VINYL FLOORING & LEVELING COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	5%	95%	None Detected	

Client Sample ID: B14-AS6-A **Lab Sample ID:** 551801387-0020
Sample Description: 2 X 4 WHITE WITH WIDTH WISE FISSURES AND SPARSE PINS CEILING TILES

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	80%	20%	None Detected	

Client Sample ID: B14-AS6-B **Lab Sample ID:** 551801387-0021
Sample Description: 2 X 4 WHITE WITH WIDTH WISE FISSURES AND SPARSE PINS CEILING TILES

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	80%	20%	None Detected	

Client Sample ID: B14-AS6-C **Lab Sample ID:** 551801387-0022
Sample Description: 2 X 4 WHITE WITH WIDTH WISE FISSURES AND SPARSE PINS CEILING TILES

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	80%	20%	None Detected	



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EMSL Canada Order 551801387
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B14-AS7-A **Lab Sample ID:** 551801387-0023
Sample Description: SPRAY FIREPROOFING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	85%	15%	None Detected	

Client Sample ID: B14-AS7-B **Lab Sample ID:** 551801387-0024
Sample Description: SPRAY FIREPROOFING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	85%	15%	None Detected	

Client Sample ID: B14-AS7-C **Lab Sample ID:** 551801387-0025
Sample Description: SPRAY FIREPROOFING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	85%	15%	None Detected	

Client Sample ID: B14-AS7-D **Lab Sample ID:** 551801387-0026
Sample Description: SPRAY FIREPROOFING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	85%	15%	None Detected	

Client Sample ID: B14-AS7-E **Lab Sample ID:** 551801387-0027
Sample Description: SPRAY FIREPROOFING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	90%	10%	None Detected	

Client Sample ID: B14-AS7-F **Lab Sample ID:** 551801387-0028
Sample Description: SPRAY FIREPROOFING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	90%	10%	None Detected	

Client Sample ID: B14-AS7-G **Lab Sample ID:** 551801387-0029
Sample Description: SPRAY FIREPROOFING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	90%	10%	None Detected	

Client Sample ID: B14-AS8-A **Lab Sample ID:** 551801387-0030
Sample Description: CONCRETE BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	



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Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B14-AS8-B **Lab Sample ID:** 551801387-0031
Sample Description: CONCRETE BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS8-C **Lab Sample ID:** 551801387-0032
Sample Description: CONCRETE BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS8-D **Lab Sample ID:** 551801387-0033
Sample Description: CONCRETE BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS8-E **Lab Sample ID:** 551801387-0034
Sample Description: CONCRETE BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS8-F **Lab Sample ID:** 551801387-0035
Sample Description: CONCRETE BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS8-G **Lab Sample ID:** 551801387-0036
Sample Description: CONCRETE BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS9-A **Lab Sample ID:** 551801387-0037
Sample Description: GREY CAULKING AROUND DUCT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS9-B **Lab Sample ID:** 551801387-0038
Sample Description: GREY CAULKING AROUND DUCT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	



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Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B14-AS9-C **Lab Sample ID:** 551801387-0039
Sample Description: GREY CAULKING AROUND DUCT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS10-A **Lab Sample ID:** 551801387-0040
Sample Description: BROWN DUCT SEALANT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS10-B **Lab Sample ID:** 551801387-0041
Sample Description: BROWN DUCT SEALANT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS10-C **Lab Sample ID:** 551801387-0042
Sample Description: BROWN DUCT SEALANT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS11-A **Lab Sample ID:** 551801387-0043
Sample Description: RED FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	

Client Sample ID: B14-AS11-B **Lab Sample ID:** 551801387-0044
Sample Description: RED FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	

Client Sample ID: B14-AS11-C **Lab Sample ID:** 551801387-0045
Sample Description: RED FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Red	0%	100%	None Detected	

Client Sample ID: B14-AS12-A **Lab Sample ID:** 551801387-0046
Sample Description: CEMENTITIOUS FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	



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Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B14-AS12-B **Lab Sample ID:** 551801387-0047
Sample Description: CEMENTITIOUS FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS12-C **Lab Sample ID:** 551801387-0048
Sample Description: CEMENTITIOUS FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS13-A **Lab Sample ID:** 551801387-0049
Sample Description: GREY/WHITE CAULKING AROUND AIR HANDLING UNITS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS13-B **Lab Sample ID:** 551801387-0050
Sample Description: GREY/WHITE CAULKING AROUND AIR HANDLING UNITS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS13-C **Lab Sample ID:** 551801387-0051
Sample Description: GREY/WHITE CAULKING AROUND AIR HANDLING UNITS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS14-A **Lab Sample ID:** 551801387-0052
Sample Description: CREAM WHITE SINK ACOUSTIC UNDERCOATING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS14-B **Lab Sample ID:** 551801387-0053
Sample Description: CREAM WHITE SINK ACOUSTIC UNDERCOATING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS14-C **Lab Sample ID:** 551801387-0054
Sample Description: CREAM WHITE SINK ACOUSTIC UNDERCOATING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	



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 Customer ID: 55MMMG25
 Customer PO: 181-00742-00
 Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B14-AS15-A **Lab Sample ID:** 551801387-0055
Sample Description: WHITE DOOR CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS15-B **Lab Sample ID:** 551801387-0056
Sample Description: WHITE DOOR CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS15-C **Lab Sample ID:** 551801387-0057
Sample Description: WHITE DOOR CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS16-A **Lab Sample ID:** 551801387-0058
Sample Description: PARGING ON FITTING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	25%	75%	None Detected	

Client Sample ID: B14-AS16-B **Lab Sample ID:** 551801387-0059
Sample Description: PARGING ON FITTING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	25%	75%	None Detected	

Client Sample ID: B14-AS16-C **Lab Sample ID:** 551801387-0060
Sample Description: PARGING ON FITTING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	25%	75%	None Detected	

Client Sample ID: B14-AS17-A **Lab Sample ID:** 551801387-0061
Sample Description: PARGING ON BOILER SYSTEM

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	15%	85%	None Detected	

Client Sample ID: B14-AS17-B **Lab Sample ID:** 551801387-0062
Sample Description: PARGING ON BOILER SYSTEM

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	15%	85%	None Detected	



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Client Sample ID: B14-AS17-C **Lab Sample ID:** 551801387-0063
Sample Description: PARGING ON BOILER SYSTEM

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	15%	85%	None Detected	

Client Sample ID: B14-AS18-A **Lab Sample ID:** 551801387-0064
Sample Description: BURGUNDY FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	

Client Sample ID: B14-AS18-B **Lab Sample ID:** 551801387-0065
Sample Description: BURGUNDY FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	

Client Sample ID: B14-AS18-C **Lab Sample ID:** 551801387-0066
Sample Description: BURGUNDY FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Red	0%	100%	None Detected	

Client Sample ID: B14-AS19-A **Lab Sample ID:** 551801387-0067
Sample Description: PINK FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Pink	0%	100%	None Detected	

Client Sample ID: B14-AS19-B **Lab Sample ID:** 551801387-0068
Sample Description: PINK FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Pink	0%	100%	None Detected	

Client Sample ID: B14-AS19-C **Lab Sample ID:** 551801387-0069
Sample Description: PINK FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Pink	0%	100%	None Detected	

Client Sample ID: B14-AS20-A **Lab Sample ID:** 551801387-0070
Sample Description: INTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	



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Client Sample ID: B14-AS20-B **Lab Sample ID:** 551801387-0071
Sample Description: INTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS20-C **Lab Sample ID:** 551801387-0072
Sample Description: INTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS20-D **Lab Sample ID:** 551801387-0073
Sample Description: INTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS20-E **Lab Sample ID:** 551801387-0074
Sample Description: INTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS20-F **Lab Sample ID:** 551801387-0075
Sample Description: INTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS20-G **Lab Sample ID:** 551801387-0076
Sample Description: INTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS21-A **Lab Sample ID:** 551801387-0077
Sample Description: BROWN CAULKING AROUND BRICK WALL & EXPANSION JOINT CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS21-B **Lab Sample ID:** 551801387-0078
Sample Description: BROWN CAULKING AROUND BRICK WALL & EXPANSION JOINT CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	



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Client Sample ID: B14-AS21-C **Lab Sample ID:** 551801387-0079
Sample Description: BROWN CAULKING AROUND BRICK WALL & EXPANSION JOINT CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS22-A-Linoleum **Lab Sample ID:** 551801387-0080
Sample Description: CREAM MARBLE LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Beige	0%	100%	None Detected	

Client Sample ID: B14-AS22-A-Mastic **Lab Sample ID:** 551801387-0080B
Sample Description: CREAM MARBLE LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Yellow	0%	100%	None Detected	

Client Sample ID: B14-AS22-B-Linoleum **Lab Sample ID:** 551801387-0081
Sample Description: CREAM MARBLE LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Beige	0%	100%	None Detected	

Client Sample ID: B14-AS22-B-Mastic **Lab Sample ID:** 551801387-0081B
Sample Description: CREAM MARBLE LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Yellow	0%	100%	None Detected	

Client Sample ID: B14-AS22-C-Linoleum **Lab Sample ID:** 551801387-0082
Sample Description: CREAM MARBLE LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Beige	0%	100%	None Detected	

Client Sample ID: B14-AS22-C-Mastic **Lab Sample ID:** 551801387-0082A
Sample Description: CREAM MARBLE LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Yellow	0%	100%	None Detected	

Client Sample ID: B14-AS23-A **Lab Sample ID:** 551801387-0083
Sample Description: CREAM SINK ACOUSTIC UNDERCOATING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	



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Client Sample ID: B14-AS23-B **Lab Sample ID:** 551801387-0084
Sample Description: CREAM SINK ACOUSTIC UNDERCOATING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS23-C **Lab Sample ID:** 551801387-0085
Sample Description: CREAM SINK ACOUSTIC UNDERCOATING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS24-A **Lab Sample ID:** 551801387-0086
Sample Description: BLACK/BROWN CAULKING AROUND WINDOWS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS24-B **Lab Sample ID:** 551801387-0087
Sample Description: BLACK/BROWN CAULKING AROUND WINDOWS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS24-C **Lab Sample ID:** 551801387-0088
Sample Description: BLACK/BROWN CAULKING AROUND WINDOWS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS25-A **Lab Sample ID:** 551801387-0089
Sample Description: GREY SINK ACOUSTIC UNDERCOATING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS25-B **Lab Sample ID:** 551801387-0090
Sample Description: GREY SINK ACOUSTIC UNDERCOATING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS25-C **Lab Sample ID:** 551801387-0091
Sample Description: GREY SINK ACOUSTIC UNDERCOATING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	



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Client Sample ID: B14-AS26-A **Lab Sample ID:** 551801387-0092
Sample Description: TEXTURED CEILING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS26-B **Lab Sample ID:** 551801387-0093
Sample Description: TEXTURED CEILING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS26-C **Lab Sample ID:** 551801387-0094
Sample Description: TEXTURED CEILING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS27-A-Linoleum **Lab Sample ID:** 551801387-0095
Sample Description: LIGHT GREY WITH PATTERN LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS27-A-Mastic **Lab Sample ID:** 551801387-0095B
Sample Description: LIGHT GREY WITH PATTERN LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Yellow	0%	100%	None Detected	

Client Sample ID: B14-AS27-B-Linoleum **Lab Sample ID:** 551801387-0096
Sample Description: LIGHT GREY WITH PATTERN LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS27-B-Mastic **Lab Sample ID:** 551801387-0096B
Sample Description: LIGHT GREY WITH PATTERN LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Yellow	0%	100%	None Detected	

Client Sample ID: B14-AS27-C **Lab Sample ID:** 551801387-0097
Sample Description: LIGHT GREY WITH PATTERN LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	No mastic



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Client Sample ID: B14-AS28-A **Lab Sample ID:** 551801387-0098
Sample Description: GREY/BROWN WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	98%	2% Chrysotile	

Client Sample ID: B14-AS28-B **Lab Sample ID:** 551801387-0099
Sample Description: GREY/BROWN WINDOW GLAZING

TEST	Analyzed	Color	Non-Asbestos		Asbestos	Comment
	Date		Fibrous	Non-Fibrous		
PLM	2/12/2018		Positive Stop (Not Analyzed)			

Client Sample ID: B14-AS28-C **Lab Sample ID:** 551801387-0100
Sample Description: GREY/BROWN WINDOW GLAZING

TEST	Analyzed	Color	Non-Asbestos		Asbestos	Comment
	Date		Fibrous	Non-Fibrous		
PLM	2/12/2018		Positive Stop (Not Analyzed)			

Client Sample ID: B14-AS29-A **Lab Sample ID:** 551801387-0101
Sample Description: STUCCO INTERIOR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS29-B **Lab Sample ID:** 551801387-0102
Sample Description: STUCCO INTERIOR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS29-C **Lab Sample ID:** 551801387-0103
Sample Description: STUCCO INTERIOR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS29-D **Lab Sample ID:** 551801387-0104
Sample Description: STUCCO INTERIOR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS29-E **Lab Sample ID:** 551801387-0105
Sample Description: STUCCO INTERIOR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	



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Client Sample ID: B14-AS29-F **Lab Sample ID:** 551801387-0106
Sample Description: STUCCO INTERIOR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS29-G **Lab Sample ID:** 551801387-0107
Sample Description: STUCCO INTERIOR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS30-A **Lab Sample ID:** 551801387-0108
Sample Description: DOOR WINDOW BLACK GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS30-B **Lab Sample ID:** 551801387-0109
Sample Description: DOOR WINDOW BLACK GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS30-C **Lab Sample ID:** 551801387-0110
Sample Description: DOOR WINDOW BLACK GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS31-A **Lab Sample ID:** 551801387-0111
Sample Description: WOOD DOOR BLACK WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	98%	2% Chrysotile	

Client Sample ID: B14-AS31-B **Lab Sample ID:** 551801387-0112
Sample Description: WOOD DOOR BLACK WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018				Positive Stop (Not Analyzed)	

Client Sample ID: B14-AS31-C **Lab Sample ID:** 551801387-0113
Sample Description: WOOD DOOR BLACK WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018				Positive Stop (Not Analyzed)	



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Client Sample ID: B14-AS32-A

Lab Sample ID: 551801387-0114

Sample Description: 2 X 4 WHITE SHORT RANDOM FISSURES WITH PIN PRICKS CEILING TILES

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	80%	20%	None Detected	

Client Sample ID: B14-AS32-B

Lab Sample ID: 551801387-0115

Sample Description: 2 X 4 WHITE SHORT RANDOM FISSURES WITH PIN PRICKS CEILING TILES

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	80%	20%	None Detected	

Client Sample ID: B14-AS32-C

Lab Sample ID: 551801387-0116

Sample Description: 2 X 4 WHITE SHORT RANDOM FISSURES WITH PIN PRICKS CEILING TILES

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	80%	20%	None Detected	

Client Sample ID: B14-AS33-A-Floor Tile

Lab Sample ID: 551801387-0117

Sample Description: 12" WHITE WITH DARK FLECK VINYL FLOOR TILES WITH MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	
TEM Grav. Reduction	2/14/2018	White	0.0%	100%	None Detected	

Client Sample ID: B14-AS33-A-Mastic

Lab Sample ID: 551801387-0117A

Sample Description: 12" WHITE WITH DARK FLECK VINYL FLOOR TILES WITH MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Yellow	0%	100%	None Detected	

Client Sample ID: B14-AS33-B

Lab Sample ID: 551801387-0118

Sample Description: 12" WHITE WITH DARK FLECK VINYL FLOOR TILES WITH MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS33-C-Floor Tile

Lab Sample ID: 551801387-0119

Sample Description: 12" WHITE WITH DARK FLECK VINYL FLOOR TILES WITH MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Beige	0%	100%	None Detected	

Client Sample ID: B14-AS33-C-Mastic

Lab Sample ID: 551801387-0119A

Sample Description: 12" WHITE WITH DARK FLECK VINYL FLOOR TILES WITH MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Brown	0%	100%	None Detected	



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EMSL Canada Order 551801387
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B14-AS34-A **Lab Sample ID:** 551801387-0120
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS34-B **Lab Sample ID:** 551801387-0121
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS34-C **Lab Sample ID:** 551801387-0122
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS35-A **Lab Sample ID:** 551801387-0123
Sample Description: CREAM WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Beige	0%	100%	None Detected	

Client Sample ID: B14-AS35-B **Lab Sample ID:** 551801387-0124
Sample Description: CREAM WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Beige	0%	100%	None Detected	

Client Sample ID: B14-AS35-C **Lab Sample ID:** 551801387-0125
Sample Description: CREAM WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Beige	0%	100%	None Detected	

Client Sample ID: B14-AS36-A **Lab Sample ID:** 551801387-0126
Sample Description: GREY CAULKING AROUND WINDOWS/DOORS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS36-B **Lab Sample ID:** 551801387-0127
Sample Description: GREY CAULKING AROUND WINDOWS/DOORS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	



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Client Sample ID: B14-AS36-C **Lab Sample ID:** 551801387-0128
Sample Description: GREY CAULKING AROUND WINDOWS/DOORS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS37-A **Lab Sample ID:** 551801387-0129
Sample Description: WHITE/GREY/BROWN WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	0%	99%	1% Chrysotile	

Client Sample ID: B14-AS37-B **Lab Sample ID:** 551801387-0130
Sample Description: WHITE/GREY/BROWN WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018				Positive Stop (Not Analyzed)	

Client Sample ID: B14-AS37-C **Lab Sample ID:** 551801387-0131
Sample Description: WHITE/GREY/BROWN WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018				Positive Stop (Not Analyzed)	

Client Sample ID: B14-AS38-A-Linoleum **Lab Sample ID:** 551801387-0132
Sample Description: BLUE/GREEN WITH COLOUR FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Blue	0%	100%	None Detected	

Client Sample ID: B14-AS38-A-Mastic **Lab Sample ID:** 551801387-0132A
Sample Description: BLUE/GREEN WITH COLOUR FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Yellow	0%	100%	None Detected	

Client Sample ID: B14-AS38-B-Linoleum **Lab Sample ID:** 551801387-0133
Sample Description: BLUE/GREEN WITH COLOUR FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Blue	0%	100%	None Detected	

Client Sample ID: B14-AS38-B-Mastic **Lab Sample ID:** 551801387-0133A
Sample Description: BLUE/GREEN WITH COLOUR FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Yellow	0%	100%	None Detected	



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Client Sample ID: B14-AS38-C-Linoleum		Lab Sample ID: 551801387-0134				
Sample Description: BLUE/GREEN WITH COLOUR FLECK LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Blue	0%	100%	None Detected	
Client Sample ID: B14-AS38-C-Mastic		Lab Sample ID: 551801387-0134A				
Sample Description: BLUE/GREEN WITH COLOUR FLECK LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Yellow	0%	100%	None Detected	
Client Sample ID: B14-AS39-A		Lab Sample ID: 551801387-0135				
Sample Description: GREY WITH COLOUR FLECK LINOLEUM VINYL FLOORING WITH PAPER BACKING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	25%	75%	None Detected	
Client Sample ID: B14-AS39-B		Lab Sample ID: 551801387-0136				
Sample Description: GREY WITH COLOUR FLECK LINOLEUM VINYL FLOORING WITH PAPER BACKING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	25%	75%	None Detected	
Client Sample ID: B14-AS39-C		Lab Sample ID: 551801387-0137				
Sample Description: GREY WITH COLOUR FLECK LINOLEUM VINYL FLOORING WITH PAPER BACKING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	20%	80%	None Detected	
Client Sample ID: B14-AS40-A		Lab Sample ID: 551801387-0138				
Sample Description: MAROON EXPANSION JOINT CAULKING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	
Client Sample ID: B14-AS40-B		Lab Sample ID: 551801387-0139				
Sample Description: MAROON EXPANSION JOINT CAULKING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	
Client Sample ID: B14-AS40-C		Lab Sample ID: 551801387-0140				
Sample Description: MAROON EXPANSION JOINT CAULKING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Brown	0%	100%	None Detected	



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Client Sample ID: B14-AS41-A-Linoleum		Lab Sample ID: 551801387-0141				
Sample Description: GREY/BUE WITH GREY FLECK LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White/Blue	0%	100%	None Detected	
Client Sample ID: B14-AS41-A-Mastic		Lab Sample ID: 551801387-0141A				
Sample Description: GREY/BUE WITH GREY FLECK LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Yellow	0%	100%	None Detected	
Client Sample ID: B14-AS41-B-Linoleum		Lab Sample ID: 551801387-0142				
Sample Description: GREY/BUE WITH GREY FLECK LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White/Blue	0%	100%	None Detected	
Client Sample ID: B14-AS41-B-Mastic		Lab Sample ID: 551801387-0142A				
Sample Description: GREY/BUE WITH GREY FLECK LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Yellow	0%	100%	None Detected	
Client Sample ID: B14-AS41-C-Linoleum		Lab Sample ID: 551801387-0143				
Sample Description: GREY/BUE WITH GREY FLECK LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	
Client Sample ID: B14-AS41-C-Mastic		Lab Sample ID: 551801387-0143A				
Sample Description: GREY/BUE WITH GREY FLECK LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Yellow	0%	100%	None Detected	
Client Sample ID: B14-AS42-A-Linoleum		Lab Sample ID: 551801387-0144				
Sample Description: CREAM WITH BEIGE PATTERN LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	
Client Sample ID: B14-AS42-A-Mastic		Lab Sample ID: 551801387-0144A				
Sample Description: CREAM WITH BEIGE PATTERN LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Beige	0%	100%	None Detected	



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Client Sample ID: B14-AS42-B-Linoleum		Lab Sample ID: 551801387-0145				
Sample Description: CREAM WITH BEIGE PATTERN LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	
Client Sample ID: B14-AS42-B-Mastic		Lab Sample ID: 551801387-0145A				
Sample Description: CREAM WITH BEIGE PATTERN LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Beige	0%	100%	None Detected	
Client Sample ID: B14-AS42-C-Linoleum		Lab Sample ID: 551801387-0146				
Sample Description: CREAM WITH BEIGE PATTERN LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	
Client Sample ID: B14-AS42-C-Mastic		Lab Sample ID: 551801387-0146A				
Sample Description: CREAM WITH BEIGE PATTERN LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Clear	0%	100%	None Detected	
Client Sample ID: B14-AS43-A		Lab Sample ID: 551801387-0147				
Sample Description: GREY DUCT SEALANT						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	
Client Sample ID: B14-AS43-B		Lab Sample ID: 551801387-0148				
Sample Description: GREY DUCT SEALANT						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	
Client Sample ID: B14-AS43-C		Lab Sample ID: 551801387-0149				
Sample Description: GREY DUCT SEALANT						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	
Client Sample ID: B14-AS44-A		Lab Sample ID: 551801387-0150				
Sample Description: GREY DOOR CAULKING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	



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Client Sample ID: B14-AS44-B **Lab Sample ID:** 551801387-0151
Sample Description: GREY DOOR CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS44-C **Lab Sample ID:** 551801387-0152
Sample Description: GREY DOOR CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS45-A **Lab Sample ID:** 551801387-0153
Sample Description: CREAM EXPANSION JOINT CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Beige	0%	100%	None Detected	

Client Sample ID: B14-AS45-B **Lab Sample ID:** 551801387-0154
Sample Description: CREAM EXPANSION JOINT CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Beige	0%	100%	None Detected	

Client Sample ID: B14-AS45-C **Lab Sample ID:** 551801387-0155
Sample Description: CREAM EXPANSION JOINT CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Beige	0%	100%	None Detected	

Client Sample ID: B14-AS46-A **Lab Sample ID:** 551801387-0156
Sample Description: CONCRETE BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS46-B **Lab Sample ID:** 551801387-0157
Sample Description: CONCRETE BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS46-C **Lab Sample ID:** 551801387-0158
Sample Description: CONCRETE BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	



