Project Title

LONDON EXHAUST FUME HOOD MANIFOLDING PROJECT

Project Number

R.099747.001

Project Date

2019-06-10

DIVISION 00 – PROCUREMENT AND CONTRACTING SERVICES
00 01 10 - Table of Contents 2

DIVISION 1 – GENERAL REQUIREMENTS
01 11 00 - Summary of Work 2
01 14 00 - Work Restrictions 3
01 31 19 - Project Meetings 2
01 32 16 – Construction Progress Schedule Bar (Gantt) Chart 3
01 33 00 - Submittal Procedures 5
01 35 29 - Health and Safety Requirements 5
01 35 43 - Environmental Procedures 3
01 41 00 - Regulatory Requirements 2
01 45 00 - Quality Control 2
01 51 00 - Temporary Utilities 2
01 52 00 - Construction Facilities 2
01 56 00 - Temporary Barriers and Enclosures 2
01 61 00 - Common Product Requirements 5
01 73 00 - Execution 3
01 74 00 - Cleaning 3
01 74 20 – Construction/Demolition, Waste Management and Disposal 2
01 77 00 - Closeout Procedures 1
01 78 00 - Closeout Submittals 6
01 79 00 - Demonstration and Training 2
01 91 13 - General Commissioning (Cx) Requirements 11

DIVISION 2 – EXISTING CONDITIONS
02 41 16 01 – Structure Demolition 2
02 41 20 - De-commissioning And Removal of General Purpose (GP) Fume Hoods .3

DIVISION 5 – METALS
05 12 23 - Structural Steel for Buildings 4
05 50 00 - Metal Fabrications 4

DIVISION 6 – WOOD, PLASTICS AND COMPOSITES
06 08 99 - Rough Carpentry 3

DIVISION 7 – THERMAL AND MOISTURE PROTECTION
07 21 13 - Board Insulation 4
07 26 00 - Vapour Retarders 3
07 27 00 - Air Barriers 4
07 31 13 - Asphalt Shingles 3
07 52 00 – Modified Bituminous Membrane Roofing..... 5
07 62 00 - Sheet Metal Flashing and Trim 4
07 84 00 – Fire Stopping 5
07 92 00 - Joint Sealants 6

DIVISION 8 – OPENINGS
08 11 00 - Metal Doors and Frames 7
08 14 16 - Flush Wood Doors 4
08 71 00 – Door Hardware 4

DIVISION 9 – FINISHES
09 30 15 - Quarry and Paver Tiling 5
09 91 13 - Exterior Painting 12
09 91 23 - Interior Painting 12

DIVISION 23 – HEATING, VENTILATION AND AIR CONDITIONING (HVAC)
23 01 31 - Air Duct Cleaning for HVAC Systems 6
23 05 00 - Common Work Results for HVAC 4
23 05 05 - Selective Demolition for Heating, Ventilating, And Air Conditioning (HVAC) 4
23 05 17 – Pipe Welding 3
23 05 53 01 – Mechanical Identification 4
23 05 93 – Testing, Adjusting and Balancing for HVAC 6
23 05 93 13 – Testing, Adjusting and Balancing of Fume Hoods 4
23 05 94 – Pressure Testing of Ducted Air Systems 3
23 07 13 – Duct Insulation 4
23 05 93 – Testing, Adjusting and Balancing for HVAC 6
23 09 95 – Laboratory Airflow Control System 7
23 31 13 02 - Metal Ducts 4
23 34 23 13 - Packaged Roof and Wall Exhausters 11

DIVISION 25 – MECHANICAL
25 10 10 – Automatic Control System – Extend Existing EMCS 8

DIVISION 26 – ELECTRICAL
26 05 00 - Common Work Results for Electrical 8
26 05 05 - Selective Demolition for Electrical 4
26 05 20 - Wire and Box Connectors (0-1000 V) 2
26 05 21 - Wires and Cables (0-1000 V) 2
26 05 22 - Connectors and Terminations 1
26 05 28 - Grounding – Secondary 3
26 05 29 - Hangers and Supports for Electrical Systems 2
26 05 31 - Splitters, Junction, Pull Boxes and Cabinets 2
26 05 32 - Outlet Boxes, Conduit Boxes and Fittings 2
26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings 4
26 24 19 - Motor Control Centres 3
26 27 26 - Wiring Devices 3
26 28 13 01 - Fuses - Low Voltage 2
26 28 16 02 - Moulded Case Circuit Breakers 2
26 28 23 - Disconnect Switches - Fused and Non-fused 2
26 29 10 - Motor Starters To 600 V 3

Appendices
Appendix A – AAFC London Asbestos Survey Report 214
Appendix B- AAFC Fume Hood Exhaust Ductwork Sampling Final Report 103
Appendix C- Designated Substances Survey AAFC London Facility 28
Appendix D – AAFC Tritium and C14 Wipe Sampling 13