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Client Sample ID: B14-AS46-D **Lab Sample ID:** 551801387-0159
Sample Description: CONCRETE BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS46-E **Lab Sample ID:** 551801387-0160
Sample Description: CONCRETE BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS46-F **Lab Sample ID:** 551801387-0161
Sample Description: CONCRETE BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS46-G **Lab Sample ID:** 551801387-0162
Sample Description: CONCRETE BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS47-A **Lab Sample ID:** 551801387-0163
Sample Description: CREAM WITH COLOUR FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray/Beige	20%	80%	None Detected	

Client Sample ID: B14-AS47-B **Lab Sample ID:** 551801387-0164
Sample Description: CREAM WITH COLOUR FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray/Beige	20%	80%	None Detected	

Client Sample ID: B14-AS47-C **Lab Sample ID:** 551801387-0165
Sample Description: CREAM WITH COLOUR FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray/Beige	20%	80%	None Detected	

Client Sample ID: B14-AS48-A **Lab Sample ID:** 551801387-0166
Sample Description: CREAM DOOR CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	



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Client Sample ID: B14-AS48-B **Lab Sample ID:** 551801387-0167
Sample Description: CREAM DOOR CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS48-C **Lab Sample ID:** 551801387-0168
Sample Description: CREAM DOOR CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS49-A **Lab Sample ID:** 551801387-0169
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS49-B **Lab Sample ID:** 551801387-0170
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS49-C **Lab Sample ID:** 551801387-0171
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS49-D **Lab Sample ID:** 551801387-0172
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS49-E **Lab Sample ID:** 551801387-0173
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS49-F **Lab Sample ID:** 551801387-0174
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	



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Client Sample ID: B14-AS49-G **Lab Sample ID:** 551801387-0175
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS50-A **Lab Sample ID:** 551801387-0176
Sample Description: CEMENTITIOUS FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS50-B **Lab Sample ID:** 551801387-0177
Sample Description: CEMENTITIOUS FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS50-C **Lab Sample ID:** 551801387-0178
Sample Description: CEMENTITIOUS FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS51-A **Lab Sample ID:** 551801387-0179
Sample Description: CREAM/YELLOW EXPANSION JOINT CAULKING & AROUND ELEVATOR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS51-B **Lab Sample ID:** 551801387-0180
Sample Description: CREAM/YELLOW EXPANSION JOINT CAULKING & AROUND ELEVATOR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS51-C **Lab Sample ID:** 551801387-0181
Sample Description: CREAM/YELLOW EXPANSION JOINT CAULKING & AROUND ELEVATOR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS52-A **Lab Sample ID:** 551801387-0182
Sample Description: 2 X 4 WHITE SHORT RANDOM FISSURE AND PIN PRICKS CEILING TILES

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	80%	20%	None Detected	



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Client Sample ID: B14-AS52-B		Lab Sample ID: 551801387-0183				
Sample Description: 2 X 4 WHITE SHORT RANDOM FISSURE AND PIN PRICKS CEILING TILES						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	80%	20%	None Detected	
Client Sample ID: B14-AS52-C		Lab Sample ID: 551801387-0184				
Sample Description: 2 X 4 WHITE SHORT RANDOM FISSURE AND PIN PRICKS CEILING TILES						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	80%	20%	None Detected	
Client Sample ID: B14-AS53-A		Lab Sample ID: 551801387-0185				
Sample Description: CREAM SINK ACOUSTIC UNDERCOATING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	
Client Sample ID: B14-AS53-B		Lab Sample ID: 551801387-0186				
Sample Description: CREAM SINK ACOUSTIC UNDERCOATING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	
Client Sample ID: B14-AS53-C		Lab Sample ID: 551801387-0187				
Sample Description: CREAM SINK ACOUSTIC UNDERCOATING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	
Client Sample ID: B14-AS54-A		Lab Sample ID: 551801387-0188				
Sample Description: 12" WHITE WITH FLECK FLOOR TILES WITH MASTIC						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	No mastic
TEM Grav. Reduction	2/14/2018	White	0.0%	100%	None Detected	
Client Sample ID: B14-AS54-B-Floor Tile		Lab Sample ID: 551801387-0189				
Sample Description: 12" WHITE WITH FLECK FLOOR TILES WITH MASTIC						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	
Client Sample ID: B14-AS54-B-Mastic		Lab Sample ID: 551801387-0189A				
Sample Description: 12" WHITE WITH FLECK FLOOR TILES WITH MASTIC						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	



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Client Sample ID: B14-AS54-C-Floor Tile **Lab Sample ID:** 551801387-0190
Sample Description: 12" WHITE WITH FLECK FLOOR TILES WITH MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS54-C-Mastic **Lab Sample ID:** 551801387-0190A
Sample Description: 12" WHITE WITH FLECK FLOOR TILES WITH MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS55-A **Lab Sample ID:** 551801387-0191
Sample Description: GREY DUCT SEALANT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS55-B **Lab Sample ID:** 551801387-0192
Sample Description: GREY DUCT SEALANT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS55-C **Lab Sample ID:** 551801387-0193
Sample Description: GREY DUCT SEALANT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS56-A **Lab Sample ID:** 551801387-0194
Sample Description: BLACK DUCT SEALANT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS56-B **Lab Sample ID:** 551801387-0195
Sample Description: BLACK DUCT SEALANT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS56-C **Lab Sample ID:** 551801387-0196
Sample Description: BLACK DUCT SEALANT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	



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Client Sample ID: B14-AS57-A **Lab Sample ID:** 551801387-0197
Sample Description: GREY WITH LIGHT FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS57-B **Lab Sample ID:** 551801387-0198
Sample Description: GREY WITH LIGHT FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS57-C **Lab Sample ID:** 551801387-0199
Sample Description: GREY WITH LIGHT FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS58-A **Lab Sample ID:** 551801387-0200
Sample Description: BROWN CAULKING AROUND ENTRANCE AND WINDOW

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS58-B **Lab Sample ID:** 551801387-0201
Sample Description: BROWN CAULKING AROUND ENTRANCE AND WINDOW

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS58-C **Lab Sample ID:** 551801387-0202
Sample Description: BROWN CAULKING AROUND ENTRANCE AND WINDOW

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS59-A-Linoleum **Lab Sample ID:** 551801387-0203
Sample Description: BLUE/GREEN WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Blue	0%	100%	None Detected	

Client Sample ID: B14-AS59-A-Mastic **Lab Sample ID:** 551801387-0203A
Sample Description: BLUE/GREEN WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Beige	0%	100%	None Detected	



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Client Sample ID: B14-AS59-B-Linoleum		Lab Sample ID: 551801387-0204				
Sample Description: BLUE/GREEN WITH FLECK LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Blue	0%	100%	None Detected	
Client Sample ID: B14-AS59-B-Mastic		Lab Sample ID: 551801387-0204A				
Sample Description: BLUE/GREEN WITH FLECK LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Beige	0%	100%	None Detected	
Client Sample ID: B14-AS59-C-Linoleum		Lab Sample ID: 551801387-0205				
Sample Description: BLUE/GREEN WITH FLECK LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Blue	0%	100%	None Detected	
Client Sample ID: B14-AS59-C-Mastic		Lab Sample ID: 551801387-0205A				
Sample Description: BLUE/GREEN WITH FLECK LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Beige	0%	100%	None Detected	
Client Sample ID: B14-AS60-A-Linoleum		Lab Sample ID: 551801387-0206				
Sample Description: BLUE/GREY WITH FLECK LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	
Client Sample ID: B14-AS60-A-Mastic		Lab Sample ID: 551801387-0206A				
Sample Description: BLUE/GREY WITH FLECK LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Beige	0%	100%	None Detected	
Client Sample ID: B14-AS60-B-Linoleum		Lab Sample ID: 551801387-0207				
Sample Description: BLUE/GREY WITH FLECK LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	
Client Sample ID: B14-AS60-B-Mastic		Lab Sample ID: 551801387-0207A				
Sample Description: BLUE/GREY WITH FLECK LINOLEUM VINYL FLOORING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Beige	0%	100%	None Detected	



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Client Sample ID: B14-AS60-C-Linoleum

Lab Sample ID: 551801387-0208

Sample Description: BLUE/GREY WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS60-C-Mastic

Lab Sample ID: 551801387-0208A

Sample Description: BLUE/GREY WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Beige	0%	100%	None Detected	

Client Sample ID: B14-AS61-A-Floor Tile

Lab Sample ID: 551801387-0209

Sample Description: 12" BEIGE WITH FLECK FLOOR TILES WITH MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Beige	0%	100%	None Detected	
TEM Grav. Reduction	2/14/2018	Beige	0.0%	100%	None Detected	

Client Sample ID: B14-AS61-A-Mastic

Lab Sample ID: 551801387-0209A

Sample Description: 12" BEIGE WITH FLECK FLOOR TILES WITH MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS61-B-Floor Tile

Lab Sample ID: 551801387-0210

Sample Description: 12" BEIGE WITH FLECK FLOOR TILES WITH MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Beige	0%	100%	None Detected	

Client Sample ID: B14-AS61-B-Mastic

Lab Sample ID: 551801387-0210A

Sample Description: 12" BEIGE WITH FLECK FLOOR TILES WITH MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS61-C-Floor Tile

Lab Sample ID: 551801387-0211

Sample Description: 12" BEIGE WITH FLECK FLOOR TILES WITH MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Beige	0%	100%	None Detected	

Client Sample ID: B14-AS61-C-Mastic

Lab Sample ID: 551801387-0211A

Sample Description: 12" BEIGE WITH FLECK FLOOR TILES WITH MASTIC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	



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Client Sample ID: B14-AS62-A **Lab Sample ID:** 551801387-0212
Sample Description: BLACK WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS62-B **Lab Sample ID:** 551801387-0213
Sample Description: BLACK WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS62-C **Lab Sample ID:** 551801387-0214
Sample Description: BLACK WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS63-A **Lab Sample ID:** 551801387-0215
Sample Description: DOOR BLACK WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS63-B **Lab Sample ID:** 551801387-0216
Sample Description: DOOR BLACK WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS63-C **Lab Sample ID:** 551801387-0217
Sample Description: DOOR BLACK WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS64-A **Lab Sample ID:** 551801387-0218
Sample Description: TAR PAPER WITHIN TUNNEL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	40%	60%	None Detected	

Client Sample ID: B14-AS64-B **Lab Sample ID:** 551801387-0219
Sample Description: TAR PAPER WITHIN TUNNEL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	40%	60%	None Detected	



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Client Sample ID: B14-AS64-C **Lab Sample ID:** 551801387-0220
Sample Description: TAR PAPER WITHIN TUNNEL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	40%	60%	None Detected	

Client Sample ID: B14-AS65-A **Lab Sample ID:** 551801387-0221
Sample Description: TAR COATING WITHIN TUNNEL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS65-B **Lab Sample ID:** 551801387-0222
Sample Description: TAR COATING WITHIN TUNNEL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS65-C **Lab Sample ID:** 551801387-0223
Sample Description: TAR COATING WITHIN TUNNEL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Black	0%	100%	None Detected	

Client Sample ID: B14-AS66-A **Lab Sample ID:** 551801387-0224
Sample Description: RED FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Red	0%	100%	None Detected	

Client Sample ID: B14-AS66-B **Lab Sample ID:** 551801387-0225
Sample Description: RED FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Red	0%	100%	None Detected	

Client Sample ID: B14-AS66-C **Lab Sample ID:** 551801387-0226
Sample Description: RED FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Red	0%	100%	None Detected	

Client Sample ID: B14-AS67-A-Linoleum **Lab Sample ID:** 551801387-0227
Sample Description: CREAM AND GREY WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	



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Client Sample ID: B14-AS67-A-Mastic **Lab Sample ID:** 551801387-0227A

Sample Description: CREAM AND GREY WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Yellow	0%	100%	None Detected	

Client Sample ID: B14-AS67-B-Linoleum **Lab Sample ID:** 551801387-0228

Sample Description: CREAM AND GREY WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS67-B-Mastic **Lab Sample ID:** 551801387-0228A

Sample Description: CREAM AND GREY WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Yellow	0%	100%	None Detected	

Client Sample ID: B14-AS67-C-Linoleum **Lab Sample ID:** 551801387-0229

Sample Description: CREAM AND GREY WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS67-C-Mastic **Lab Sample ID:** 551801387-0229A

Sample Description: CREAM AND GREY WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/13/2018	Yellow	0%	100%	None Detected	

Client Sample ID: B14-AS68-A **Lab Sample ID:** 551801387-0230

Sample Description: MAROON EXPANSION JOINT CAULKING AROUND VENTS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS68-B **Lab Sample ID:** 551801387-0231

Sample Description: MAROON EXPANSION JOINT CAULKING AROUND VENTS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown/Red	0%	100%	None Detected	

Client Sample ID: B14-AS68-C **Lab Sample ID:** 551801387-0232

Sample Description: MAROON EXPANSION JOINT CAULKING AROUND VENTS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown/Red	0%	100%	None Detected	



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EMSL Canada Order 551801387
 Customer ID: 55MMMG25
 Customer PO: 181-00742-00
 Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B14-AS69-A		Lab Sample ID: 551801387-0233				
Sample Description: BLACK WINDOW GLAZING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	98%	2% Chrysotile	
Client Sample ID: B14-AS69-B		Lab Sample ID: 551801387-0234				
Sample Description: BLACK WINDOW GLAZING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018				Positive Stop (Not Analyzed)	
Client Sample ID: B14-AS69-C		Lab Sample ID: 551801387-0235				
Sample Description: BLACK WINDOW GLAZING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018				Positive Stop (Not Analyzed)	
Client Sample ID: B14-AS70-A		Lab Sample ID: 551801387-0236				
Sample Description: DARK BROWN EXTERIOR WINDOW CAULKING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	
Client Sample ID: B14-AS70-B		Lab Sample ID: 551801387-0237				
Sample Description: DARK BROWN EXTERIOR WINDOW CAULKING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	
Client Sample ID: B14-AS70-C		Lab Sample ID: 551801387-0238				
Sample Description: DARK BROWN EXTERIOR WINDOW CAULKING						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	
Client Sample ID: B14-AS71-A		Lab Sample ID: 551801387-0239				
Sample Description: BROWN CAULKING AROUND EXHAUST VENT						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	
Client Sample ID: B14-AS71-B		Lab Sample ID: 551801387-0240				
Sample Description: BROWN CAULKING AROUND EXHAUST VENT						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	



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EMSL Canada Order 551801387
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B14-AS71-C		Lab Sample ID: 551801387-0241				
Sample Description: BROWN CAULKING AROUND EXHAUST VENT						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	
Client Sample ID: B14-AS72-A		Lab Sample ID: 551801387-0242				
Sample Description: CREAM CAULKING BRICK & FLASHING ON CONCRETE BASE SLAB						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	
Client Sample ID: B14-AS72-B		Lab Sample ID: 551801387-0243				
Sample Description: CREAM CAULKING BRICK & FLASHING ON CONCRETE BASE SLAB						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	
Client Sample ID: B14-AS72-C		Lab Sample ID: 551801387-0244				
Sample Description: CREAM CAULKING BRICK & FLASHING ON CONCRETE BASE SLAB						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	
Client Sample ID: B14-AS73-A		Lab Sample ID: 551801387-0245				
Sample Description: BROWN/RED CAULKING ON EAVESTROUGH BASES						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	
Client Sample ID: B14-AS73-B		Lab Sample ID: 551801387-0246				
Sample Description: BROWN/RED CAULKING ON EAVESTROUGH BASES						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	
Client Sample ID: B14-AS73-C		Lab Sample ID: 551801387-0247				
Sample Description: BROWN/RED CAULKING ON EAVESTROUGH BASES						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	
Client Sample ID: B14-AS74-A		Lab Sample ID: 551801387-0248				
Sample Description: EXTERIOR STUCCO						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	



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EMSL Canada Order 551801387
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B14-AS74-B **Lab Sample ID:** 551801387-0249
Sample Description: EXTERIOR STUCCO

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS74-C **Lab Sample ID:** 551801387-0250
Sample Description: EXTERIOR STUCCO

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS74-D **Lab Sample ID:** 551801387-0251
Sample Description: EXTERIOR STUCCO

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS74-E **Lab Sample ID:** 551801387-0252
Sample Description: EXTERIOR STUCCO

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B14-AS75-A **Lab Sample ID:** 551801387-0253
Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS75-B **Lab Sample ID:** 551801387-0254
Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS75-C **Lab Sample ID:** 551801387-0255
Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS75-D **Lab Sample ID:** 551801387-0256
Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	



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Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B14-AS75-E **Lab Sample ID:** 551801387-0257
Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS75-F **Lab Sample ID:** 551801387-0258
Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS75-G **Lab Sample ID:** 551801387-0259
Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS76-A **Lab Sample ID:** 551801387-0260
Sample Description: BLACK WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS76-B **Lab Sample ID:** 551801387-0261
Sample Description: BLACK WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS76-C **Lab Sample ID:** 551801387-0262
Sample Description: BLACK WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS77-A **Lab Sample ID:** 551801387-0263
Sample Description: DARK BROWN WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS77-B **Lab Sample ID:** 551801387-0264
Sample Description: DARK BROWN WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	



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 Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B14-AS77-C **Lab Sample ID:** 551801387-0265
Sample Description: DARK BROWN WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS78-A **Lab Sample ID:** 551801387-0266
Sample Description: MAROON EXPANSION JOINT CAULKING AND AROUND VENTS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS78-B **Lab Sample ID:** 551801387-0267
Sample Description: MAROON EXPANSION JOINT CAULKING AND AROUND VENTS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS78-C **Lab Sample ID:** 551801387-0268
Sample Description: MAROON EXPANSION JOINT CAULKING AND AROUND VENTS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B14-AS79-A **Lab Sample ID:** 551801387-0269
Sample Description: TAR ALONG BASE BETWEEN BRICK & CONCRETE SLAB BASE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black/Blue	0%	100%	None Detected	

Client Sample ID: B14-AS79-B **Lab Sample ID:** 551801387-0270
Sample Description: TAR ALONG BASE BETWEEN BRICK & CONCRETE SLAB BASE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black/Blue	0%	100%	None Detected	

Client Sample ID: B14-AS79-C **Lab Sample ID:** 551801387-0271
Sample Description: TAR ALONG BASE BETWEEN BRICK & CONCRETE SLAB BASE

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black/Blue	0%	100%	None Detected	

Client Sample ID: B14-AS80-A **Lab Sample ID:** 551801387-0272
Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	



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Client Sample ID: B14-AS80-B **Lab Sample ID:** 551801387-0273
Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS80-C **Lab Sample ID:** 551801387-0274
Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS80-D **Lab Sample ID:** 551801387-0275
Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS80-E **Lab Sample ID:** 551801387-0276
Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS80-F **Lab Sample ID:** 551801387-0277
Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS80-G **Lab Sample ID:** 551801387-0278
Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	



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Analyst(s):

Anne Balayboa PLM (98)
Caroline Allen PLM (15)
Shorthri Kalikutty PLM (188)
TEM Grav. Reduction (3)

Reviewed and approved by:

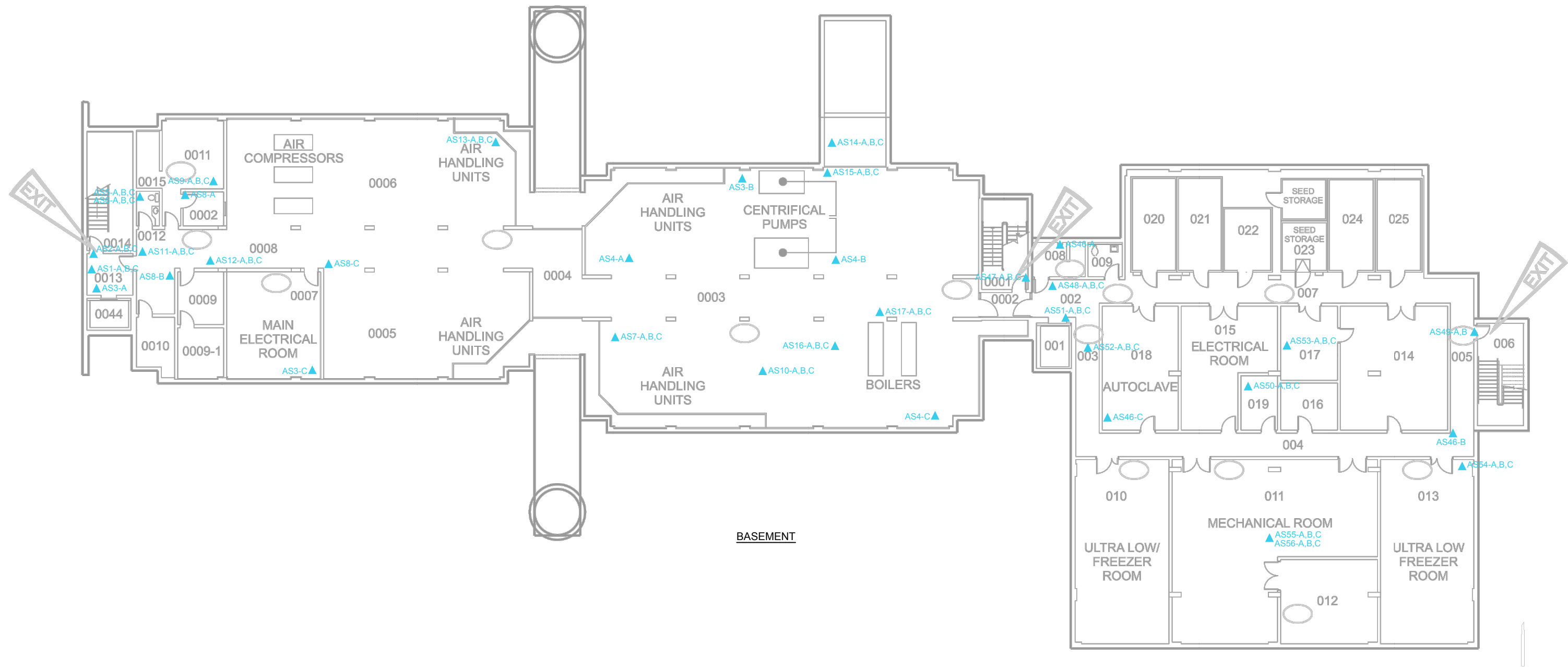
Matthew Davis or other approved signatory
or Other Approved Signatory

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. Mississauga, ON NVLAP Lab Code 200877-0

Report amended: 02/14/2018 14:40:05 Replaces initial report from: 02/13/2018 14:26:00 Reason Code: Client-Additional Analysis

DRAWINGS



- NOTES:
1. Not to scale. Drawing is based on WSP's field observations.
 2. This drawing must be read in conjunction with associated report.
 3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
 4. Other suspect asbestos-containing materials may be present within concealed building spaces.
 5. The following materials were confirmed to be ACM: Grey/black window glazing, interior door black window glazing, exterior window glazing, interior white/grey/brown window glazing.

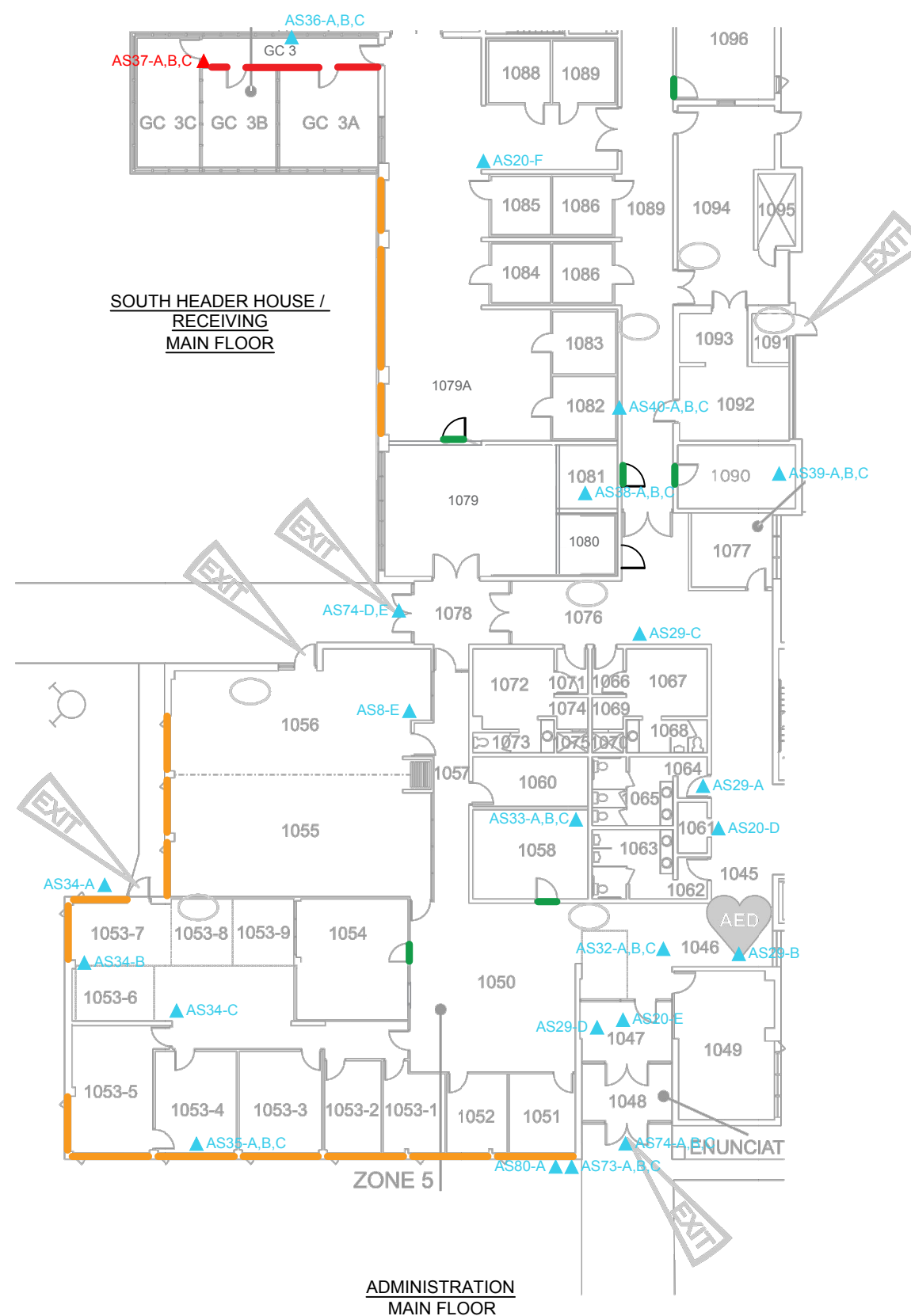
<div>LEGEND</div> <div><div></div> ASBESTOS BULK SAMPLE LOCATION</div> <div><div></div> CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION</div> <div><div></div> EXTERIOR WINDOW GLAZING</div> <div><div></div> INTERIOR WHITE/GREY/BROWN WINDOW GLAZING</div> <div><div></div> INTERIOR DOOR BLACK WINDOW GLAZING</div> <div><div></div> GREY/BLACK WINDOW GLAZING</div>	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA	<div>LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 14 OFFICE/LABORATORY BUILDING</div>	Figure No: <div>D-1</div>
	PSPC No: R.095602.001			Site Location: 1391 SANDFORD STREET, LONDON, ONTARIO
	Date: MARCH 2018			
	Drawn By: NN			
	App'd By: SWH			



INSECTARY WING
MAIN FLOOR

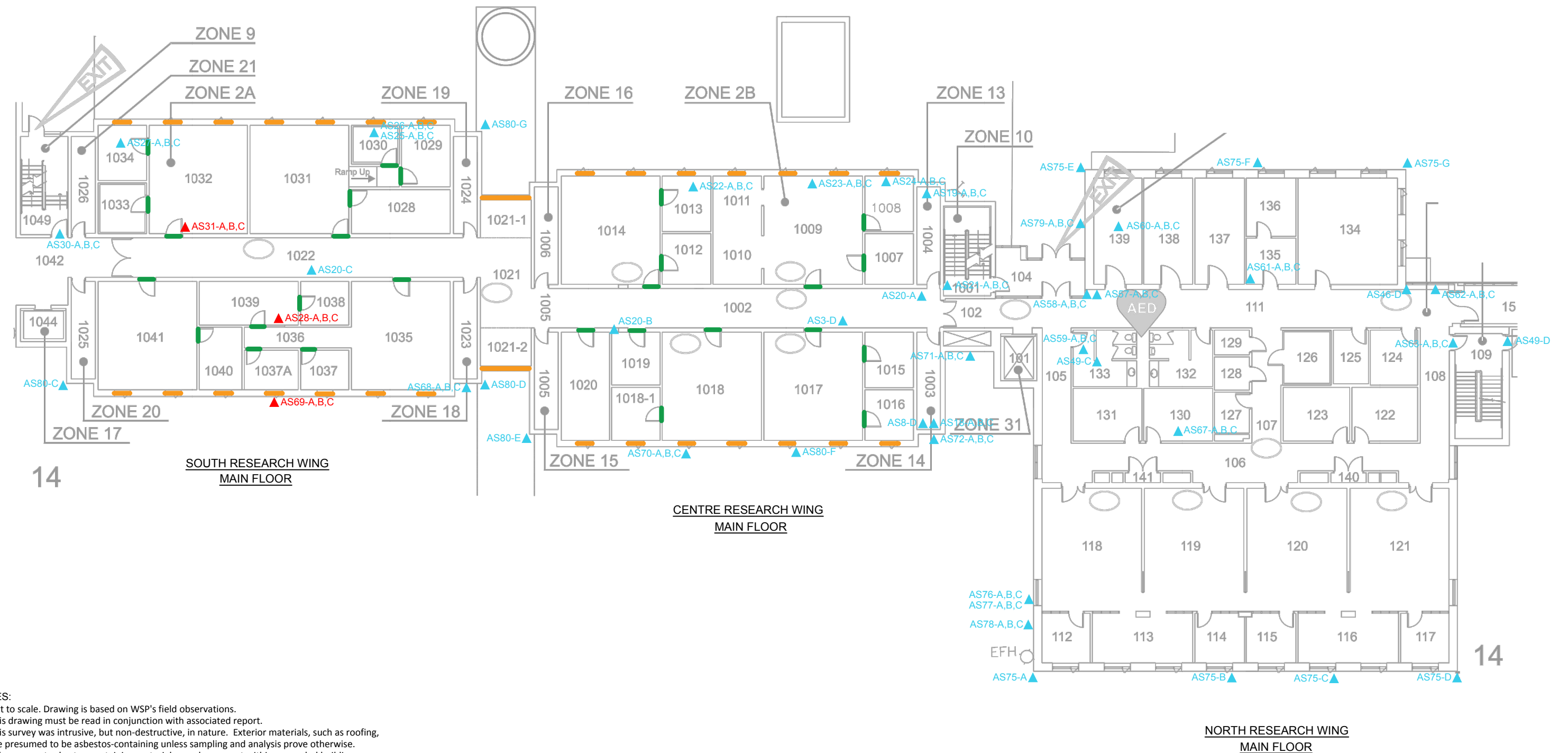
- NOTES:
- 1. Not to scale. Drawing is based on WSP's field observations.
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 - 3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
 - 4. Other suspect asbestos-containing materials may be present within concealed building spaces.
 - 5. The following materials were confirmed to be ACM: Grey/black window glazing, interior door black window glazing, exterior window glazing, interior white/grey/brown window glazing.

<div>LEGEND</div> <div><div><div></div><div>ASBESTOS BULK SAMPLE LOCATION</div></div><div><div></div><div>CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION</div></div><div><div></div><div>EXTERIOR WINDOW GLAZING</div></div><div><div></div><div>INTERIOR WHITE/GREY/BROWN WINDOW GLAZING</div></div><div><div></div><div>INTERIOR DOOR BLACK WINDOW GLAZING</div></div><div><div></div><div>GREY/BLACK WINDOW GLAZING</div></div></div>	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA	<div>LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 14 OFFICE/LABORATORY BUILDING</div>	Figure No: <div>D-2</div>
	PSPC No: R.095602.001			<div>Site Location:</div> <div>1391 SANDFORD STREET, LONDON, ONTARIO</div> <div><div>wsp</div></div>
	Date: MARCH 2018			
	Drawn By: NN			
	App'd By: SWH			



- NOTES:
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 4. Other suspect asbestos-containing materials may be present within concealed building spaces.
 5. The following materials were confirmed to be ACM: Grey/black window glazing, interior door black window glazing, exterior window glazing, interior white/grey/brown window glazing.

LEGEND ASBESTOS BULK SAMPLE LOCATION CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION EXTERIOR WINDOW GLAZING INTERIOR WHITE/GREY/BROWN WINDOW GLAZING INTERIOR DOOR BLACK WINDOW GLAZING GREY/BLACK WINDOW GLAZING	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA Site Location: 1391 SANDFORD STREET, LONDON, ONTARIO	LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 14 OFFICE/LABORATORY BUILDING	Figure No: D-3
	PSPC No: R.095602.001			
	Date: MARCH 2018			
	Drawn By: NN			
	App'd By: SWH			



NOTES:

1. Not to scale. Drawing is based on WSP's field observations.
2. This drawing must be read in conjunction with associated report.
3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
4. Other suspect asbestos-containing materials may be present within concealed building spaces.
5. The following materials were confirmed to be ACM: Grey/black window glazing, interior door black window glazing, exterior window glazing, interior white/grey/brown window glazing.

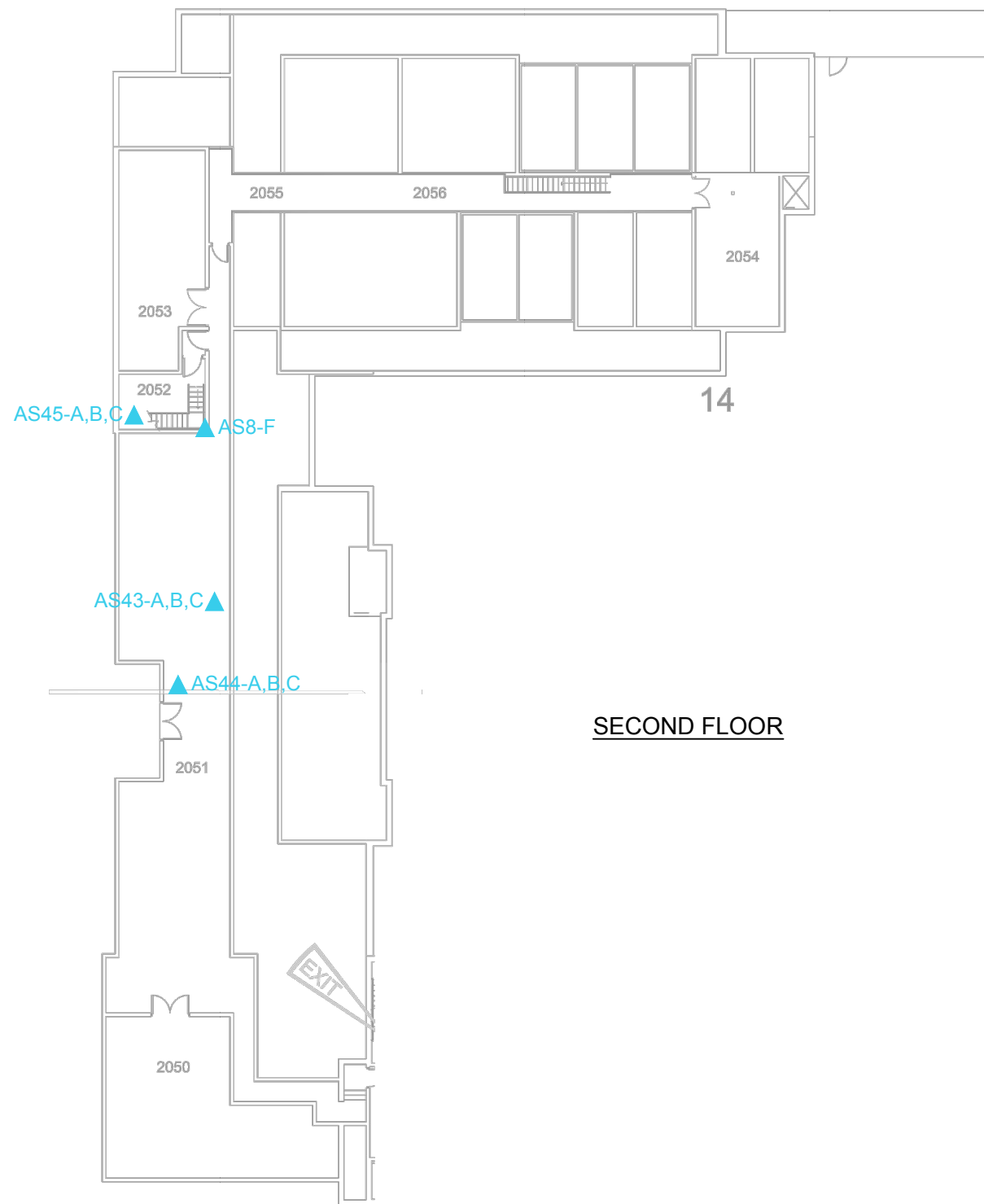
LEGEND	
▲	ASBESTOS BULK SAMPLE LOCATION
▲	CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION
—	EXTERIOR WINDOW GLAZING
—	INTERIOR WHITE/GREY/BROWN WINDOW GLAZING
—	INTERIOR DOOR BLACK WINDOW GLAZING
—	GREY/BLACK WINDOW GLAZING

WSP Project No: 181-00742-00
PSPC No: R.095602.001
Date: MARCH 2018
Drawn By: NN
App'd By: SWH

Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA
Site Location: 1391 SANDFORD STREET, LONDON, ONTARIO

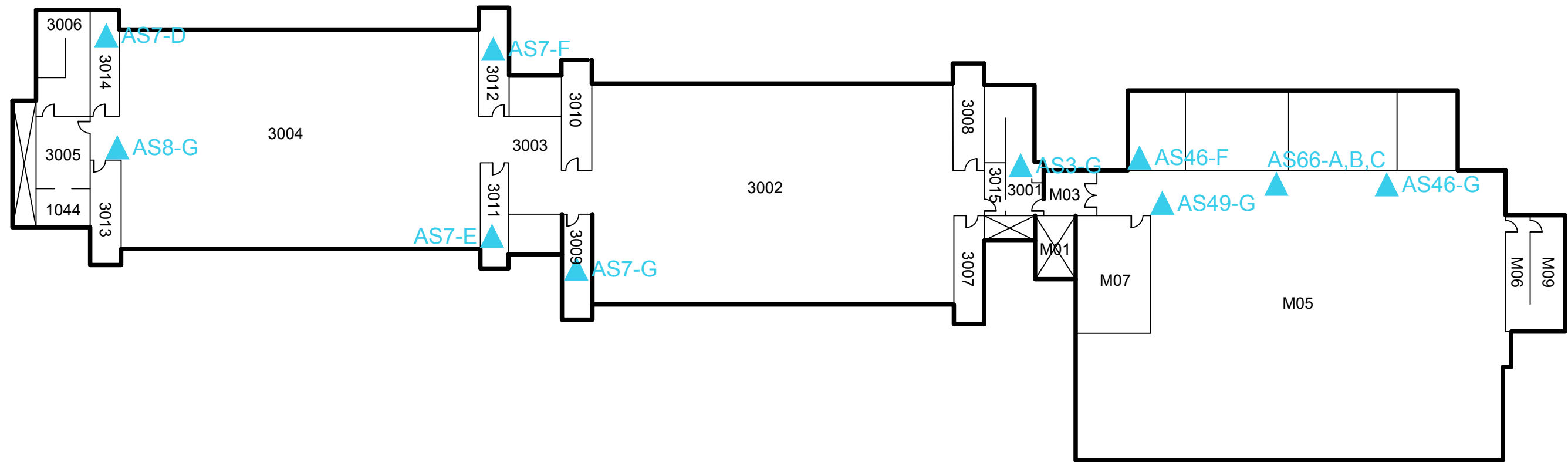
**LOCATIONS OF SAMPLES AND
ASBESTOS-CONTAINING MATERIALS
BUILDING 14
OFFICE/LABORATORY BUILDING**

Figure No: D-4
wsp



- NOTES:
- 1. Not to scale. Drawing is based on WSP's field observations.
 - 2. This drawing must be read in conjunction with associated report.
 - 3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
 - 4. Other suspect asbestos-containing materials may be present within concealed building spaces.
 - 5. The following materials were confirmed to be ACM: Grey/black window glazing, interior door black window glazing, exterior window glazing, interior white/grey/brown window glazing.







LEGEND ▲ ASBESTOS BULK SAMPLE LOCATION ▲ CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION — EXTERIOR WINDOW GLAZING — INTERIOR WHITE/GREY/BROWN WINDOW GLAZING — INTERIOR DOOR BLACK WINDOW GLAZING — GREY/BLACK WINDOW GLAZING	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA	LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 14 OFFICE/LABORATORY BUILDING	Figure No: D-6
	PSPC No: R.095602.001			
	Date: MARCH 2018	Site Location:		
	Drawn By: NN	1391 SANDFORD STREET, LONDON, ONTARIO		
	App'd By: SWH			



RESEARCH WING SOUTH
PENTHOUSE

NOTES:

1. Not to scale. Drawing is based on WSP's field observations.
2. This drawing must be read in conjunction with associated report.
3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
4. Other suspect asbestos-containing materials may be present within concealed building spaces.
5. The following materials were confirmed to be ACM: Grey/black window glazing, interior door black window glazing, exterior window glazing, interior white/grey/brown window glazing.

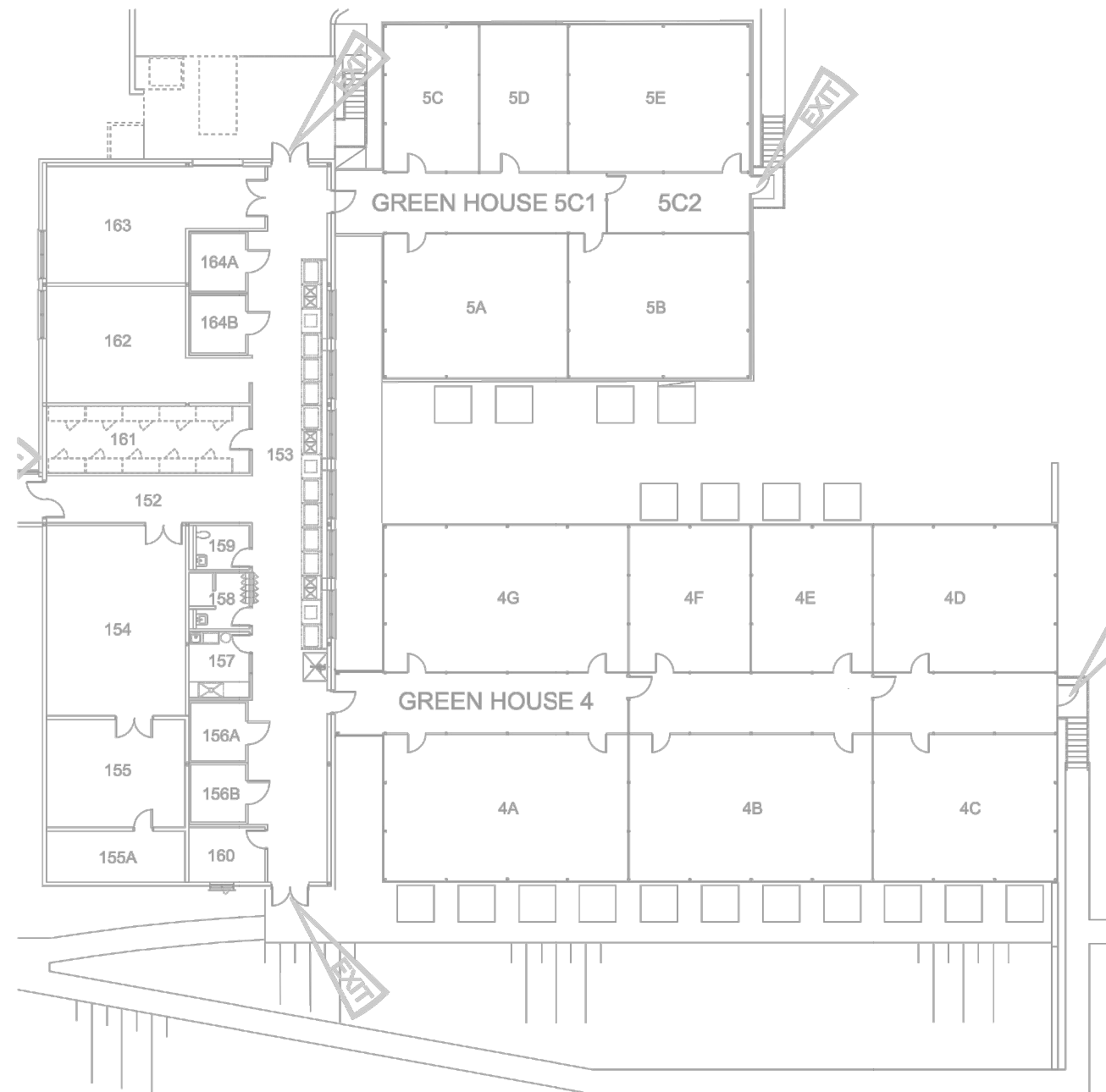
LEGEND	
	ASBESTOS BULK SAMPLE LOCATION
	CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION
	EXTERIOR WINDOW GLAZING
	INTERIOR WHITE/GREY/BROWN WINDOW GLAZING
	INTERIOR DOOR BLACK WINDOW GLAZING
	GREY/BLACK WINDOW GLAZING

WSP Project No: 181-00742-00
PSPC No: R.095602.001
Date: MARCH 2018
Drawn By: NN
App'd By: SWH

Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA
Site Location: 1391 SANDFORD STREET, LONDON, ONTARIO

**LOCATIONS OF SAMPLES AND
ASBESTOS-CONTAINING MATERIALS
BUILDING 14
OFFICE/LABORATORY BUILDING**

Figure No: D-7

GREENHOUSE COMPLEX

- NOTES:
- 1. Not to scale. Drawing is based on WSP's field observations.
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 - 3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
 - 4. Other suspect asbestos-containing materials may be present within concealed building spaces.
 - 5. The following materials were confirmed to be ACM: Grey/black window glazing, interior door black window glazing, exterior window glazing, interior white/grey/brown window glazing.