PART 1 - GENERAL

1.1 PRECEDENCE

.1 For Federal Government projects, Division 01 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises fume hoods exhaust renovation of The Agriculture & Agri-Food Canada London Research and Development Centre, located at 1391 Sandford St, London, ON; and further identified as London Exhaust Fume Hood Manifolding 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 independent fume hood exhaust fans and the associated mechanical duct, electrical power supply and control devices.
- .2 Demolition of existing fume hoods as indicated and the associated mechanical duct connections up to above ceiling, power supply and control devices. Patch and make good existing architectural finishes to match existing.
- .3 New architectural work as indicated on drawing.
- .4 Installation of new centralized fume hood exhaust fan systems complete with required air valves and control systems.
- .5 Reconnection of existing fume hoods exhaust to new manifold exhaust system.
- .6 Existing BAS control system upgrade and integration as required to accommodate new work as outlined in the tender document.
- .7 Existing fume hoods ASHRAE 110 testing for PSPC MD15128 compliance and certification.
- .8 Electrical system modifications as required to accommodate new mechanical installation.
- .9 New structural support platform and roof level modification as required for new installation.
- .10 General site requirement as outlined in elsewhere of the tender document.

1.3 CONTRACT METHOD

.1 Construct work under lump sum contract.

1.4 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.

1.5 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.

1.6 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.

1.7 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.

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 Departmental Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.

.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 fume hoods, 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 Fume hoods can only be offline one group at a time, subject to Departmental Representative direction. Hoods can be offline for a maximum of two weeks from demolition to operation, including commissioning. Commissioning will be done separately for each set of fume hoods exhaust switchover. The Contractor cannot advance to the next stage of work until all fans and hoods from previous stage are fully commissioned and operational. Provide minimum 4 weeks notice to Departmental Representative for changes in schedule that affect fume hood operation. Any fume hood disruption work is subject to Departmental Representative approval of schedule.

.4 Provide for personnel and vehicular traffic.

.5 Roof area contains exhaust stacks of operational fume hoods. Contractor is to be aware of hazards associated with working in area, and to provide temporary fume hood exhaust stack extensions to protect workers. Coordinate with Departmental Representative to determine which stacks need extensions at each stage of work.

1.5 SPECIAL REQUIREMENTS

.1 Carry out noise generating Work Monday to Friday from 18:00 to 07:00 hours and on Saturdays, Sundays, and statutory holidays.

.2 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.3 Keep within limits of work and avenues of ingress and egress.

.4 Deliver materials during working hours, but outside of peak traffic hours 17:00 to 07:00 and 13:00 to 15:00 unless otherwise approved by Departmental Representative. Contractor is responsible for unloading all materials.

.5 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.

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.

.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.

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.

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.

.5 Preside at meetings.

.6 Unless directed otherwise by Departmental Representative, 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.

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 Structural Steel.
.6 Siding and Roofing.
.7 Electrical.
.8 Controls.
.9 Heating, Ventilating, and Air Conditioning.
.10 Millwork.
.11 Testing and Commissioning.
.12 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.

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 Price. 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 Material 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 Price. 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.
.1 Upon completion of: 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.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Asbestos Survey Report - March 21, 2018

.2 Designated Substances Survey – December 2005

.3 Fume Hood Exhaust Ductwork Sampling – March 19, 2019

.4 Fume Hood Exhaust Ductwork #7 Tritium and C14 Wipes – June 6, 2019

1.2 REFERENCES

.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.

.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 Asbestos Survey Report, Designated Substances Survey, Fume Hood Exhaust Ductwork Sampling reports 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 Material Safety Data Sheets.
- .9 Written Emeregency 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.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 01 74 00 – Cleaning.

.2 Section 01 74 20 – Construction/Demolition Waste Management and Disposal.

1.2 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.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.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.

1.4 FIRES

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

1.5 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.

1.6 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.

1.7 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.
.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.

.4 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.

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 IAQ - INDOOR AIR QUALITY

.1 Comply with CSA B651-18.

1.5 TAXES

.1 Pay applicable Federal, Provincial and Municipal taxes.

1.6 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.

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.

PART 1 - GENERAL

1.1 ACTION AND INFORMATION SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

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 HEATING AND VENTILATION

.1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.

.2 Construction heaters used inside building must be vented to outside or be flameless type. Solid fuel salamanders are not permitted.

.3 Provide temporary heat and ventilation in enclosed areas as required to:
- .1 Facilitate progress of Work.
- .2 Protect Work and products against dampness and cold.
- .3 Prevent moisture condensation on surfaces.
- .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
- .5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10°C in areas where construction is in progress.

.5 Ventilating:
- .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
- .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.
- .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

1.5 TEMPORARY POWER AND LIGHT

.1 Contractor can utilize building power 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.

1.6 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.

.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

.1 Not Used.

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.