<div>LEGEND</div> <div><div><div></div><div>ASBESTOS BULK SAMPLE LOCATION</div></div><div><div></div><div>CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION</div></div><div><div></div><div>EXTERIOR WINDOW GLAZING</div></div><div><div></div><div>INTERIOR WHITE/GREY/BROWN WINDOW GLAZING</div></div><div><div></div><div>INTERIOR DOOR BLACK WINDOW GLAZING</div></div><div><div></div><div>GREY/BLACK WINDOW GLAZING</div></div></div>	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA	<div>LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 14 OFFICE/LABORATORY BUILDING</div>	Figure No: <div>D-8</div>
	PSPC No: R.095602.001			<div>Site Location:</div> <div>1391 SANDFORD STREET, LONDON, ONTARIO</div>
	Date: MARCH 2018			
	Drawn By: NN			
	App'd By: SWH			

APPENDIX

E

BUILDING 15 – MASS
PRODUCTION



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ATTACHMENTS

SITE PHOTOGRAPHS

LABORATORY CERTIFICATES OF ANALYSIS

DRAWINGS

1 OBSERVATIONS AND RESULTS

Building 15, the Mass Production Building, is located between Building 14 (Office/Lab Building) and Building 16 (Garage) at the Subject Property. The rectangular-shaped structure was reportedly constructed in 1988 with renovations in 2001/2002 and is approximately 440 m² (4,736 ft²) in area. The roof was reportedly replaced in 2008. It is a two-storey building consisting of an entrance vestibule, hallways, offices, labs, and a second-floor mechanical room.

The building has a brick exterior with a sloped, shingled roof. The interior finishes consist of concrete block, brick, drywall, and acoustic ceiling tiles. Flooring materials include vinyl sheet flooring and concrete.

1.1 ASBESTOS-CONTAINING MATERIALS

The *Canada Occupational Health & Safety Regulations (SOR/86-304)* and *Ontario Regulation 278/05 (O. Reg. 278/05)* both establish definitions of asbestos-containing material (ACM), however, *O. Reg. 278/05* is more stringent. In accordance with the requirements of *O. Reg. 278/05*, homogenous materials (i.e. materials uniform in color and texture) must be considered to be asbestos-containing, if any sample which is collected from that homogeneous material, is identified to have an asbestos concentration of 0.5% or greater. However, recognizing that other provinces utilize more stringent criteria, in order to establish national consistency, AAFC considers homogeneous materials to be asbestos-containing if the asbestos concentration is 0.1% or greater.

A total of seventy-two (72) building material samples were collected from twenty (20) homogenous building materials and submitted for laboratory analysis of asbestos content. The table below summarizes only those materials which were subsequently identified, confirmed or presumed to be asbestos-containing materials and are presented along with recommended remedial actions for each respective material.

Recommended actions for management, repair or removal of these materials, are based on the requirements and procedures specified by *O. Reg. 278/05* and PSPC's *Asbestos Management Standard*, and have been suggested based on the type of disturbance which is anticipated or likely. Alternate handling, repair and removal procedures must comply with the requirements of *O. Reg. 278/05* and PSPC's *Asbestos Management Standard*.

Table 1 – Asbestos-Containing Materials

MATERIAL DESCRIPTION & LOCATION	ASSESSMENT ¹	ACTION ²	PHOTO ³
Interior Door Window Glazing Approximately 20 linear meters (66 linear feet) observed around the interior wood door windows.	Sample ID/Concentration: B15-AS89-A [2% Chrysotile] Material: Non-Friable Accessibility: A (Areas of the building within reach of all building users.) Condition: Good	Action 7 Routine surveillance of ACM in good condition. Prior to demolition activities which may disturb this material, remove the material following: Type 1 abatement procedures – if the material is wetted and the work is performed using non-powered hand tools.	2,3

¹ For sample ID and concentration levels refer to attached Laboratory Certificates of Analysis.

² Actions and procedures recommended are based on the requirements of the PSPC *Asbestos Management Standard* and *O. Reg. 278/05*.

³ For relevant photographs taken during the survey refer to attached Site Photographs.

As the survey was non-destructive in nature, suspect materials may be present within concealed building materials or present on the roof, such as caulking, mastics, tar, etc., and should be presumed to contain asbestos if observed. Prior to disturbance of suspect ACM, samples should be collected and analyzed to confirm the presence or absence of asbestos.

If renovation or demolition activities are likely to disturb the materials, it is required that all identified asbestos-containing materials be removed in accordance with *O. Reg. 278/05* and PSPC's *Asbestos Management Standard*. If any potential asbestos-containing materials are encountered unexpectedly, a qualified environmental consultant should be contacted to sample, monitor and/or document the removal of asbestos-containing materials, and to ensure that appropriate procedures are being followed.

1.2 SUMMARY OF BULK SAMPLES IDENTIFIED AS “NON-ASBESTOS”




The table below summarizes the results of bulk material samples collected from suspect materials during the current survey, which had either no detectable concentrations of asbestos, or had asbestos concentrations less than the AAFC required threshold limit of 0.1% (by weight), and therefore can be considered as “non-asbestos”.

Table 2 – Summary of Bulk Samples Identified as “Non-Asbestos”

MATERIAL DESCRIPTION / LOCATION	SAMPLE ID ¹
Concrete block mortar	B15-AS81-A,B,C,D,E,F,G
Interior brown caulking around doors and windows	B15-AS82-A,B,C
Cream/beige with fleck vinyl linoleum sheet flooring	B15-AS83-A,B,C
Interior white door, window and expansion joint caulking	B15-AS84-A,B,C
Drywall joint compound	B15-AS85-A,B,C,D,E,F,G
Blue/grey with fleck vinyl linoleum sheet flooring	B15-AS86-A,B,C
Cream sink acoustic undercoating	B15-AS87-A,B,C
Blue/Green with fleck vinyl linoleum sheet flooring	B15-AS88-A,B,C
Interior brick mortar	B15-AS90-A,B,C
Interior black window glazing	B15-AS91-A,B,C
Interior texture coat / Room 1215	B15-AS92-A,B,C
Brown duct sealant / Room 2201	B15-AS93-A,B,C
Parging cement on fibreglass insulation ends / Room 2201	B15-AS94-A,B,C
White block insulation / Room 2201	B15-AS95-A,B,C
Brown exterior door and window caulking	B15-AS96-A,B,C
Exterior maroon door caulking	B15-AS97-A,B,C
Exterior window glazing	B15-AS98-A,B,C
Grey firestop around exterior conduits	B15-AS99-A,B,C
Exterior brick mortar	B15-AS100-A,B,C,D,E,F,G

¹ For sample ID and concentration levels refer to attached Laboratory Certificates of Analysis.

SITE PHOTOGRAPHS

PHOTO NO. 1	
DATE: January 31, 2018	
DESCRIPTION: View of Building 15 (Mass Production) (facing southwest).	
SAMPLE NUMBER(S): -	
PHOTO NO. 2	
DATE: January 31, 2018	
DESCRIPTION: View of asbestos-containing interior wood door window glazing.	
SAMPLE NUMBER(S): B15-AS89-A,B,C	
PHOTO NO. 3	
DATE: January 31, 2018	
DESCRIPTION: View of asbestos-containing interior wood door window glazing.	
SAMPLE NUMBER(S): B15-AS89-A,B,C	

LABORATORY CERTIFICATES OF ANALYSIS



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EMSL Canada Order 551801504
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Attn: Stephen Heikkila
WSP Canada Group Limited
100 Commerce Valley Drive West
Thornhill, ON L3T 0A1

Phone: (905) 882-4211
Fax: (905) 882-1857
Collected: 1/31/2018
Received: 2/05/2018
Analyzed: 2/12/2018

Proj: 181-00742-00 London

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B15-AS81-A

Lab Sample ID: 551801504-0001

Sample Description: Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	None Detected	

Client Sample ID: B15-AS81-B

Lab Sample ID: 551801504-0002

Sample Description: Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	None Detected	

Client Sample ID: B15-AS81-C

Lab Sample ID: 551801504-0003

Sample Description: Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	None Detected	

Client Sample ID: B15-AS81-D

Lab Sample ID: 551801504-0004

Sample Description: Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	None Detected	

Client Sample ID: B15-AS81-E

Lab Sample ID: 551801504-0005

Sample Description: Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B15-AS81-F

Lab Sample ID: 551801504-0006

Sample Description: Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B15-AS81-G

Lab Sample ID: 551801504-0007

Sample Description: Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	



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EMSL Canada Order 551801504
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B15-AS82-A **Lab Sample ID:** 551801504-0008
Sample Description: Brown Door/Window Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	

Client Sample ID: B15-AS82-B **Lab Sample ID:** 551801504-0009
Sample Description: Brown Door/Window Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	

Client Sample ID: B15-AS82-C **Lab Sample ID:** 551801504-0010
Sample Description: Brown Door/Window Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	

Client Sample ID: B15-AS83-A-Flooring **Lab Sample ID:** 551801504-0011
Sample Description: Cream/Beige with flecks Linoleum Vinyl Flooring

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	0%	100%	None Detected	

Client Sample ID: B15-AS83-A-Mastic **Lab Sample ID:** 551801504-0011A
Sample Description: Cream/Beige with flecks Linoleum Vinyl Flooring

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Yellow	0%	100%	None Detected	

Client Sample ID: B15-AS83-A-Leveler **Lab Sample ID:** 551801504-0011B
Sample Description: Cream/Beige with flecks Linoleum Vinyl Flooring

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B15-AS83-B-Flooring **Lab Sample ID:** 551801504-0012
Sample Description: Cream/Beige with flecks Linoleum Vinyl Flooring

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	0%	100%	None Detected	

Client Sample ID: B15-AS83-B-Mastic **Lab Sample ID:** 551801504-0012A
Sample Description: Cream/Beige with flecks Linoleum Vinyl Flooring

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Yellow	0%	100%	None Detected	



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EMSL Canada Order 551801504
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B15-AS83-B-Leveler		Lab Sample ID: 551801504-0012B				
Sample Description: Cream/Beige with flecks Linoleum Vinyl Flooring						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	
Client Sample ID: B15-AS83-C-Flooring		Lab Sample ID: 551801504-0013				
Sample Description: Cream/Beige with flecks Linoleum Vinyl Flooring						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	
Client Sample ID: B15-AS83-C-Mastic		Lab Sample ID: 551801504-0013A				
Sample Description: Cream/Beige with flecks Linoleum Vinyl Flooring						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Yellow	0%	100%	None Detected	
Client Sample ID: B15-AS83-C-Leveler		Lab Sample ID: 551801504-0013B				
Sample Description: Cream/Beige with flecks Linoleum Vinyl Flooring						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	
Client Sample ID: B15-AS84-A		Lab Sample ID: 551801504-0014				
Sample Description: White Expansion Joint Caulking + Around Doors/Windows						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	
Client Sample ID: B15-AS84-B		Lab Sample ID: 551801504-0015				
Sample Description: White Expansion Joint Caulking + Around Doors/Windows						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	
Client Sample ID: B15-AS84-C		Lab Sample ID: 551801504-0016				
Sample Description: White Expansion Joint Caulking + Around Doors/Windows						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	
Client Sample ID: B15-AS85-A		Lab Sample ID: 551801504-0017				
Sample Description: Drywall Joint Compound						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	



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Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B15-AS85-B **Lab Sample ID:** 551801504-0018
Sample Description: Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B15-AS85-C **Lab Sample ID:** 551801504-0019
Sample Description: Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B15-AS85-D **Lab Sample ID:** 551801504-0020
Sample Description: Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B15-AS85-E **Lab Sample ID:** 551801504-0021
Sample Description: Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B15-AS85-F **Lab Sample ID:** 551801504-0022
Sample Description: Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B15-AS85-G **Lab Sample ID:** 551801504-0023
Sample Description: Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B15-AS86-A **Lab Sample ID:** 551801504-0024
Sample Description: Blue/Grey with flecks Linoleum Vinyl Flooring

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/Blue	0%	100%	None Detected	

Client Sample ID: B15-AS86-B **Lab Sample ID:** 551801504-0025
Sample Description: Blue/Grey with flecks Linoleum Vinyl Flooring

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/Blue	0%	100%	None Detected	



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EMSL Canada Order 551801504
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B15-AS86-C **Lab Sample ID:** 551801504-0026
Sample Description: Blue/Grey with flecks Linoleum Vinyl Flooring

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Blue	0%	100%	None Detected	

Client Sample ID: B15-AS87-A **Lab Sample ID:** 551801504-0027
Sample Description: Cream Sink acoustic undercoating

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	0%	100%	None Detected	

Client Sample ID: B15-AS87-B **Lab Sample ID:** 551801504-0028
Sample Description: Cream Sink acoustic undercoating

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	0%	100%	None Detected	

Client Sample ID: B15-AS87-C **Lab Sample ID:** 551801504-0029
Sample Description: Cream Sink acoustic undercoating

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	0%	100%	None Detected	

Client Sample ID: B15-AS88-A-Flooring **Lab Sample ID:** 551801504-0030
Sample Description: Blue/Green with flecks Linoleum Vinyl Flooring

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Blue	0%	100%	None Detected	

Client Sample ID: B15-AS88-A-Mastic **Lab Sample ID:** 551801504-0030A
Sample Description: Blue/Green with flecks Linoleum Vinyl Flooring

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B15-AS88-B-Flooring **Lab Sample ID:** 551801504-0031
Sample Description: Blue/Green with flecks Linoleum Vinyl Flooring

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Blue	0%	100%	None Detected	

Client Sample ID: B15-AS88-B-Mastic **Lab Sample ID:** 551801504-0031A
Sample Description: Blue/Green with flecks Linoleum Vinyl Flooring

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	



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EMSL Canada Order 551801504
 Customer ID: 55MMMG25
 Customer PO: 181-00742-00
 Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B15-AS88-C-Flooring		Lab Sample ID: 551801504-0032				
Sample Description: Blue/Green with flecks Linoleum Vinyl Flooring						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Blue	0%	100%	None Detected	
Client Sample ID: B15-AS88-C-Mastic		Lab Sample ID: 551801504-0032A				
Sample Description: Blue/Green with flecks Linoleum Vinyl Flooring						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	
Client Sample ID: B15-AS89-A		Lab Sample ID: 551801504-0033				
Sample Description: Door Black Window Glazing						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	10%	88%	2% Chrysotile	
Client Sample ID: B15-AS89-B		Lab Sample ID: 551801504-0034				
Sample Description: Door Black Window Glazing						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018				Positive Stop (Not Analyzed)	
Client Sample ID: B15-AS89-C		Lab Sample ID: 551801504-0035				
Sample Description: Door Black Window Glazing						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018				Positive Stop (Not Analyzed)	
Client Sample ID: B15-AS90-A		Lab Sample ID: 551801504-0036				
Sample Description: Brick Mortar Interior						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	
Client Sample ID: B15-AS90-B		Lab Sample ID: 551801504-0037				
Sample Description: Brick Mortar Interior						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	
Client Sample ID: B15-AS90-C		Lab Sample ID: 551801504-0038				
Sample Description: Brick Mortar Interior						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	



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Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B15-AS91-A **Lab Sample ID:** 551801504-0039

Sample Description: Black Interior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	

Client Sample ID: B15-AS91-B **Lab Sample ID:** 551801504-0040

Sample Description: Black Interior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	

Client Sample ID: B15-AS91-C **Lab Sample ID:** 551801504-0041

Sample Description: Black Interior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	

Client Sample ID: B15-AS92-A **Lab Sample ID:** 551801504-0042

Sample Description: Texture Coat

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B15-AS92-B **Lab Sample ID:** 551801504-0043

Sample Description: Texture Coat

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B15-AS92-C **Lab Sample ID:** 551801504-0044

Sample Description: Texture Coat

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B15-AS93-A **Lab Sample ID:** 551801504-0045

Sample Description: Brown Duct Sealant

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B15-AS93-B **Lab Sample ID:** 551801504-0046

Sample Description: Brown Duct Sealant

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	



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Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B15-AS93-C **Lab Sample ID:** 551801504-0047
Sample Description: Brown Duct Sealent

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B15-AS94-A **Lab Sample ID:** 551801504-0048
Sample Description: Parging on fibreglass ends

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	20%	80%	None Detected	

Client Sample ID: B15-AS94-B **Lab Sample ID:** 551801504-0049
Sample Description: Parging on fibreglass ends

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	20%	80%	None Detected	

Client Sample ID: B15-AS94-C **Lab Sample ID:** 551801504-0050
Sample Description: Parging on fibreglass ends

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	10%	90%	None Detected	

Client Sample ID: B15-AS95-A **Lab Sample ID:** 551801504-0051
Sample Description: White Block Insulation

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	15%	85%	None Detected	

Client Sample ID: B15-AS95-B **Lab Sample ID:** 551801504-0052
Sample Description: White Block Insulation

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	10%	90%	None Detected	

Client Sample ID: B15-AS95-C **Lab Sample ID:** 551801504-0053
Sample Description: White Block Insulation

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B15-AS96-A **Lab Sample ID:** 551801504-0054
Sample Description: Brown Ext Door/Window Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	



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Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B15-AS96-B **Lab Sample ID:** 551801504-0055

Sample Description: Brown Ext Door/Window Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	

Client Sample ID: B15-AS96-C **Lab Sample ID:** 551801504-0056

Sample Description: Brown Ext Door/Window Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B15-AS97-A **Lab Sample ID:** 551801504-0057

Sample Description: Maroon Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	0%	100%	None Detected	

Client Sample ID: B15-AS97-B **Lab Sample ID:** 551801504-0058

Sample Description: Maroon Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	0%	100%	None Detected	

Client Sample ID: B15-AS97-C **Lab Sample ID:** 551801504-0059

Sample Description: Maroon Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	0%	100%	None Detected	

Client Sample ID: B15-AS98-A **Lab Sample ID:** 551801504-0060

Sample Description: Exterior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	

Client Sample ID: B15-AS98-B **Lab Sample ID:** 551801504-0061

Sample Description: Exterior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	

Client Sample ID: B15-AS98-C **Lab Sample ID:** 551801504-0062

Sample Description: Exterior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	



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Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B15-AS99-A **Lab Sample ID:** 551801504-0063

Sample Description: Grey Fire Stop Around EXT Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/Red	0%	100%	None Detected	

Client Sample ID: B15-AS99-B **Lab Sample ID:** 551801504-0064

Sample Description: Grey Fire Stop Around EXT Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/Red	0%	100%	None Detected	

Client Sample ID: B15-AS99-C **Lab Sample ID:** 551801504-0065

Sample Description: Grey Fire Stop Around EXT Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/Red	0%	100%	None Detected	

Client Sample ID: B15-AS100-A **Lab Sample ID:** 551801504-0066

Sample Description: Exterior Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	

Client Sample ID: B15-AS100-B **Lab Sample ID:** 551801504-0067

Sample Description: Exterior Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	

Client Sample ID: B15-AS100-C **Lab Sample ID:** 551801504-0068

Sample Description: Exterior Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	

Client Sample ID: B15-AS100-D **Lab Sample ID:** 551801504-0069

Sample Description: Exterior Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	

Client Sample ID: B15-AS100-E **Lab Sample ID:** 551801504-0070

Sample Description: Exterior Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	



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Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B15-AS100-F

Lab Sample ID: 551801504-0071

Sample Description: Exterior Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	

Client Sample ID: B15-AS100-G

Lab Sample ID: 551801504-0072

Sample Description: Exterior Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	

Analyst(s):

Brian Jolly PLM (28)
Christine Stouffer PLM (51)

Reviewed and approved by:

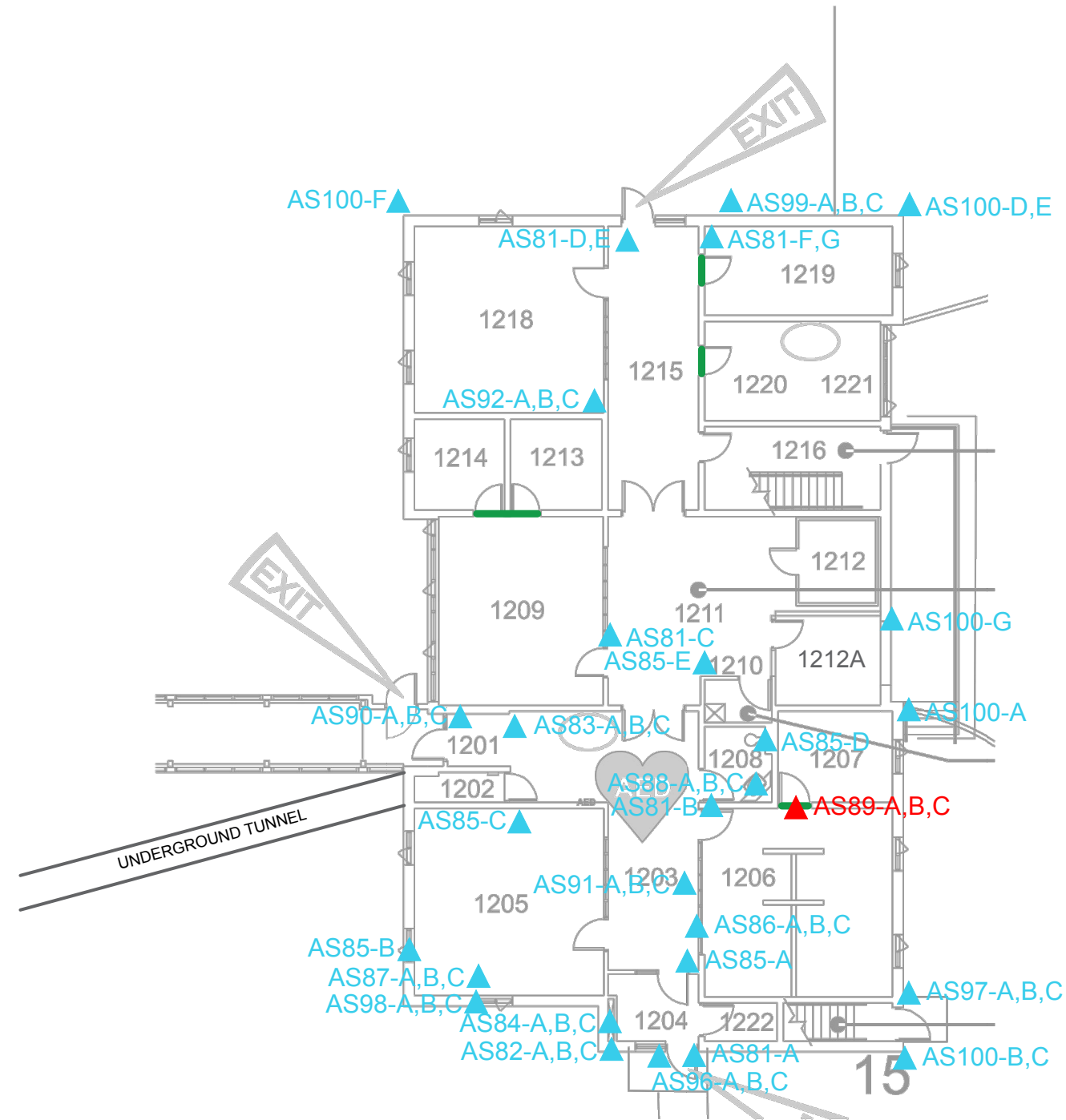
Matthew Davis or other approved signatory
or Other Approved Signatory

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 Analytical, Inc. Hillside, IL NVLAP Lab Code 200399-0, TX 300289

Initial report from: 02/12/2018 17:18:20

DRAWINGS



MAIN FLOOR

NOTES:

1. Not to scale. Drawing is based on WSP's field observations.
2. This drawing must be read in conjunction with associated report.
3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
4. Other suspect asbestos-containing materials may be present within concealed building spaces.
5. The following materials were confirmed to be ACM: Interior door window glazing.

LEGEND

- ▲ ASBESTOS BULK SAMPLE LOCATION
- ▲ CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION
- INTERIOR DOOR WINDOW GLAZING

WSP Project No: 181-00742-00

PSPC No: R.095602.001

Date: MARCH 2018

Drawn By: NN

App'd By: SWH

Client: PUBLIC SERVICES AND PROCUREMENT CANADA
on behalf of
AGRICULTURE AND AGRI-FOOD CANADA

Site Location:

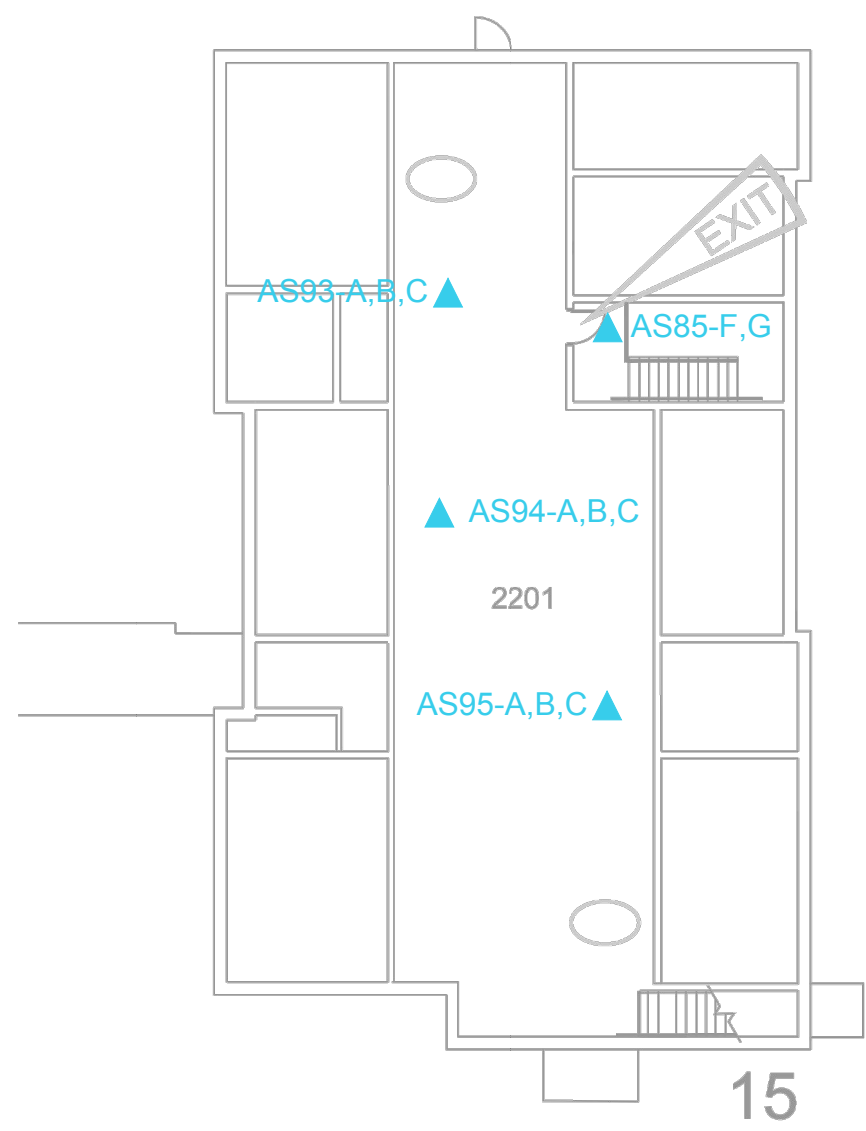
1391 SANDFORD STREET,
LONDON, ONTARIO

**LOCATIONS OF SAMPLES AND
ASBESTOS-CONTAINING MATERIALS
BUILDING 15
MASS PRODUCTION**

Figure No:

E-1

wsp



SECOND FLOOR

- NOTES:
- 1. Not to scale. Drawing is based on WSP's field observations.
 - 2. This drawing must be read in conjunction with associated report.
 - 3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
 - 4. Other suspect asbestos-containing materials may be present within concealed building spaces.
 - 5. The following materials were confirmed to be ACM: Interior door window glazing.

<div>LEGEND</div> <div><div><div></div><div>ASBESTOS BULK SAMPLE LOCATION</div></div><div><div></div><div>CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION</div></div><div><div></div><div>INTERIOR DOOR WINDOW GLAZING</div></div></div>	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA	LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 15 MASS PRODUCTION	Figure No: E-2
	PSPC No: R.095602.001			Site Location: 1391 SANDFORD STREET, LONDON, ONTARIO
	Date: MARCH 2018			
	Drawn By: NN			
	App'd By: SWH			

APPENDIX

F

BUILDING 17 – PESTICIDE
HANDLING BUILDING



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TABLE 1 – SUMMARY OF BULK SAMPLES IDENTIFIED AS “NON-ASBESTOS”	1
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ATTACHMENTS

SITE PHOTOGRAPHS

LABORATORY CERTIFICATES OF ANALYSIS

DRAWINGS

1 OBSERVATIONS AND RESULTS

Building 17, the Pesticide Handling Building, is located next to Building 12 (Implement Barn) at the Subject Property. The rectangular-shaped structure was reportedly constructed in 2002 and is approximately 20 m² (215 ft²) in area. It is a single-storey building used for pesticide handling.

The building has metal-clad exterior walls and roofing. The interior finishes consist of metal-cladding walls and ceiling and a concrete floor.

1.1 ASBESTOS-CONTAINING MATERIALS

The *Canada Occupational Health & Safety Regulations (SOR/86-304)* and *Ontario Regulation 278/05 (O. Reg. 278/05)* both establish definitions of asbestos-containing material (ACM), however, *O. Reg. 278/05* is more stringent. In accordance with the requirements of *O. Reg. 278/05*, homogenous materials (i.e. materials uniform in color and texture) must be considered to be asbestos-containing, if any sample which is collected from that homogeneous material, is identified to have an asbestos concentration of 0.5% or greater. However, recognizing that other provinces utilize more stringent criteria, in order to establish national consistency, AAFC considers homogeneous materials to be asbestos-containing if the asbestos concentration is 0.1% or greater.

A total of twelve (12) building material samples were collected from four (4) homogenous building materials and submitted for laboratory analysis of asbestos content. The table below summarizes the results of bulk material samples collected from suspect materials which had either no detectable concentrations of asbestos, or had asbestos concentrations less than the AAFC required threshold limit of 0.1% (by weight), and therefore can be considered as “non-asbestos”.

Table 1 – Summary of Bulk Samples Identified as “Non-Asbestos”

MATERIAL DESCRIPTION / LOCATION	SAMPLE ID ¹
Cream caulking around interior cladding seams and around exterior conduits	B17-AS115-A,B,C
Cream sink acoustic undercoating	B17-AS116-A,B,C
Brown caulking around interior/exterior doors and vents	B17-AS117-A,B,C
Grey exterior door window glazing	B17-AS118-A,B,C

¹ For sample ID and concentration levels refer to attached Laboratory Certificates of Analysis.

As the survey was non-destructive in nature, suspect materials may be present within concealed building materials or present on the roof, such as caulking, mastics, tar, etc., and should be presumed to contain asbestos if observed. Prior to disturbance of suspect ACM, samples should be collected and analyzed to confirm the presence or absence of asbestos.

SITE PHOTOGRAPHS

PHOTO NO. 1	
DATE: January 31, 2018	
DESCRIPTION: View of Building 17 – Pesticide Handling Building (facing northwest).	
SAMPLE NUMBER(S): -	

LABORATORY CERTIFICATES OF ANALYSIS



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Customer ID: 55MMMG25
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Project ID:

Attn: Stephen Heikkila
WSP Canada Group Limited
100 Commerce Valley Drive West
Thornhill, ON L3T 0A1

Phone: (905) 882-4211
Fax: (905) 882-1857
Collected: 1/31/2018
Received: 2/05/2018
Analyzed: 2/12/2018

Proj: 181-00742-00 London/B17

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B17-AS115-A **Lab Sample ID:** 551801417-0001

Sample Description: Cream caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	0%	100%	None Detected	

Client Sample ID: B17-AS115-B **Lab Sample ID:** 551801417-0002

Sample Description: Cream caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	0%	100%	None Detected	

Client Sample ID: B17-AS115-C **Lab Sample ID:** 551801417-0003

Sample Description: Cream caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	0%	100%	None Detected	

Client Sample ID: B17-AS116-A **Lab Sample ID:** 551801417-0004

Sample Description: Cream sink acoustic undercoating

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	0%	100%	None Detected	

Client Sample ID: B17-AS116-B **Lab Sample ID:** 551801417-0005

Sample Description: Cream sink acoustic undercoating

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	<1%	100%	None Detected	

Client Sample ID: B17-AS116-C **Lab Sample ID:** 551801417-0006

Sample Description: Cream sink acoustic undercoating

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	2%	98%	None Detected	

Client Sample ID: B17-AS117-A **Lab Sample ID:** 551801417-0007

Sample Description: Brown caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	2%	98%	None Detected	



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Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B17-AS117-B

Lab Sample ID: 551801417-0008

Sample Description: Brown caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B17-AS117-C

Lab Sample ID: 551801417-0009

Sample Description: Brown caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	2%	98%	None Detected	

Client Sample ID: B17-AS118-A

Lab Sample ID: 551801417-0010

Sample Description: Grey door window glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B17-AS118-B

Lab Sample ID: 551801417-0011

Sample Description: Grey door window glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	2%	98%	None Detected	

Client Sample ID: B17-AS118-C

Lab Sample ID: 551801417-0012

Sample Description: Grey door window glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Analyst(s):

Colin Slattery PLM (12)

Reviewed and approved by:

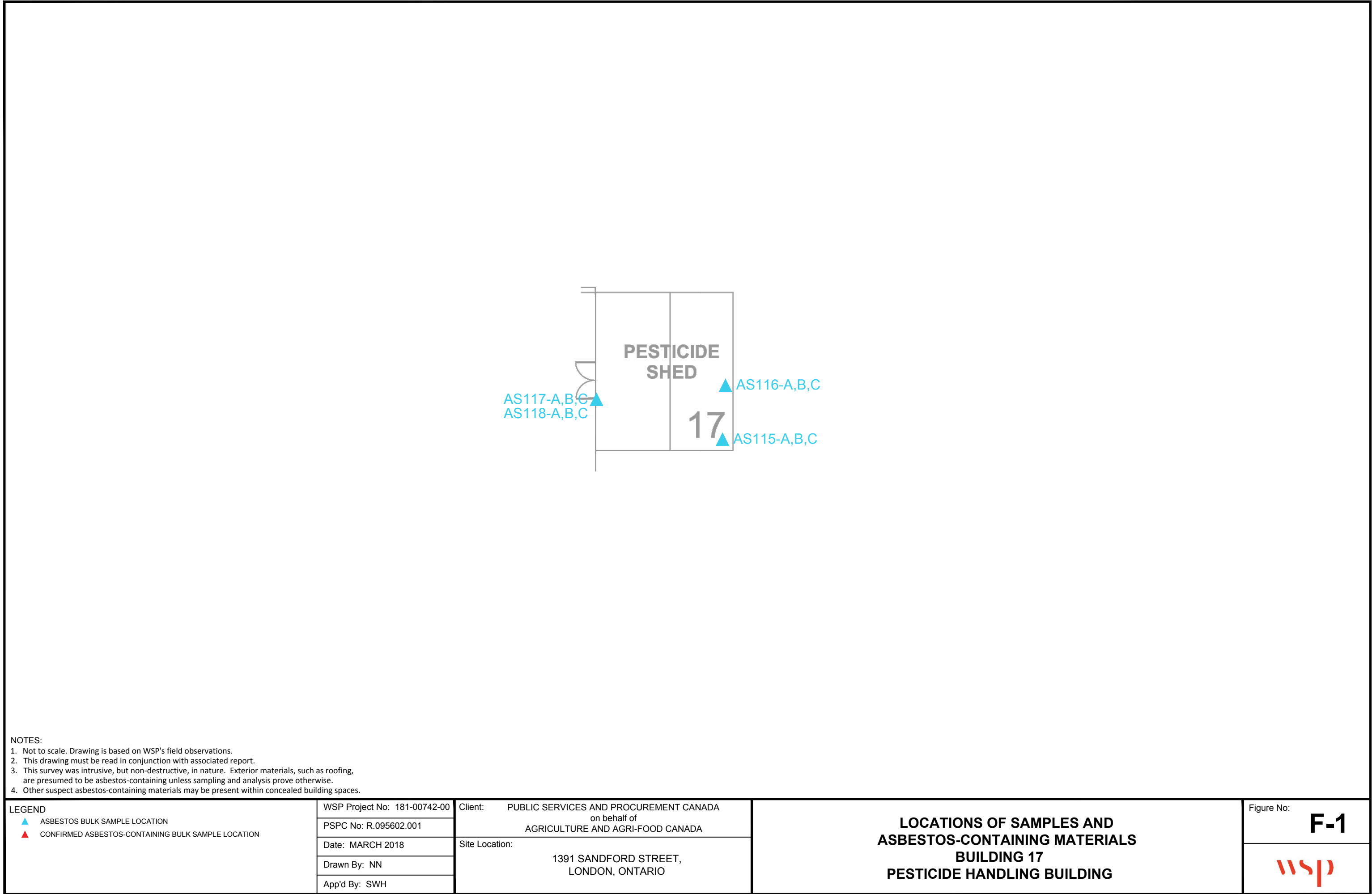
Matthew Davis or other approved signatory
or Other Approved Signatory

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 Analytical, Inc. Piscataway, NJ NYS ELAP 11423, NVLAP Lab Code 101048-2, NJ NELAC 12037

Initial report from: 02/12/2018 13:00:43

DRAWINGS



- NOTES:
- 1. Not to scale. Drawing is based on WSP's field observations.
 - 2. This drawing must be read in conjunction with associated report.
 - 3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
 - 4. Other suspect asbestos-containing materials may be present within concealed building spaces.

<div>LEGEND</div> <div><div><div></div><div>ASBESTOS BULK SAMPLE LOCATION</div></div><div><div></div><div>CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION</div></div></div>	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA	<div>LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 17 PESTICIDE HANDLING BUILDING</div>	Figure No: <div>F-1</div>
	PSPC No: R.095602.001			<div>Site Location: 1391 SANDFORD STREET, LONDON, ONTARIO</div>
	Date: MARCH 2018			
	Drawn By: NN			
	App'd By: SWH			

APPENDIX

G

BUILDING 18 – MULTI
PURPOSE FACILITY



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ATTACHMENTS

SITE PHOTOGRAPHS

LABORATORY CERTIFICATES OF ANALYSIS

DRAWINGS

1 OBSERVATIONS AND RESULTS

Building 18, the Multi-Purpose Facility, is located next to Building 10 (Garage) and across from Building 17 (Pesticide Handling Building) at the Subject Property. The rectangular-shaped structure was reportedly constructed in 2004 and is approximately 165 m² (1,776 ft²) in area. It is a single-storey building; one side is heated and used to repair equipment while the other side is not heated and used for storage.

The building has wood-panelled exterior walls and a metal-clad roof. The interior finishes consist of wood beams supporting the exterior panelling and cladding, concrete flooring, and a wood-framed mezzanine.

1.1 ASBESTOS-CONTAINING MATERIALS

The *Canada Occupational Health & Safety Regulations (SOR/86-304)* and *Ontario Regulation 278/05 (O. Reg. 278/05)* both establish definitions of asbestos-containing material (ACM), however, *O. Reg. 278/05* is more stringent. In accordance with the requirements of *O. Reg. 278/05*, homogenous materials (i.e. materials uniform in color and texture) must be considered to be asbestos-containing, if any sample which is collected from that homogeneous material, is identified to have an asbestos concentration of 0.5% or greater. However, recognizing that other provinces utilize more stringent criteria, in order to establish national consistency, AAFC considers homogeneous materials to be asbestos-containing if the asbestos concentration is 0.1% or greater.

A total of twelve (12) building material samples were collected from four (4) homogenous building materials and submitted for laboratory analysis of asbestos content. The table below summarizes the results of bulk material samples collected from suspect materials which had either no detectable concentrations of asbestos, or had asbestos concentrations less than the AAFC required threshold limit of 0.1% (by weight), and therefore can be considered as “non-asbestos”.


Table 1 – Summary of Bulk Samples Identified as “Non-Asbestos”

MATERIAL DESCRIPTION / LOCATION	SAMPLE ID ¹
White caulking between the interior concrete and wood panelling	B18-AS124-A,B,C
Interior door and window caulking	B18-AS125-A,B,C
Fireproofing over spray foam	B18-AS126-A,B,C
Cream exterior door caulking	B18-AS127-A,B,C

¹ For sample ID and concentration levels refer to attached Laboratory Certificates of Analysis.

As the survey was non-destructive in nature, suspect materials may be present on the roof, such as caulking, mastics, tar, etc., and should be presumed to contain asbestos if observed. Prior to disturbance of suspect ACM, samples should be collected and analyzed to confirm the presence or absence of asbestos.

SITE PHOTOGRAPHS

PHOTO NO. 1	
DATE: January 31, 2018	
DESCRIPTION: View of Building 18 – Multi Purpose Facility (facing southwest).	
SAMPLE NUMBER(S): -	

LABORATORY CERTIFICATES OF ANALYSIS



EMSL Canada Inc.

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EMSL Canada Order 551801454
Customer ID: 55MMM25
Customer PO: 181-00742-00
Project ID:

Attn: Stephen Heikkila
WSP Canada Group Limited
100 Commerce Valley Drive West
Thornhill, ON L3T 0A1

Phone: (905) 882-4211
Fax: (905) 882-1857
Collected: 1/31/2018
Received: 2/05/2018
Analyzed: 2/12/2018

Proj: 181-00742-00 London

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B18-AS124-A **Lab Sample ID:** 551801454-0001

Sample Description: White Caulking around Concrete Slab

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan/White	0%	100%	None Detected	

Client Sample ID: B18-AS124-B **Lab Sample ID:** 551801454-0002

Sample Description: White Caulking around Concrete Slab

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan/White	0%	100%	None Detected	

Client Sample ID: B18-AS124-C **Lab Sample ID:** 551801454-0003

Sample Description: White Caulking around Concrete Slab

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	None Detected	

Client Sample ID: B18-AS125-A **Lab Sample ID:** 551801454-0004

Sample Description: Interior Door/Window Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	None Detected	

Client Sample ID: B18-AS125-B **Lab Sample ID:** 551801454-0005

Sample Description: Interior Door/Window Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	None Detected	

Client Sample ID: B18-AS125-C **Lab Sample ID:** 551801454-0006

Sample Description: Interior Door/Window Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	None Detected	

Client Sample ID: B18-AS126-A **Lab Sample ID:** 551801454-0007

Sample Description: Fireproofing Over Spray Foam

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	18%	82%	None Detected	Vermiculite is a problem matrix. Other analytical options are recommended such as EPA 600 PLM/TEM with milling prep or TEM Qualitative



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EMSL Canada Order 551801454
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B18-AS126-B **Lab Sample ID:** 551801454-0008

Sample Description: Fireproofing Over Spray Foam

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	14%	86%	None Detected	Vermiculite is a problem matrix. Other analytical options are recommended such as EPA 600 PLM/TEM with milling prep or TEM Qualitative

Client Sample ID: B18-AS126-C **Lab Sample ID:** 551801454-0009

Sample Description: Fireproofing Over Spray Foam

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	28%	72%	None Detected	Vermiculite is a problem matrix. Other analytical options are recommended such as EPA 600 PLM/TEM with milling prep or TEM Qualitative

Client Sample ID: B18-AS127-A **Lab Sample ID:** 551801454-0010

Sample Description: Ceam Ext Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan/White	0%	100%	None Detected	

Client Sample ID: B18-AS127-B **Lab Sample ID:** 551801454-0011

Sample Description: Ceam Ext Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan/White/Black	0%	100%	None Detected	

Client Sample ID: B18-AS127-C **Lab Sample ID:** 551801454-0012

Sample Description: Ceam Ext Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan/White	0%	100%	None Detected	



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EMSL Canada Order 551801454
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Analyst(s):

Rebecca Newman PLM (8)
Ryan Shannon PLM (4)

Reviewed and approved by:

Matthew Davis or other approved signatory
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 Analytical, Inc. Ann Arbor, MI NVLAP Lab Code 101048-4

Initial report from: 02/12/2018 15:31:28

DRAWINGS



- NOTES:
- 1. Not to scale. Drawing is based on WSP's field observations.
 - 2. This drawing must be read in conjunction with associated report.
 - 3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
 - 4. Other suspect asbestos-containing materials may be present within concealed building spaces.

<div>LEGEND</div> <div><div><div></div><div>ASBESTOS BULK SAMPLE LOCATION</div></div><div><div></div><div>CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION</div></div></div>	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA	<div>LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS</div> <div>BUILDING 18</div> <div>MULTI-PURPOSE FACILITY</div>	Figure No: <div>G-1</div>
	PSPC No: R.095602.001			Site Location: 1391 SANDFORD STREET, LONDON, ONTARIO
	Date: MARCH 2018			
	Drawn By: NN			
	App'd By: SWH			

APPENDIX

H

BUILDING 19 – POLE BARN



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SITE PHOTOGRAPHS

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1 OBSERVATIONS AND RESULTS

Building 19, the Pole Barn, is located next to Building 16 (Garage) at the Subject Property. The rectangular-shaped structure was reportedly constructed in 2013 and is approximately 267 m² (2,874 ft²) in area. It is a single-storey building used to store farm equipment.

The building has metal-clad exterior walls and roofing. The interior finishes consist of wood beams and concrete flooring.

1.1 ASBESTOS-CONTAINING MATERIALS

The *Canada Occupational Health & Safety Regulations (SOR/86-304)* and *Ontario Regulation 278/05 (O. Reg. 278/05)* both establish definitions of asbestos-containing material (ACM), however, *O. Reg. 278/05* is more stringent. In accordance with the requirements of *O. Reg. 278/05*, homogenous materials (i.e. materials uniform in color and texture) must be considered to be asbestos-containing, if any sample which is collected from that homogeneous material, is identified to have an asbestos concentration of 0.5% or greater. However, recognizing that other provinces utilize more stringent criteria, in order to establish national consistency, AAFC considers homogeneous materials to be asbestos-containing if the asbestos concentration is 0.1% or greater.

During the survey, suspected asbestos-containing materials were not observed. As such, bulk material samples were not collected for analysis of asbestos content.

SITE PHOTOGRAPHS

PHOTO NO. 1	
DATE: January 31, 2018	
DESCRIPTION: View of Building 19 – Pole Barn (facing southwest).	
SAMPLE NUMBER(S): -	

DRAWINGS



- NOTES:
- 1. Not to scale. Drawing is based on WSP's field observations.
 - 2. This drawing must be read in conjunction with associated report.
 - 3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
 - 4. Other suspect asbestos-containing materials may be present within concealed building spaces.

<div>LEGEND</div> <div><div>▲</div> ASBESTOS BULK SAMPLE LOCATION</div> <div><div>▲</div> CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION</div>	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA	<div>LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS</div> <div>BUILDING 19 POLE BARN</div>	Figure No: <div>H-1</div>
	PSPC No: R.095602.001			<div>Site Location:</div> <div>1391 SANDFORD STREET, LONDON, ONTARIO</div>
	Date: MARCH 2018			
	Drawn By: NN			
	App'd By: SWH			

APPENDIX



BUILDING 10 - GARAGE



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ATTACHMENTS

SITE PHOTOGRAPHS

LABORATORY CERTIFICATES OF ANALYSIS

DRAWINGS

1 OBSERVATIONS AND RESULTS

Building 10, the Garage, is located between Building 11 (Field Laboratory House) and Building 18 (Multi-Purpose Facility) at the Subject Property. The square-shaped structure was reportedly constructed in 1986 and is approximately 54 m² (576 ft²) in area. It is a single-storey building used to store lawn maintenance equipment.

The building has wood-panelled exterior walls and a metal-clad roof. The interior finishes consist of wood beams and concrete flooring.

1.1 ASBESTOS-CONTAINING MATERIALS

The *Canada Occupational Health & Safety Regulations (SOR/86-304)* and *Ontario Regulation 278/05 (O. Reg. 278/05)* both establish definitions of asbestos-containing material (ACM), however, *O. Reg. 278/05* is more stringent. In accordance with the requirements of *O. Reg. 278/05*, homogenous materials (i.e. materials uniform in color and texture) must be considered to be asbestos-containing, if any sample which is collected from that homogeneous material, is identified to have an asbestos concentration of 0.5% or greater. However, recognizing that other provinces utilize more stringent criteria, in order to establish national consistency, AAFC considers homogeneous materials to be asbestos-containing if the asbestos concentration is 0.1% or greater.

A total of nine (9) building material samples were collected from three (3) homogenous building materials and submitted for laboratory analysis of asbestos content. The table below summarizes the results of bulk material samples collected from suspect materials which had either no detectable concentrations of asbestos, or had asbestos concentrations less than the AAFC required threshold limit of 0.1% (by weight), and therefore can be considered as “non-asbestos”.

Table 1 – Summary of Bulk Samples Identified as “Non-Asbestos”

MATERIAL DESCRIPTION / LOCATION	SAMPLE ID ¹
Exterior window glazing	B10-AS121-A,B,C
Exterior grey putty/caulking around conduits	B10-AS122-A,B,C
Interior window glazing	B10-AS123-A,B,C

¹ For sample ID and concentration levels refer to attached Laboratory Certificates of Analysis.

As the survey was non-destructive in nature, suspect materials may be present on the roof, such as caulking, mastics, tar, etc., and should be presumed to contain asbestos if observed. Prior to disturbance of suspect ACM, samples should be collected and analyzed to confirm the presence or absence of asbestos.

SITE PHOTOGRAPHS

PHOTO NO. 1	
DATE: January 31, 2018	
DESCRIPTION: View of Building 10 - Garage (facing southwest).	
SAMPLE NUMBER(S): -	

LABORATORY CERTIFICATES OF ANALYSIS



EMSL Canada Inc.

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EMSL Canada Order 551801453
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Attn: Stephen Heikkila
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100 Commerce Valley Drive West
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Phone: (905) 882-4211
Fax: (905) 882-1857
Collected: 1/31/2018
Received: 2/05/2018
Analyzed: 2/12/2018

Proj: 181-00742-00 London/B10

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B10-AS121-A **Lab Sample ID:** 551801453-0001

Sample Description: Exterior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	2%	98%	None Detected	

Client Sample ID: B10-AS121-B **Lab Sample ID:** 551801453-0002

Sample Description: Exterior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	4%	96%	None Detected	

Client Sample ID: B10-AS121-C **Lab Sample ID:** 551801453-0003

Sample Description: Exterior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	2%	98%	None Detected	

Client Sample ID: B10-AS122-A **Lab Sample ID:** 551801453-0004

Sample Description: Grey Puddy Around Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	4%	96%	None Detected	

Client Sample ID: B10-AS122-B **Lab Sample ID:** 551801453-0005

Sample Description: Grey Puddy Around Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	4%	96%	None Detected	

Client Sample ID: B10-AS122-C **Lab Sample ID:** 551801453-0006

Sample Description: Grey Puddy Around Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	8%	92%	None Detected	

Client Sample ID: B10-AS123-A **Lab Sample ID:** 551801453-0007

Sample Description: Interior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	2%	98%	None Detected	



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EMSL Canada Order 551801453
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B10-AS123-B

Lab Sample ID: 551801453-0008

Sample Description: Interior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	4%	96%	None Detected	

Client Sample ID: B10-AS123-C

Lab Sample ID: 551801453-0009

Sample Description: Interior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	<1%	100%	None Detected	

Analyst(s):

Colin Slattery PLM (9)

Reviewed and approved by:

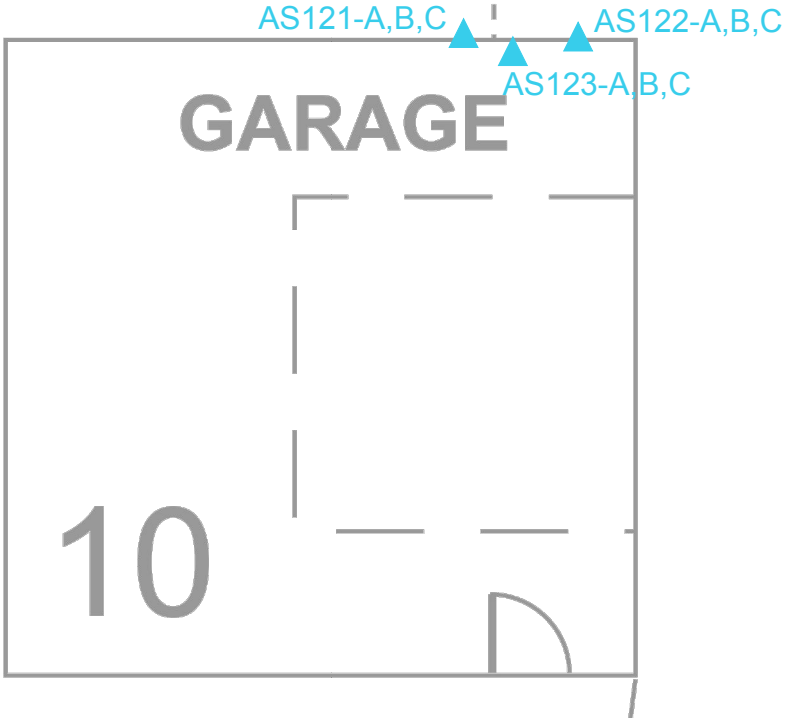
Matthew Davis or other approved signatory
or Other Approved Signatory

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 Analytical, Inc. Piscataway, NJ NYS ELAP 11423, NVLAP Lab Code 101048-2, NJ NELAC 12037

Initial report from: 02/12/2018 13:32:42

DRAWINGS



- NOTES:
- 1. Not to scale. Drawing is based on WSP's field observations.
 - 2. This drawing must be read in conjunction with associated report.
 - 3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
 - 4. Other suspect asbestos-containing materials may be present within concealed building spaces.

<div>LEGEND</div> <div><div><div></div><div>ASBESTOS BULK SAMPLE LOCATION</div></div><div><div></div><div>CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION</div></div></div>	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA	LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 10 GARAGE	Figure No: I-1
	PSPC No: R.095602.001			
	Date: MARCH 2018	Site Location:		wsp
	Drawn By: NN	1391 SANDFORD STREET, LONDON, ONTARIO		
	App'd By: SWH			



APPENDIX

J

BUILDING 16 - GARAGE



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ATTACHMENTS

SITE PHOTOGRAPHS

LABORATORY CERTIFICATES OF ANALYSIS

DRAWINGS

1 OBSERVATIONS AND RESULTS

Building 16, the Garage, is located between Building 15 (Mass Production) and Building 19 (Pole Barn) at the Subject Property. The rectangular-shaped structure was reportedly constructed in 1988 and is approximately 400 m² (4,305 ft²) in area. The roof was replaced in 2008. It is a single-storey building that is used as a garage and for storage.

The building has a brick exterior with a shingled roof. The interior finishes consist of concrete block, drywall, and concrete floors.

1.1 ASBESTOS-CONTAINING MATERIALS

The *Canada Occupational Health & Safety Regulations (SOR/86-304)* and *Ontario Regulation 278/05 (O. Reg. 278/05)* both establish definitions of asbestos-containing material (ACM), however, *O. Reg. 278/05* is more stringent. In accordance with the requirements of *O. Reg. 278/05*, homogenous materials (i.e. materials uniform in color and texture) must be considered to be asbestos-containing, if any sample which is collected from that homogeneous material, is identified to have an asbestos concentration of 0.5% or greater. However, recognizing that other provinces utilize more stringent criteria, in order to establish national consistency, AAFC considers homogeneous materials to be asbestos-containing if the asbestos concentration is 0.1% or greater.

A total of forty-six (46) building material samples were collected from fourteen (14) homogenous building materials and submitted for laboratory analysis of asbestos content. The table below summarizes only those materials which were subsequently identified, confirmed or presumed to be asbestos-containing materials and are presented along with recommended remedial actions for each respective material.

Recommended actions for management, repair or removal of these materials, are based on the requirements and procedures specified by *O. Reg. 278/05* and PSPC's *Asbestos Management Standard*, and have been suggested based on the type of disturbance which is anticipated or likely. Alternate handling, repair and removal procedures must comply with the requirements of *O. Reg. 278/05* and PSPC's *Asbestos Management Standard*.

Table 1 – Asbestos-Containing Materials

MATERIAL DESCRIPTION & LOCATION	ASSESSMENT ¹	ACTION ²	PHOTO ³
Interior Door Window Glazing Approximately 2 linear meters (7 linear feet) observed around an interior door window (from Room 1301 into 1304 and 1303)	Sample ID/Concentration: B16-AS110-A [4% Chrysotile] Material: Non-Friable Accessibility: A <i>(Areas of the building within reach of all building users.)</i> Condition: Good	Action 7 Routine surveillance of ACM in good condition. Prior to demolition activities which may disturb this material, remove the material following: Type 1 abatement procedures – if the material is wetted and the work is performed using non-powered hand tools.	2
Exterior Window Glazing Approximately 4 linear meters (13 linear feet) was observed around the exterior window.	Sample ID/Concentration: B16-AS112-A [5% Chrysotile] Material: Non-Friable Accessibility: A <i>(Areas of the building within reach of all building users.)</i> Condition: Good	Action 7 Routine surveillance of ACM in good condition. Prior to demolition activities which may disturb this material, remove the material following: Type 1 abatement procedures – if the material is wetted and the work is performed using non-powered hand tools.	3

¹ For sample ID and concentration levels refer to attached Laboratory Certificates of Analysis.

² Actions and procedures recommended are based on the requirements of the PSPC *Asbestos Management Standard* and *O. Reg. 278/05*.

³ For relevant photographs taken during the survey refer to attached Site Photographs.

As the survey was non-destructive in nature, suspect materials may be present within concealed building materials or present on the roof, such as caulking, mastics, tar, etc., and should be presumed to contain asbestos if observed. Prior to disturbance of suspect ACM, samples should be collected and analyzed to confirm the presence or absence of asbestos.

If renovation or demolition activities are likely to disturb the materials, it is required that all identified asbestos-containing materials be removed in accordance with *O. Reg. 278/05* and PSPC's *Asbestos Management Standard*. If any potential asbestos-containing materials are encountered unexpectedly, a qualified environmental consultant should be contacted to sample, monitor and/or document the removal of asbestos-containing materials, and to ensure that appropriate procedures are being followed.

1.2 SUMMARY OF BULK SAMPLES IDENTIFIED AS “NON-ASBESTOS”




The table below summarizes the results of bulk material samples collected from suspect materials during the current survey, which had either no detectable concentrations of asbestos, or had asbestos concentrations less than the AAFC required threshold limit of 0.1% (by weight), and therefore can be considered as “non-asbestos”.

Table 2 – Summary of Bulk Samples Identified as “Non-Asbestos”

MATERIAL DESCRIPTION / LOCATION	SAMPLE ID ¹
Black caulking around interior window and door	B16-101-A,B,C
Concrete block mortar	B16-102-A,B,C,D,E
White caulking around interior doors	B16-103-A,B,C
Drywall joint compound / Rooms 1302 and 1301	B16-104-A,B,C
Pink firestop around interior electrical conduits	B16-105-A,B,C
Interior cream expansion joint caulking	B16-106-A,B,C
Parging cement on generator pipe and duct	B16-107-A,B,C
Exterior brick mortar	B16-108-A,B,C,D,E
Exterior brown door and window caulking	B16-109-A,B,C
Exterior stucco/texture coat	B16-111-A,B,C
Putty around exterior electrical conduits	B16-113-A,B,C
Exterior maroon door and expansion joint caulking	B16-114-A,B,C

1 For sample ID and concentration levels refer to attached Laboratory Certificates of Analysis.

SITE PHOTOGRAPHS

PHOTO NO. 1	
DATE: January 31, 2018	
DESCRIPTION: View of Building 16 - Garage (facing northwest).	
SAMPLE NUMBER(S): -	
PHOTO NO. 2	
DATE: January 31, 2018	
DESCRIPTION: View of asbestos-containing interior window door glazing.	
SAMPLE NUMBER(S): B16-AS110-A,B,C	
PHOTO NO. 3	
DATE: January 31, 2018	
DESCRIPTION: View of asbestos-containing exterior window glazing.	
SAMPLE NUMBER(S): B16-AS112-A,B,C	

LABORATORY CERTIFICATES OF ANALYSIS



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EMSL Canada Order 551801418
 Customer ID: 55MMMG25
 Customer PO: 181-00742-00
 Project ID:

Attn: Stephen Heikkila
 WSP Canada Group Limited
 100 Commerce Valley Drive West
 Thornhill, ON L3T 0A1

Phone: (905) 882-4211
Fax: (905) 882-1857
Collected: 1/31/2018
Received: 2/05/2018
Analyzed: 2/12/2018

Proj: 181-00742-00 London/B16

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B16-AS101-A-Caulk			Lab Sample ID: 551801418-0001			
Sample Description: Black Window /Door Caulking						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	
Client Sample ID: B16-AS101-A-Finish Coat			Lab Sample ID: 551801418-0001A			
Sample Description: Black Window /Door Caulking						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	
Client Sample ID: B16-AS101-A-Base Coat			Lab Sample ID: 551801418-0001B			
Sample Description: Black Window /Door Caulking						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	
Client Sample ID: B16-AS101-B-Caulk			Lab Sample ID: 551801418-0002			
Sample Description: Black Window /Door Caulking						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	
Client Sample ID: B16-AS101-B-Finish Coat			Lab Sample ID: 551801418-0002A			
Sample Description: Black Window /Door Caulking						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	
Client Sample ID: B16-AS101-B-Base Coat			Lab Sample ID: 551801418-0002B			
Sample Description: Black Window /Door Caulking						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown	0%	100%	None Detected	
Client Sample ID: B16-AS101-B-Adhesive			Lab Sample ID: 551801418-0002C			
Sample Description: Black Window /Door Caulking						
TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	0%	100%	None Detected	



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Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B16-AS101-C-Caulk **Lab Sample ID:** 551801418-0003
Sample Description: Black Window /Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	

Client Sample ID: B16-AS101-C-Brick **Lab Sample ID:** 551801418-0003A
Sample Description: Black Window /Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	

Client Sample ID: B16-AS101-C-Adhesive **Lab Sample ID:** 551801418-0003B
Sample Description: Black Window /Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Yellow	0%	100%	None Detected	

Client Sample ID: B16-AS102-A **Lab Sample ID:** 551801418-0004
Sample Description: Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	<1%	100%	None Detected	Inseparable paint / coating layer included in analysis

Client Sample ID: B16-AS102-B **Lab Sample ID:** 551801418-0005
Sample Description: Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	<1%	100%	None Detected	Inseparable paint / coating layer included in analysis

Client Sample ID: B16-AS102-C **Lab Sample ID:** 551801418-0006
Sample Description: Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	<1%	100%	None Detected	Inseparable paint / coating layer included in analysis

Client Sample ID: B16-AS102-D **Lab Sample ID:** 551801418-0007
Sample Description: Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	0%	100%	None Detected	Inseparable paint / coating layer included in analysis

Client Sample ID: B16-AS102-E **Lab Sample ID:** 551801418-0008
Sample Description: Concrete Block Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/White	<1%	100%	None Detected	Inseparable paint / coating layer included in analysis



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EMSL Canada Order 551801418
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B16-AS103-A **Lab Sample ID:** 551801418-0009
Sample Description: White Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B16-AS103-B **Lab Sample ID:** 551801418-0010
Sample Description: White Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B16-AS103-C **Lab Sample ID:** 551801418-0011
Sample Description: White Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B16-AS104-A **Lab Sample ID:** 551801418-0012
Sample Description: Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B16-AS104-B **Lab Sample ID:** 551801418-0013
Sample Description: Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B16-AS104-C **Lab Sample ID:** 551801418-0014
Sample Description: Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	<1%	100%	None Detected	

Client Sample ID: B16-AS105-A **Lab Sample ID:** 551801418-0015
Sample Description: Pink Fire Stop

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red/Black	0%	100%	None Detected	

Client Sample ID: B16-AS105-B **Lab Sample ID:** 551801418-0016
Sample Description: Pink Fire Stop

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red/Black	0%	100%	None Detected	



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EMSL Canada Order 551801418
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B16-AS105-C **Lab Sample ID:** 551801418-0017
Sample Description: Pink Fire Stop

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	

Client Sample ID: B16-AS106-A **Lab Sample ID:** 551801418-0018
Sample Description: Cream Expansion Joint Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B16-AS106-B **Lab Sample ID:** 551801418-0019
Sample Description: Cream Expansion Joint Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B16-AS106-C **Lab Sample ID:** 551801418-0020
Sample Description: Cream Expansion Joint Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B16-AS107-A **Lab Sample ID:** 551801418-0021
Sample Description: Parging on Generator Pipe & Duct

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	19%	81%	None Detected	

Client Sample ID: B16-AS107-B **Lab Sample ID:** 551801418-0022
Sample Description: Parging on Generator Pipe & Duct

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	19%	81%	None Detected	

Client Sample ID: B16-AS107-C **Lab Sample ID:** 551801418-0023
Sample Description: Parging on Generator Pipe & Duct

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	18%	82%	None Detected	

Client Sample ID: B16-AS108-A **Lab Sample ID:** 551801418-0024
Sample Description: Exterior Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown/Red	<1%	100%	None Detected	



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EMSL Canada Order 551801418
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B16-AS108-B **Lab Sample ID:** 551801418-0025
Sample Description: Exterior Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown/Red	0%	100%	None Detected	

Client Sample ID: B16-AS108-C **Lab Sample ID:** 551801418-0026
Sample Description: Exterior Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown/Red	0%	100%	None Detected	

Client Sample ID: B16-AS108-D **Lab Sample ID:** 551801418-0027
Sample Description: Exterior Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	

Client Sample ID: B16-AS108-E **Lab Sample ID:** 551801418-0028
Sample Description: Exterior Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Red	0%	100%	None Detected	

Client Sample ID: B16-AS109-A **Lab Sample ID:** 551801418-0029
Sample Description: Brown Door/Window/Vent Exterior Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown/Black	0%	100%	None Detected	

Client Sample ID: B16-AS109-B **Lab Sample ID:** 551801418-0030
Sample Description: Brown Door/Window/Vent Exterior Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	

Client Sample ID: B16-AS109-C **Lab Sample ID:** 551801418-0031
Sample Description: Brown Door/Window/Vent Exterior Caulking

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Black	0%	100%	None Detected	

Client Sample ID: B16-AS110-A **Lab Sample ID:** 551801418-0032
Sample Description: Interior Door Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/Black	0%	96%	4% Chrysotile	



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EMSL Canada Order 551801418
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B16-AS110-B **Lab Sample ID:** 551801418-0033
Sample Description: Interior Door Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018					Positive Stop (Not Analyzed)

Client Sample ID: B16-AS110-C **Lab Sample ID:** 551801418-0034
Sample Description: Interior Door Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018					Positive Stop (Not Analyzed)

Client Sample ID: B16-AS111-A **Lab Sample ID:** 551801418-0035
Sample Description: Exterior Stucco

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	<1%	100%	None Detected	

Client Sample ID: B16-AS111-b **Lab Sample ID:** 551801418-0036
Sample Description: Exterior Stucco

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B16-AS111-C **Lab Sample ID:** 551801418-0037
Sample Description: Exterior Stucco

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B16-AS112-A **Lab Sample ID:** 551801418-0038
Sample Description: Exterior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray/Black	0%	95%	5% Chrysotile	

Client Sample ID: B16-AS112-B **Lab Sample ID:** 551801418-0039
Sample Description: Exterior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018					Positive Stop (Not Analyzed)

Client Sample ID: B16-AS112-C **Lab Sample ID:** 551801418-0040
Sample Description: Exterior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018					Positive Stop (Not Analyzed)



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Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: B16-AS113-A **Lab Sample ID:** 551801418-0041

Sample Description: Puddy aournd Electrical Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B16-AS113-B **Lab Sample ID:** 551801418-0042

Sample Description: Puddy aournd Electrical Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B16-AS113-C **Lab Sample ID:** 551801418-0043

Sample Description: Puddy aournd Electrical Conduits

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Gray	0%	100%	None Detected	

Client Sample ID: B16-AS114-A **Lab Sample ID:** 551801418-0044

Sample Description: Marroon Door Caulking & Expansion Joint

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown/Red	0%	100%	None Detected	

Client Sample ID: B16-AS114-B **Lab Sample ID:** 551801418-0045

Sample Description: Marroon Door Caulking & Expansion Joint

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Brown/Red	0%	100%	None Detected	

Client Sample ID: B16-AS114-C **Lab Sample ID:** 551801418-0046

Sample Description: Marroon Door Caulking & Expansion Joint

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	2/12/2018	Tan	0%	100%	None Detected	



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Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Analyst(s):

Eric Budai PLM (16)
Rebecca Newman PLM (33)

Reviewed and approved by:

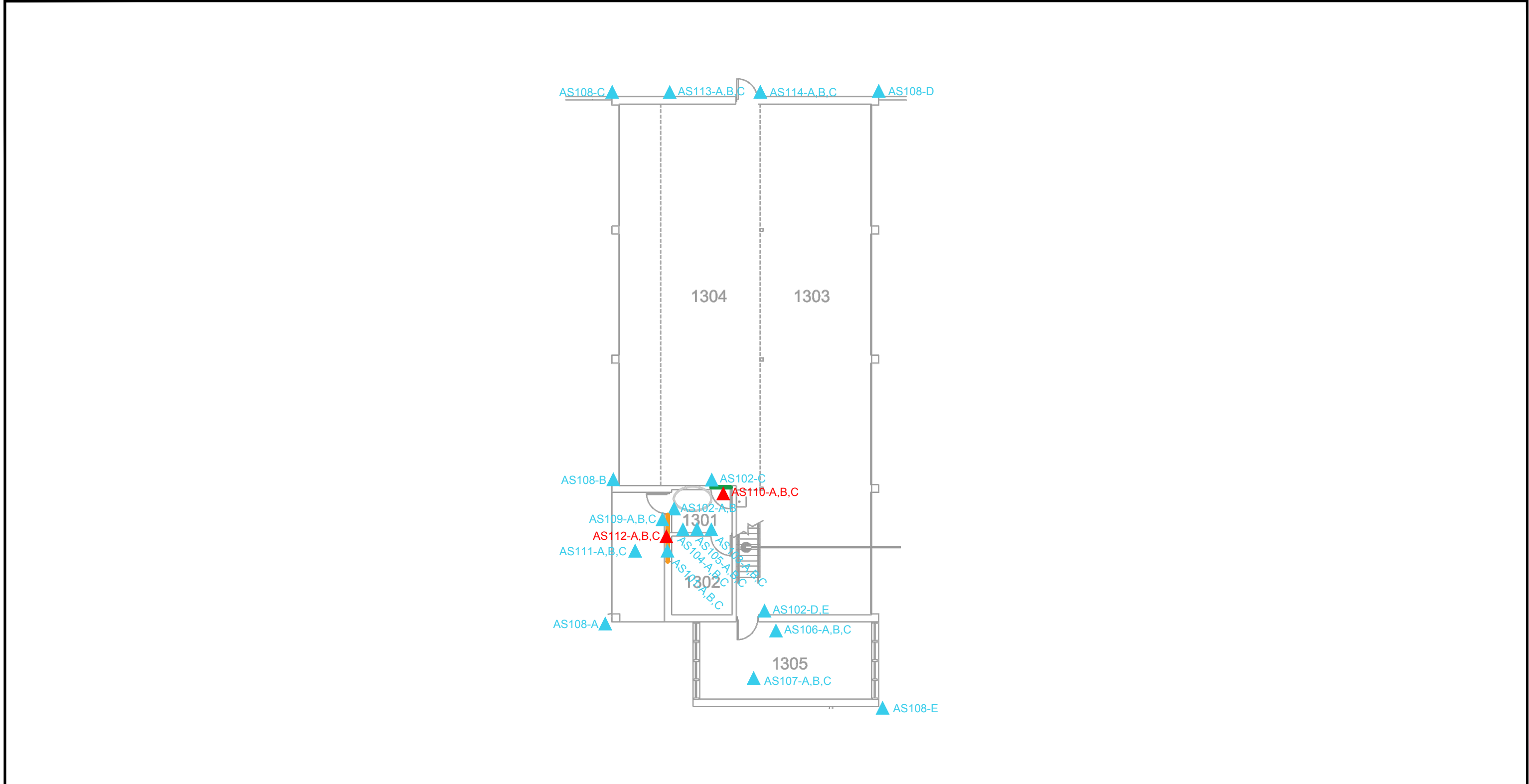
Matthew Davis or other approved signatory
or Other Approved Signatory

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 Analytical, Inc. Ann Arbor, MI NVLAP Lab Code 101048-4

Initial report from: 02/12/2018 15:30:09

DRAWINGS



MAIN FLOOR

- NOTES:
- 1. Not to scale. Drawing is based on WSP's field observations.
 - 2. This drawing must be read in conjunction with associated report.
 - 3. This survey was intrusive, but non-destructive, in nature. Exterior materials, such as roofing, are presumed to be asbestos-containing unless sampling and analysis prove otherwise.
 - 4. Other suspect asbestos-containing materials may be present within concealed building spaces.
 - 5. The following materials were confirmed to be ACM: Exterior window glazing, interior door window glazing.

<div>LEGEND</div> <div><div><div></div><div>ASBESTOS BULK SAMPLE LOCATION</div></div><div><div></div><div>CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION</div></div><div><div></div><div>EXTERIOR WINDOW GLAZING</div></div><div><div></div><div>INTERIOR DOOR WINDOW GLAZING</div></div></div>	WSP Project No: 181-00742-00	Client: PUBLIC SERVICES AND PROCUREMENT CANADA on behalf of AGRICULTURE AND AGRI-FOOD CANADA	<div>LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 16 GARAGE</div>	Figure No: <div>J-1</div>
	PSPC No: R.095602.001			Site Location: 1391 SANDFORD STREET, LONDON, ONTARIO
	Date: MARCH 2018			
	Drawn By: NN			
	App'd By: SWH			

APPENDIX

K

PSPC ASBESTOS MANAGEMENT STANDARD (2017)



Title: Asbestos Management Standard

1. Effective date: June 5, 2017

2. Authority

This standard is issued under the authority of the Assistant Deputy Minister (ADM), Real Property Branch (RPB), Public Services and Procurement Canada (PSPC).

3. Context

This standard enhances and supplements Part II of the *Canada Labour Code* - Occupational Health and Safety, as well as the *Canada Occupational Health and Safety Regulations* (COHSR) Part X - Hazardous Substances, subsection 10.19 Control of Hazards, and should be read in that context.

This standard should also be read in conjunction with the National Joint Council *Occupational Health and Safety Directive*, Part XI - Hazardous Substances, and the PSPC *Standard on Hazardous Substances*, which is part of the departmental occupational health and safety policy suite.

4. Scope

This standard applies to buildings and engineering assets, both Crown-owned and leased (including lease-purchase, and sale leaseback), where PSPC is the custodian, in which either:

- asbestos-containing material has been found to be present; or
- no professional certification attesting that the building does not include any known asbestos-containing material can be obtained.

This includes buildings and engineering assets that are managed internally, as well as those managed on behalf of PSPC by real property contractors.

5. Purpose

This standard sets out Real Property Branch's requirements regarding the operational and technical activities required to be carried out for the management of asbestos-containing material.

6. Details on Asbestos Management, Maintenance and Repair Work Processes

Each building that contains asbestos-containing material shall have in place an Asbestos Management Plan that must be kept onsite, and be available to building systems technicians, building operator maintainers, and service providers through the Asset Manager, or Property and Facility Manager, as well as departmental employees through the Employer representatives. Annual reassessment of asbestos-containing material, work records, and sampling results must be part of the Asbestos Management Plan.

An Asbestos Management Plan is required for all buildings unless a professional certification confirming that the building does not include any known asbestos-containing materials is obtained. The certification must be kept onsite and be available to all building occupants upon request.

The asbestos management requirements for leased buildings are subject to the existing lease clauses, in addition to the requirements named in this standard.

Processes regarding the contents and preparation of the Asbestos Management Plan are provided in Section 6.1, Asbestos Management Plan.

Maintenance and renovation work performed in a building known to contain asbestos-containing material shall be conducted as per the processes outlined in Section 6.2, Maintenance, renovations and construction processes involving asbestos-containing materials.

6.1. Asbestos Management Plan

6.1.1. Background information

An Asbestos Management Plan is required to ensure that asbestos-containing material is managed and controlled in PSPC custodial buildings and engineering assets, both Crown-owned and leased (including lease-purchase, and sale leaseback), to reduce the risk of damaging asbestos-containing material, and potential occupant exposure to airborne asbestos fibers. The Asbestos Management Plan is to be reviewed and updated to reflect changes in policy and regulations at least every 5 years, or more frequently if required. Whenever reviewed or updated, the Asbestos Management Plan must be provided to the Employer representatives and retained in accordance with section 6.2.11. A record must be kept reflecting when and to whom the report was presented.

The Asbestos Management Plan performs the following functions:

- At the building level, it is a central repository of all information related to the management of asbestos for each facility.
- It acts as a control mechanism to ensure compliance.
- It communicates roles and responsibilities of those required to work with or around asbestos-containing materials.
- It describes work classification for disturbances of asbestos-containing materials.

- It communicates the departmental processes for working with asbestos-containing materials.
- It acts as common terms of reference for the safe operation and management of a building or engineering asset with asbestos-containing materials.

The Asbestos Management Plan includes the following elements at a minimum:

- a list of applicable regulatory requirements
- a brief summary of locations and types of material that contain asbestos present in the building
- a survey and inventory of asbestos-containing materials, and assessment of material condition
- annual asbestos-containing material reassessment
- notification of location, quantity, and condition of asbestos-containing materials and the potential for disturbance
- training and awareness requirements
- notification of Employer representatives when work will be performed that disturbs asbestos
- repair and maintenance procedures
 - classification
 - sample collection and analysis
 - processes
 - project inspection
 - air monitoring
- emergency work procedure(s)
- laboratory results for all materials tested (to be included whether samples are positive or negative for asbestos content)

6.1.2. Crown-owned Buildings and Engineering Assets' asbestos-containing material inspection, assessment, and inventory

6.1.2.1. Inspection

In order to determine the presence of asbestos-containing material in buildings and engineering assets, and to ensure the maintenance of a complete inventory of asbestos-containing materials, an initial baseline survey must be completed by a qualified person on all buildings and engineering assets which have the potential to contain asbestos. An annual reassessment must be performed by a qualified person on all asbestos-containing materials identified in the baseline asbestos survey, and on those materials which may have subsequently been identified during maintenance, renovations, or other construction activities at the site.

The baseline survey must include:

- identification, location, condition, accessibility, and quantity of suspected and confirmed friable and non-friable asbestos-containing material; and

- an action matrix (as described in Annex A, Section 1.4.3.), which establishes recommended asbestos control action(s).

Any material suspected of containing asbestos must have its status confirmed through laboratory analysis; until confirmed, it is assumed to be asbestos-containing material.

6.1.2.2. Laboratory material analysis

The collection of material samples shall be carried out as randomly-collected bulk samples, and be representative of the homogeneous surfaces, areas, and types of material present. Samples are to be collected following the procedures outlined in Section 6.2.6.

The analysis of bulk samples shall be performed by a laboratory accredited by either the National Voluntary Laboratory Accreditation Program (NVLAP), American Industrial Hygiene association (AIHA), or the Canadian Association for Laboratory Accreditation (CALA), or using a method noted in provincial regulations where the sample was taken, to the detection limits specified in Annex A, Section 1.2. Frequency of sample collection must meet federal/provincial/territorial regulations, but can be more frequent at the discretion of the surveyor.

Analysis of bulk samples are to be performed, where possible, using the United States Environmental Protection Agency method EPA/600/R-93/116 for Polarized Light Microscopy (PLM). In some instances, analysis must be performed using Transmission Electron Microscopy (TEM) (an example of this would be analysis of vinyl floor tile).

6.1.3. Assessment of asbestos-containing materials

Asbestos-containing materials that are identified as a result of the survey and laboratory analysis shall be assessed for their condition and accessibility. Annex A - *Evaluation of Asbestos-Containing Materials and Recommendations for Control*, provides specific criteria for the assessment of asbestos-containing materials based on condition and accessibility, as well as mandatory Asbestos Management Program response(s) relative to health risk. It also provides an action matrix, which is used to determine the recommended action to control asbestos-containing materials based on the particular circumstances. Detailed information regarding the requirements to properly undertake each action is also provided.

6.1.4. Inventory of asbestos-containing materials

An inventory of asbestos-containing materials must be maintained, and the inventory shall contain information for the specific building or engineering asset. The inventory record shall remain in the building or engineering asset. The inventory shall contain a list of all known asbestos-containing materials and their locations. If access to an area is not permitted due to security or other reasons, it will be noted in the inventory.

In general, inventories are in table format and include the following:

- type of building material that contains asbestos (example: floor tile)
- asbestos location
- asbestos type and percent content (example: amosite 3%)

- asbestos friability (friable or non-friable)
- quantity of building material
- asbestos condition
- accessibility of the asbestos

Floor plans indicating the location(s) of asbestos-containing materials may be included.

It must be ensured that a copy of the current inventory is maintained onsite at a location that is accessible, and provided to the Employer representatives, and facility maintenance staff.

6.1.5. Annual asbestos-containing material reassessment

On a yearly basis, the building or engineering asset's asbestos-containing material inventory information is to be updated through a reassessment based primarily on change in condition and quantity (refer to Annex B), and outdated versions of the inventory records must be archived and retained in accordance with section 6.2.11. The Asbestos Management Plan shall be updated with new inventory information as changes are made at the various locations, or where new information identifies the existence of asbestos-containing material not previously identified.

The reassessment must be signed by, and conducted under the direction of, a person qualified in asbestos management. The results of this assessment are to be added to the building Asbestos Management Plan as described in section 6.1.1.

In a timely fashion, the annual re-assessment, along with a summary of the report in plain language, must be provided to the Employer representatives and Regional Asbestos Coordinator. A record must be kept reflecting when and to whom the report was presented.

6.1.6. Leased Space

If a building is known to contain asbestos-containing materials, then before leased space is occupied, an Asbestos Management Plan must be obtained from the Lessor that identifies all friable and non-friable asbestos-containing materials located within the building and on the property. Otherwise, a professional certification confirming that the building does not include any known asbestos-containing materials is required.

The Asset Manager, or Property and Facility Manager will keep an electronic copy of the Asbestos Management Plan available to be distributed upon request.

For detail on lease clauses, refer to *PWGSC's Invitation to Offer document*, owned by the Real Estate Services Service Line.

6.2. Maintenance, renovations and construction processes involving asbestos-containing materials

6.2.1. Classification of asbestos-related work

The following criteria shall be used in determining the classification of asbestos work.

6.2.1.1. Low risk work

Low risk work includes:

- non-destructive (i.e. without breaking, cutting, drilling, abrading) removal of non-friable asbestos-containing material;
- destructive work (i.e. breaking, cutting, drilling, abrading) on wetted non-friable asbestos-containing material with non-powered hand-held tools;
- removal of one square meter or less of drywall in which joint compounds contain asbestos-containing materials;
- removal or replacement of 7.5 square metres or less of asbestos-containing compressed-mineral-fibre-type ceiling tiles; and
- collecting samples of materials suspected of containing friable asbestos.

6.2.1.2. Intermediate risk work

Intermediate risk work includes:

- entry into ceiling spaces, crawlspaces, pipe tunnels, etc., where friable asbestos debris is or may be present;
- removing more than 7.5 square meters of asbestos-containing suspended ceiling tiles;
- removal of more than one square metre of drywall where asbestos-containing joint compound materials has been used;
- destructive work (i.e. breaking, cutting, drilling, abrading) on non-wetted, non-friable asbestos-containing material with non-powered hand held tools;
- destructive work (i.e. breaking, cutting, drilling, abrading) on non-friable asbestos-containing material if the work is done by means of power tools that are attached to dust collecting devices equipped with a high efficiency particulate air (HEPA) filters;
- minor removal or disturbance of friable asbestos-containing material. Minor is defined as follows:
 - in British Columbia: up to 0.1 m² surface area, or 3 linear metres of pipe insulation
 - in Quebec: up to 0.03 m³ of debris
 - all others: up to 1 m² of surface area
- enclosing friable asbestos-containing material;
- applying tape or cover to asbestos-containing insulation;
- glove bag removal of asbestos-containing material from a pipe, duct or similar structure;
- removing filters in an air handling unit in a building that has sprayed-on asbestos-containing fireproofing; and
- work not otherwise classified as either low or high risk.

6.2.1.3. High risk work

High risk work includes:

- major removal or disturbance of friable asbestos-containing material (greater than quantities defined under intermediate work);

- destructive work (i.e. breaking, cutting, drilling, abrading) of non-friable asbestos-containing material using power tools not attached to dust-collecting devices equipped with HEPA filters;
- encapsulating friable asbestos-containing material by spray application of an encapsulant or sealant;
- cleaning or removal of ductwork and air handling equipment serving or passing through areas of buildings with sprayed, friable asbestos-containing material; and
- repair, alteration or demolition of a boiler, furnace, kiln, or similar equipment made of asbestos-containing refractory materials.

6.2.2. Asbestos work processes

Written processes for performing low, intermediate, and high risk work are to be developed for the work to be undertaken, based on the friability of the asbestos-containing material, processes to be used, and the worksite. These processes shall be developed in accordance with the *Canadian National Master Construction Specification (NMS)*, Sections 02 82 00.01 (Asbestos Abatement - Minimum Precautions), 02 82 00.02 (Asbestos Abatement - Intermediate Precautions), or 02 82 00.03 (Asbestos Abatement - Maximum Precautions).

6.2.3. Notification

Written notification must be given to the Asset Manager, or Property and Facility Manager of the potential disturbance of asbestos-containing materials during repair, maintenance and construction projects.

6.2.4. Control prior to maintenance work

All maintenance work shall be reviewed for the possibility of disturbance of asbestos-containing material when work is required.

Before undertaking any work that may disturb asbestos-containing materials, a report shall be prepared stating the type(s) of asbestos and the condition of the asbestos-containing material, and the location of the asbestos-containing material.

When there are friable or non-friable asbestos-containing materials in the work area and this material will be disturbed by the work, then the work shall be considered asbestos-related work, and the risk level classified by a qualified person in accordance with the work to be performed.

Prior to the start of work, the Asset Manager, or Property and Facility Manager will inform the Employer representatives.

Arrangements shall be made for specifications to be prepared for asbestos work by a qualified person, following the appropriate specifications according to *Canadian National Master Construction Specification (NMS)* format mentioned in Section 6.2.2. Alterations to specifications, in order to accommodate specific federal and provincial requirements, shall be determined based on work requirements.

When there are asbestos-containing materials in the maintenance area, and it has been determined that these materials could be disturbed by the work, the maintenance staff or the service provider must be notified.

Before asbestos abatement work is started, the following documentation must be provided by the service provider as proof of competency as per provincial/territorial regulations:

- third-party liability insurance
- fit test certificate
- service provider's site-specific safety plan
- Notice of Project
- copy of Workplace Safety and Insurance Board / Ministry of Labour clearance
- copy of trade certificates / competency cards
- other certificates where required (fall protection, confined space, man lift, etc.)

Also prior to the commencement of asbestos abatement work, the following precautions must be ensured:

- management has received proof of adequate training for employees performing asbestos work and approved personal protective equipment is provided;
- containers for asbestos waste shall be labeled as asbestos waste and are held at a pre-determined, secure location in the building; and
- the collection and disposal of asbestos-containing material waste is performed in accordance with the applicable provincial regulations.

In the event of a suspected release of asbestos-containing material outside of the contained work area, the processes detailed in the building Asbestos Management Plan concerning emergency work procedures must be complied with.

6.2.5. Control prior to renovation and construction work

Prior to commencement of projects that include the demolition of material suspected of containing asbestos which has not yet been tested (such as material not accessible in the original survey), testing of this material for asbestos shall be undertaken, unless previous comprehensive testing in the building has shown this material to be free of asbestos. Along with the asbestos surveys of the building, records of test results shall be maintained on site as per Section 6.2.11.

When there are friable or non-friable asbestos-containing materials in the work area and this material will be disturbed by the work, then the work shall be determined as asbestos-related work and the risk level classified by a qualified person in accordance with the work to be performed.

In a timely fashion, a summary report, written in plain language, concerning the asbestos work must be provided to the Employer representatives. A record must be kept reflecting when and to whom the report was provided.

Arrangements shall be made for specifications to be prepared for asbestos work by a qualified person, following the appropriate *Canadian National Master Construction Specification (NMS)* format mentioned in Section 6.2.2. Alterations to specifications, in order to accommodate specific federal and provincial requirements, shall be determined based on work requirements.

Services related to the design and preparation of specifications shall be performed by a qualified person with the appropriate training, experience, and insurance for asbestos-related work.

When there are asbestos-containing materials in the renovation area, and it has been determined that these materials could be disturbed by the work, the maintenance staff and/or the service provider must be notified of the presence of asbestos-containing material.

Prior to the start of asbestos abatement work, documentation and work precautions must be ensured as per section 6.2.4.

In the event of a suspected release of asbestos-containing material outside of the contained work area, the processes detailed in the building Asbestos Management Plan concerning emergency work procedures must be followed.

Upon completion of any project work which alters the amount or condition of asbestos-containing material in the building or engineering asset, a report will be prepared that indicates the work that has been completed. The inventory shall be updated, and this information is to be retained in accordance with Section 6.2.11.

6.2.6. Bulk sample procedures

During the annual reassessment or investigation prior to renovation projects, material may be discovered that could contain asbestos. The only way to confirm the presence of asbestos is by means of laboratory testing. In order to establish whether there are any asbestos-containing materials, and to identify the type and concentration of asbestos, bulk material samples must be collected by a qualified person from a homogeneous surface, area or insulation. The information gathered is essential in ensuring proper identification of asbestos materials by microscope analysis. Bulk material sampling is conducted as follows:

1. The material must be sampled when the area is not in use where feasible. Only those persons needed for sampling should be present in the immediate area.
2. The use of a National Institute for Occupational Safety and Health (NIOSH) approved respirator is recommended for all sampling. Depending on the condition and location of the material, airborne fibres can be generated during sampling.
3. Under the work area, polyethylene drop sheet must be placed over flooring that absorbs dust (such as carpeting) and over flooring in the asbestos work area where dust and contamination cannot otherwise be safely contained. Drop sheets are not to be reused.

4. The material is to be sprayed with a light mist of water to prevent asbestos fibre release during sampling, if possible. The material must not be disturbed any more than necessary.
5. Materials of different appearance should be sampled separately. Mechanical insulation must be sampled separately on all systems, tanks, vessels, etc. Both the straight sections of pre-formed insulation, and the insulating cement typically present at elbows, fittings, etc. (unless visually identified as fibreglass) must be sampled. Frequency of sampling must meet federal/provincial/territorial regulations.
6. For asbestos insulation, the sample is collected by penetrating the entire depth of the material, as the insulation may have been applied in more than one layer or covered with paint or other protective coating.
7. If pieces of material break off during sampling, the contaminated area must be cleaned up by wet cleaning. Any debris generated must be placed in plastic bags, labelled, sealed and disposed of as asbestos waste in accordance with requirements of the provincial/territorial and/or federal authority having jurisdiction.
8. Samples must be placed in labeled plastic bags with a zip-lock closure or in sealed plastic vials. Samples shall be identified with the following information:
 - sample number
 - location (e.g. building name, room number)
 - date of sampling
 - name of sampler
 - source of sample, e.g. cold water pipe, cold water fitting, etc.
9. Any openings created to collect the sample must be sealed (e.g. self-adhesive tape, paint or metal-foil tape to be wrapped completely around the pipe, duct or structure).
10. Bulk sample analysis shall be done by an accredited laboratory (refer to Section 6.1.2.2, Laboratory material analysis).
11. The minimum number of bulk material samples to be collected for each type of test material is 3. When sampling homogeneous materials such as plaster, or materials applied by troweling, 5 samples are required when the area is greater than 90 square meters, 7 samples are required when the area exceeds 450 square meters.

6.2.7. Respirator fitting, inspection and maintenance

For matters pertaining to respiratory protection, refer to the departmental *Procedure on Respiratory Protection* which is under the *Standard on Personal Protective Equipment and Clothing for Employees*.

6.2.8. Asbestos work inspection and air quality monitoring

6.2.8.1. Low risk work

Work classified as low risk shall be subject to the standard maintenance or project inspection requirements, ensuring all asbestos-containing material has been removed and the area cleaned of dust and debris. Air monitoring is not required during or after work.

6.2.8.2. Intermediate risk work

Work classified as intermediate risk shall be inspected by a qualified person during the work. Air monitoring for total fibre concentration outside of work areas will be conducted adjacent to the work area daily by a qualified person. Upon completion of work, with acceptable results attained by the inspection and air monitoring, asbestos precautions in the area are no longer required.

The air samples will be analyzed by phase contrast microscopy as determined by NIOSH Method 7400, or an equivalent under provincial regulations. Analysis of samples shall be performed by organizations participating in a recognized external quality control program. A stop-work order will be issued when phase contrast microscopy measurements of the air samples exceed 0.05 fibres/cm³. This order is in effect until work processes are corrected and subsequent tests are less than 0.05 fibres/cm³.

6.2.8.3. High risk work

Arrangements shall be made for a qualified person to inspect and perform daily air monitoring for total fibre concentration outside of work areas classified as high risk. If required, additional monitoring shall be performed to meet provincial/territorial regulations.

The air samples are to be analyzed by phase contrast microscopy as determined by NIOSH, Method 7400, or an equivalent under provincial regulations. Analysis of samples shall be performed by organizations participating in a recognized external quality control program. A stop-work order will be issued when phase contrast microscopy measurements of the air samples exceed 0.05 fibres/cm³. This order is in effect until work processes are corrected and subsequent tests are less than 0.05 fibres/cm³.

All high risk removal projects shall be subject to final clearance air testing. The clearance criterion shall be a concentration of less than 0.01 fibres per cubic centimetre (fibres/cm³) of air, as determined by NIOSH, Method 7400, or an equivalent under provincial regulations. If any sample does not pass the phase contrast microscopy test, samples shall be further analyzed via transmission electron microscopy following NIOSH Method 7402.

6.2.9. Hazardous occurrence investigation and reporting

When a building occupant is, or may have accidentally been, exposed to airborne asbestos as a result of disturbance of asbestos-containing material, or by inadvertent contact during regular maintenance, renovation or construction work, a qualified person shall be appointed to conduct a hazard investigation as defined by the *Canada Occupational Health and Safety Regulations*.

The assessment shall determine the potential hazard, and must conclude as to whether the hazardous material could be present as an airborne hazard, at a level of at least 50% of the exposure limit as determined by the threshold limit values identified by the American Conference of Governmental Industrial Hygienists (ACGIH). The Asset Manager or Property and Facility Manager, building Employer representatives, and the Workplace Health and Safety Committee must be invited to participate in the assessment. At the conclusion of the assessment, all participants will receive a copy of the Hazardous Occurrence Investigation report.

When airborne asbestos-containing materials are likely present at level of at least 50% of the exposure limit, a control plan shall be instituted. The control plan must address the following:

- a record of where asbestos-containing material was found
- written procedures for control
- a communication plan with building Employer representatives
- medical surveillance, when applicable
- training of employees

6.2.10. Emergency work procedures

A building's Asbestos Management Plan outlines emergency work procedures.

6.2.11. Records

Records shall be kept in accordance with the following:

Document	Length of retention – electronic copy	Information on site
Annual record of inspection	30 years (including beyond the life of the building / disposal of the building / building no longer managed by PSPC)	Most recent copy
Asbestos Management Plan	30 years (including beyond the life of the building / disposal of the building / building no longer managed by PSPC)	Most recent copy
Asbestos Containing Materials inventory	30 years (including beyond the life of the building / disposal of the building / building no longer managed by PSPC)	Most recent copy
Test results (air and bulk sampling)	30 years (including beyond the life of the building / disposal of the building / building no longer managed by PSPC)	Most recent copy
Medical test records	30 years from date of test - Refer to human resources document storage requirements	Refer to human resources requirements

In addition, for records noted above to be kept on site, these shall be retained on site as long as a building is occupied or managed by PSPC. For electronic copies (other than medical

records), these records shall be saved and retained in GCDOCS as per the above retention schedule, and managed subject to any instructions for a hazardous substances information management system.

All other documents related to asbestos management and abatements shall be maintained and disposed of as per PSPC's departmental policy *Records Management and Information Holdings (044)*, and the associated Departmental Records Retention and Disposal Plan.

7. Definitions

Asbestos: naturally occurring fibrous silicates, including chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.

Asbestos containing material (ACM): any material found to contain asbestos that is at or above the limit defined by provincial standards, as determined by the standard Polarized Light Microscopy (PLM) or Transmission Electron Microscopy (TEM) methods for the analysis of bulk samples.

Asbestos-related work: work that will disturb friable or non-friable asbestos-containing material in the area.

Asbestos work area: area where work is being performed which will or may disturb asbestos-containing material, including overspray and fallen material or settled dust that may contain asbestos.

Assets and facilities for which PSPC is the custodian: any federal real property or federal immovable acquired or leased by the Department for the purposes of the Department under the administration of the Minister of Public Services and Procurement.

Construction: any work or undertaking in connection with a project, including, but not restricted to, erection, alteration, repair, dismantling, demolition, structural maintenance, painting, land clearing, earth moving, grading, excavating, trenching, digging, boring, drilling, blasting or concreting; the installation of any machinery or plant; and ship repair/maintenance when in dry dock.

Custodian: a department whose minister has administration of real property for the purposes of department or agency programs, or for the accommodation of other federal departments and agencies.

Department: Public Service and Procurement Canada (PSPC)

Employee: a person employed in the part of the public service to which the Public Service Commission has exclusive authority to make appointments; this includes students and part-time employees and casual workers.

Employer: a person who employs one or more employees, and includes an employer's organization and any person who acts on behalf of an employer.

Employer representative: a person who acts on behalf of the employer department, as designated by the department. This means that each department located in a building has a representative who communicates with his or her department's Workplace Health and Safety Committee, in compliance with the *Canada Labour Code*, Part II.

Encapsulation: application of a liquid sealant to asbestos-containing material; the sealant may penetrate and harden the material, or cover the surface with a protective coating (bridging sealants). Also called encasement.

Enclosure: a structure made of polyethylene or other suitable material to prevent the spread of asbestos containing material from the work area.


Friable asbestos product: asbestos-containing material that, when dry, can be crumbled, pulverized or powdered by hand pressure. This definition also includes dust or debris arising from non-friable materials that are, or will become, crumbled, pulverized or powdered, i.e. asbestos-containing plaster disturbed by demolition.

Glove bag removal: a method of removing friable insulation from a piping system using a prefabricated bag which isolates the section of insulation being removed.

Hazard: any source of potential damage, harm or adverse effects on life, health, property or environment at work. It refers to any biological, chemical, ergonomic, physical, psychosocial or safety factor that is reasonably likely to cause harm or damage to humans, other organisms, or the environment in the absence of its control. Sometimes a hazard is referred to as being the actual harm or the health effect it caused rather than the hazard. For example the disease tuberculosis might be called a hazard by some but in general the tuberculosis-causing bacteria would be considered the "hazard" or "hazardous biological agent". Exposure to tuberculosis would be the hazardous incident.

Hazardous occurrence: an event occurring at a PSPC-managed building or worksite, or through the course of an employee's work, that results in, or has the potential to result in, a fatality, injury, illness, exposure to a hazardous substance or property damage, or an escapement of a hazardous material. For the purpose of investigating, recording and reporting hazardous occurrences, the following are included under this term: disabling injuries, minor injuries and near-misses.

Hazardous substance: a controlled product that is a chemical, biological or physical agent that, by reason of a property that the agent possesses, is hazardous to the safety or health of a person exposed to it.



Investigation: act or process of a qualified person investigating a hazardous occurrence; a careful search or examination in order to discover facts, identify the root cause and contributing factors to produce a report of corrective measures.

Manager: an employee who forms part of a management team and is accountable for exercising delegated authority over human and financial resources to accomplish the objectives of the organization.

Personal protective equipment: any clothing, equipment, or device worn or used by a person to protect that person from injury or illness, and to minimize exposure to specific occupational hazards.

Professional certification: a document which has been validated by the signature of a person formally certified by a professional body.

Qualified person: a person who:

- has the required knowledge, training and experience to organize the work and its performance;
- is familiar with all legislation and regulations that apply to the work; and
- has knowledge of any potential or actual danger to health or safety in the workplace.

Examples of a qualified person include a Professional Engineer, Industrial Hygienist, or someone who has another professional designation for the purposes of this standard that are related to asbestos management.

Risk: for the purposes of this document, the potential for harm befalling an individual, given the probability of an incident occurring, combined with the potential severity of the harm.

Real property contractor: a person, entity, or entities named in contracts to supply services to Canada as defined in procurement mechanisms such as RP-1 property management and project delivery services; RP-2 National Capital Area property management, project delivery services and optional services; and subsequent real property procurement mechanisms RP-n.

Service provider: a person or entity who performs work for and/or supplies services to the owner for monetary compensation, either by undertaking the work alone, by employing one or more workers, or by contracting the services of one or more workers.

Supervisor: a person who has the responsibility for day to day supervision of other employees, e.g. assigns work, sets priorities, assesses performance, and approves or recommends approval of leave.

Workplace: any place where an employee is engaged in work for the department.

Workplace Health and Safety Committee: as defined in the *Canada Labour Code*, Part II, Occupational Health and Safety, Sections 134.1, 135, and 136.

Vermiculite: silicate mineral with a layered (mica-like) morphology which may range in colour from silvery-blond to dark grey-brown. For the purposes of this document, vermiculite with any concentration of asbestos measured in a composite sample taken in accordance with provincial/territorial sampling and analysis standards is considered an asbestos-containing material.

8. References

Federal acts and regulations:

[Canada Labour Code, Part II](#)
[Canada Occupational Health and Safety Regulations](#)
[Canadian Environmental Protection Act](#)
[Hazardous Materials Information Review Act](#)
[Hazardous Products Act](#)

National Joint Council publications:

[Occupational Health and Safety Directive](#)
[Occupational Health Evaluation Standard](#)

PSPC publications:

[Directive on occupational health and safety - Hazard prevention program \(007-1\)](#)
[Policy on occupational health and safety \(007\)](#)
[Procedure on Respiratory Protection](#)
[Records management and information holdings](#)
[Standard on Hazardous Occurrence Investigation and Reporting](#)
[Standard on Personal Protective Equipment and Clothing for Employees](#)
PWGSC's Invitation to Offer document


Other publications:

Provincial and territorial occupational health and safety legislation
Provincial and territorial environmental protection legislation
American Conference of Governmental Industrial Hygienists (ACGIH), TLVs and BEIs Book
(as amended from time to time)
[Canadian National Master Construction Specification \(NMS\)](#) - Asbestos Abatement
Precautions

Attachments

Annex A – Evaluation of Asbestos-Containing Materials and Recommendations for Control
Annex B – Asbestos-containing Material Reassessment

9. Enquiries



Please direct all enquiries regarding this standard to:
Senior Director, Environment, Health & Safety
Technical Services
Real Property Branch, PSPC

Evaluation of Asbestos-Containing Materials and Recommendations for Control

1. Assessment of condition

1.1. Spray-applied fireproofing, insulation and texture finishes

In evaluating the condition of asbestos-containing material spray applied as fireproofing, thermal insulation, or 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 of the surface area having 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, insulation or texture finishes where no delamination or damage is observed, and encapsulated fireproofing, insulation or texture finishes where the encapsulation has been applied after the damage or fallout occurred.

POOR Sprayed materials show signs of damage, delamination or deterioration. More than one percent damage to surface of asbestos-containing 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 survey or reassessment form.

NOTE: FAIR condition is not used or considered as a valid criterion in the evaluation of sprayed fireproofing, sprayed insulation, or texture coat finishes.

The evaluation of asbestos-containing material spray applied as fireproofing, non-mechanical thermal insulation, or texture, decorative, or acoustic finishes which 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. Persons entering the ceiling area are advised to be watchful for asbestos-containing material debris prior to accessing or working above ceilings in areas of buildings with asbestos-containing material, regardless of the reported condition.

1.2. Detection limit of bulk analysis

Asbestos-containing material is defined as any material found to contain asbestos at or above the limit defined by provincial/territorial standards for an asbestos-containing material, as determined by the allowable analytical method for the analysis of bulk samples (refer to *Asbestos Management Standard*, Section 6.1.2.2). Except in the case of vermiculite, the provincially/territorially-regulated limits or generally-accepted guidelines to consider a

material as an asbestos-containing material, subject to asbestos in buildings regulation, are provided as follows:

MINIMUM CONCENTRATION TO CONSIDER AS AN ASBESTOS-CONTAINING MATERIAL (BY PROVINCE)

QUEBEC (includes part of National Capital Area)	0.1%
MANITOBA, SASKATCHEWAN (for friable material)	0.1%
ONTARIO (includes part of National Capital Area) BRITISH COLUMBIA	0.5%
NOVA SCOTIA	0.5%
All other provinces and territories, (non-friable material in Manitoba, Saskatchewan)	1.0%

Note that these concentrations may change with regulatory amendments, therefore applicable legislation should be consulted to confirm that they are still valid.

Vermiculite is considered an asbestos-containing material in the presence of any concentration of asbestos measured in a composite sample taken in accordance with provincial/territorial sampling standards.

1.3. Mechanical insulation

In evaluating the condition of 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, i.e. 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 should range from 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 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.

1.4. Non-friable and potentially-friable materials

Non-friable materials generally have little potential to release airborne fibres, even when damaged by mechanical breakage, but can become friable if disturbed by drilling or abrading.

However, some non-friable materials, e.g. 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.

1.4.1. Asbestos-containing material debris

1.4.1.1. Debris from friable asbestos-containing material

The presence of fallen friable asbestos-containing material is noted separately from the presumed friable asbestos-containing material source (sprayed fireproofing, thermal insulation, texture, decorative or acoustic finishes or mechanical insulation) and is referred to as **debris**.

The presence of fallen asbestos-containing material from damaged non-friable asbestos-containing material is reported separately from the non-friable asbestos-containing material source. Fallen non-friable asbestos-containing material that has become friable is reported as debris. Workers are advised to be watchful for the presence of debris prior to accessing, or working in proximity to, mechanical insulation or above ceiling areas of buildings with asbestos-containing material, regardless of the reported presence or absence of debris.

1.4.2. Evaluation of accessibility

The accessibility of building materials known or suspected of being asbestos-containing material is rated according to the following criteria:

- ACCESS (A) Areas of the building within reach (from floor level) of all building users. Includes areas such as gymnasiums, workshops, and storage areas where activities of the building users (e.g. basketball on gym ceiling) may result in disturbance of asbestos-containing material not normally within reach from floor level.
- ACCESS (B) Frequently entered maintenance areas within reach of maintenance staff, without the need for a ladder. Includes: frequently entered pipe chases, tunnels and service areas or areas within reach from a fixed ladder or catwalk, e.g. tops of equipment, mezzanines.
- ACCESS (C)
EXPOSED Areas of the building above 8'0" where use of a ladder is required to reach the asbestos-containing material. Only refers to asbestos-containing material materials that are exposed to view, from the floor or ladder, without removing or opening other building components such as ceiling tiles, or service access doors or hatches. Does not include infrequently-accessed service areas of the building.

ACCESS (C)

CONCEALED Areas of the building which require the removal of a building component, including lay-in ceilings and access panels into solid ceiling systems such as a ventilation plenum. Includes rarely-entered crawl spaces, attic spaces, etc. Observations are limited to the extent visible from the access points.

ACCESS (D) Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the ceiling, wall or equipment, etc., is required to reach the asbestos-containing material. Evaluation of condition and extent of asbestos-containing material is limited or impossible, depending on the assessor's ability to visually examine the materials in areas rated Access (D).

1.4.3. Action matrix and action descriptions

The action matrix below (Table 1) prioritizes the corrective actions in terms of potential health risk based on condition, accessibility, and potential for future disturbance.

The following factors shall be considered in making site-specific recommendations for corrective actions in conformance with the existing applicable regulation or codes of practice in most provinces, and for the practical implementation of asbestos management:

1. Asbestos-containing material in POOR condition is not routinely repairable. If an abatement action is necessary, removal is the recommended action (enclosure is a viable option in unusual circumstances, e.g. where removal is difficult or costly and the asbestos-containing material can be thoroughly enclosed).
2. Mechanical insulation in FAIR condition will be repaired or removed based on the following general recommendations, applied on a case-by-case basis:
 - Asbestos-containing mechanical insulation found in FAIR condition in ACCESS (B) or ACCESS (C) EXPOSED areas is to be repaired.
 - Asbestos-containing mechanical insulation found in FAIR condition in ACCESS (B) and ACCESS (C) EXPOSED areas, where future damage to the asbestos-containing material is likely to occur, is to be removed.
3. Asbestos-containing material in GOOD condition present in ACCESS (A) can be managed by surveillance, as long as it is not disturbed by future renovation, maintenance or demolition. Proactive removal of the asbestos-containing material in ACCESS (A) will be considered where damage is possible by ongoing occupant activity (accidental or intentional).
4. Non-friable or manufactured products are considered in the action matrix as follows:
 - Non-friable and manufactured products reported in POOR condition, or friable DEBRIS resulting from the deterioration of non-friable asbestos-containing material, are treated as friable materials and the appropriate action, depending on

accessibility, is determined from the action matrix for friable asbestos-containing material.

- For non-friable or manufactured products reported in GOOD condition, Action 7 (surveillance) is recommended regardless of accessibility.

5. All asbestos-containing material from a particular area is to be removed where small quantities of asbestos are present and removal will negate the need for the use of an Asbestos Management Program in that area.

The action matrix provided below establishes the recommended asbestos control action. The ACTIONS themselves are described in full following the table.

Table 1: Action matrix for determining actions required based on the location and condition of asbestos-containing materials.

ASBESTOS-CONTAINING MATERIAL				
ACCESS	CONDITION			DEBRIS
	GOOD	FAIR	POOR	
(A)	ACTION 5/7 ¹	ACTION 5/6 ²	ACTION 3	ACTION 1
(B)	ACTION 7	ACTION 6/5 ³	ACTION 3	ACTION 1
(C) exposed	ACTION 7	ACTION 6	ACTION 4	ACTION 2
(C) concealed	ACTION 7	ACTION 7	ACTION 4	ACTION 2
(D)	ACTION 7	ACTION 7	ACTION 7	ACTION 7

¹ If material in **ACCESS (A)/GOOD** condition is not removed, **ACTION 7** is required.

² If material in **ACCESS (A)/FAIR** condition is not removed, **ACTION 6** is required.

³ Remove asbestos-containing material in **ACCESS (B)/FAIR** condition if asbestos-containing material is likely to be disturbed.

ACTION 1 Immediate clean-up of debris that is likely to be disturbed.

Access that is likely to cause a disturbance of the ASBESTOS-CONTAINING MATERIAL DEBRIS is to be restricted and clean up ASBESTOS-CONTAINING MATERIAL DEBRIS is to be done immediately. Use correct asbestos procedures. This action is required for compliance with regulatory requirements and good practice. The assessor should immediately notify the Asset or Property and Facility Manager, or Regional/Area Asbestos Management Coordinator of this condition.

ACTION 2 Entry into areas with asbestos-containing material debris requires intermediate risk precautions.

At locations where ASBESTOS-CONTAINING MATERIAL DEBRIS can be isolated in lieu of removal or cleaned up, appropriate means to limit entry to the area is to be used. Access to the area is restricted to persons using intermediate risk asbestos-work precautions. The precautions will be required until the ASBESTOS-CONTAINING MATERIAL DEBRIS has been cleaned up, and the source of the DEBRIS has been stabilized or removed following intermediate risk (if minor) or high risk precautions.

ACTION 3 Asbestos-containing material removal required for compliance.

Asbestos-containing material must be removed for compliance with regulatory requirements and good practice. Use asbestos procedures appropriate to the scope of the removal work.

ACTION 4 Access into areas where asbestos-containing material is present and likely to be disturbed by access requires intermediate risk precautions.

Intermediate risk asbestos precautions are to be used when entry or access into an area is likely to disturb the asbestos-containing material. ACTION 4 must be used until the asbestos-containing material is removed (Use ACTION 1 or 2 if DEBRIS is present). Intermediate risk or high risk precautions should be used for removal (depending on extent of removal).

ACTION 5 Proactive asbestos-containing material removal.

Removal of asbestos-containing material in lieu of repair may be considered, even if it is in GOOD condition at locations, where asbestos-containing material is easily accessible, limited in quantity, and removal would be cost-effective.



ACTION 6 Asbestos-containing material repair.

Asbestos-containing material may be repaired if found in FAIR condition and not likely to be damaged again or disturbed by normal use of the area or room. Upon completion of the repair work, asbestos-containing material is to be treated as being in GOOD condition and ACTION 7 is to be implemented. If asbestos-containing material is likely to be damaged or disturbed during normal use of the area or room, ACTION 5 is to be implemented.

ACTION 7 Routine Surveillance.

Routine surveillance of the asbestos-containing material is to be instituted. Trained workers or service providers must use appropriate asbestos precautions (low, intermediate or high) during disturbance of the remaining asbestos-containing material.

Asbestos-containing Material Reassessment

The following outlines the **minimum** requirements to include in all Asbestos Reassessment Reports.

Table of contents

The table of contents is to include a list of tables and a list of appendices. At minimum, appendices include:

- photographs of damaged asbestos (clearly labeled linking to findings tables); and
- the requirements set out in the *Asbestos Management Standard*.

Executive summary

The following must be noted when preparing the executive summary:

1. The executive summary is to be written in layman's terms. Every effort must be made to use plain language, and where technical information is used, context must be given for the average reader.
2. Reference is to be made to the previous year's assessment/reassessment, and the status of any areas previously identified as Action level 1.
3. When identifying asbestos materials, it is to be noted if the location is accessible to building occupants, maintenance staff, or service providers.
4. The term "not compliant" is only to be used when referring to a regulation - the exact title of the regulation is to be cited, as well as the specific section where there is a compliance issue. NOTE: guidelines, and departmental/Employer policies and processes are not regulatory items and "compliance" terminology cannot be used for these type of documents.

Introduction

The introduction is to include the following elements:

- The regulatory and "other" requirements are to be outlined:
 - applicable requirements under the *Canada Labour Code*
 - applicable provincial acts and regulations
 - RPB policy/directive/standard requirements
- Purpose
- Scope
- Limitations of the assessment conducted

Methodology

Information must be included as to how RPB documentation is used when assessing condition of materials, as well as accessibility.

Survey findings

This section must include a general description of the building. Findings are to be presented in a table format as follows:

- Table 1 – Summary of Findings (Action level 1 – This must include any newly-discovered materials covered in Table 3 which are considered Action level 1). A note must be included stating that items in this table should be actioned as soon as possible.
- Table 2 – Summary of Findings (for all materials other than Action level 1). A note must be included stating that items in this table are less urgent and can be addressed through long term action plans.
- Table 3 – Summary of Findings (newly-discovered materials – if applicable)

Each table in which the findings are presented must use the following headings (example provided):

Floor	Location	Material Description	Quantity	Condition	Accessibility	Action Level
8th	Rm 812	Pipe Fitting (paring cement)	5 fittings	Good	C (concealed)	7

Conclusions and recommendations

State any conclusions reached and recommendations for further action.

Abatement strategies

If applicable, provide abatement strategies, including the following:

- the complexity of the abatement (low, intermediate, or high risk); and
- a general description of the project, as well as the estimated scope/size of the abatement.

Updated Guidance for Contractors Working in AAFC Buildings

- For the purposes of this document, the term Contractor will mean contractor, sub-contractor, consultants and sub-consultants. Contractors are responsible to ensure that all their hired sub-contractors also adhere to the requirements of this document.
- Prior to accessing AAFC building interiors, Contractors will hold a orientation meeting (tele or video conference) with AAFC Facility Manager and Project Manager, and the following will be agreed to in writing with the intent of maintain physical distancing:
 - ☐ Access/egress and material delivery door(s) for worksite.
 - ☐ Daily shift or specific occupancy times, including estimated number of personnel.
 - ☐ Construction or work zone limits.
 - ☐ Use of site: washrooms, drinking water, parking location, garbage and recycling disposal.
 - ☐ Protocol that whenever physical distancing cannot be achieved at the worksite, facial covering will be worn by all personnel involved (AAFC and Contractor).
- Contractors are to submit signed confirmation that they understand and will follow requirements set out in attached **COVID-19 Check List for Contractors Working in AAFC Buildings**.

COVID-19 Check List for Contractors Working in AAFC Buildings

Prior to beginning contracted work in an AAFC building, Contractors are to submit signed confirmation that they and their hired subcontractors agree to the following:

- ☐ Contractor will follow **Canadian Construction Association's COVID-19 – Standardized Protocols for All Canadian Construction Sites**. (<https://www.cca-acc.com/covid-19-resources/>)
- ☐ All contractor personnel will complete Government of Canada's online **COVID-19 Symptom Self Assessment Tool** each day prior to work shift and will not come to AAFC site if Tool advises or recommends to self-isolate, stay at home or seek medical attention. (<https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19.html>)
- ☐ Advise AAFC Representative as soon as possible if any of Contractor's personnel who have worked in an AAFC building begin to exhibit flu-like symptoms.
- ☐ All contractor and hired sub-contract personnel will follow local, provincial and federal public health guidance and requirements including that of **Public Health Agency of Canada (PHAC) for Coronavirus disease (COVID-19): Prevention and risk**. (<https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/prevention-risks.html?topic=tilelink>)
- ☐ While on AAFC property, all Contractor and sub-contractors will comply to all posted signage in AAFC buildings, or advise AAFC Representative immediately if unable to comply.

These above mentioned requirements will be complied while conducting work in AAFC buildings for the duration of the contract.

Signature of Contractor Representative