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

.1 Not Used.

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Barriers.

.2 Environmental Controls.

.3 Traffic Controls.

.4 Fire Routes.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.3 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.

1.4 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.

1.5 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.

1.6 ACCESS TO SITE

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

1.7 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.

1.8 FIRE ROUTES

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

1.9 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.

1.10 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.

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 Price 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.

PART 1 - GENERAL

1.1 ACTION AND INFORMATION SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00.

.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.

1.2 MATERIALS

.1 Required for original installation.

.2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00.

1.3 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.

1.4 EXECUTION

.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.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

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 Clear snow and ice from access to building, bank/pile snow in designated areas only.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

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

.6 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 20.

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

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

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

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

.11 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 HEPA vacuum clean and dust building interiors, behind grilles, louvres and screens.

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

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

.13 Remove dirt and other disfiguration from exterior surfaces.

.14 Clean and sweep roofs, gutters, areaways, and sunken wells.

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

.16 Clean roofs, downspouts, and drainage systems.

.17 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.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

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 Province of: Ontario.
- .1 Ministry of Environment, Conservation and Parks, 135 St. Clair Avenue West, Toronto, ON, M4V 1P5.
- .2 Telephone: 1-800-565-4923 or 416-323-4321.
- .3 Fax: 416-314-6713.

.2 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/.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Government Chief Responsibility for the Environment.

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

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.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

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 copies 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.

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, trouble-shooting, 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.

PART 1 - GENERAL

1.1 RELATED SECTIONS:

.1 Section 01 31 19 – Project Meetings

.2 Section 01 32 16 – Construction Progress Schedule – BAR (GANTT) Chart

.3 Section 01 33 00 – Submittal Procedures.

.4 Section 01 79 00 - Demonstration and Training

1.2 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.

1.3 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.

1.4 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.

1.5 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.

1.6 ROLES AND RESPONSIBILITIES - CONTRACTOR

.1 Before Construction:
- .1 Review contract documents, confirm by writing to Departmental Representative.
  - .1 Adequacy of provisions for Cx.
  - .2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction:
- .1 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.

1.7 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.

1.8 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.

1.9 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00.
.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.

1.10 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 Maintenance Manuals.
.11 O&M Training Schedule.
.12 O&M Training Report.

.2 Departmental Representative to review and approve Cx documentation.

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

1.11 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16, 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.

1.12 COMMISSIONING MEETINGS

.1 Convene Cx meetings following project meetings: Section 01 31 19 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.

1.13 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.

1.14 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.

1.15 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.

1.16 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.

1.17 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.

1.18 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.

1.19 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.

1.20 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.

1.21 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.

1.22 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.

1.23 WITNESSING COMMISSIONING

.1 Departmental Representative to witness activities and verify results.

1.24 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.

1.25 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.

1.26 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.

1.27 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.

1.28 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.

1.29 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.

1.30 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.

1.31 TRAINING

.1 In accordance with Section 01 79 00.

1.32 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

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

1.33 OCCUPANCY

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

1.34 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.

1.35 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.

1.36 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.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

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

1.2 DELIVERY, STORAGE AND HANDLING

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

1.3 SITE CONDITIONS

.1 Review designated substance report and take precautions to protect environment.

.2 Should material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Departmental Representative immediately.
  .1 Do not proceed until written instructions have been received from Departmental Representative.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Leave equipment and machinery running only while in use, except where extreme temperatures prohibit shutting down.

.2 Demonstrate that tools and machinery are being used in manner which allows for salvage of materials in best condition possible.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Do Work in accordance with Section 01 35 29.

.2 Protection:
  .1 Prevent movement, settlement, or damage to adjacent structures, utilities, to remain in place.
  .2 Keep noise, dust, and inconvenience to occupants to minimum.
  .3 Protect building systems, services and equipment.
  .4 Provide temporary dust screens, covers, railings, supports and other protection as required.

3.2 DEMOLITION SALVAGE AND DISPOSAL

.1 Remove parts of existing building to permit new construction. Sort materials into appropriate piles for reuse and recycling.

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

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

3.3 REMOVAL FROM SITE

.1 Dispose of materials not designated for alternate disposal in accordance with applicable regulations. Disposal facilities must be approved of and listed in waste reduction workplan. Do not deviate from disposal facilities listed in waste reduction workplan without prior written authorization from Departmental Representative.

3.4 CLEANING AND RESTORATION

.1 Keep site clean and organized throughout demolition procedure.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Safety Data Sheets (SDS).

1.2 QUALITY ASSURANCE

.1 Regulatory Requirements:
- .1 Comply with federal, provincial and municipal requirements pertaining to fire protection, occupational health and safety in effect at time that this work is performed.
- .2 In event of conflict among these requirements and this specification, most stringent will apply. Report discrepancies to Departmental Representative.

1.3 SITE CONDITIONS

.1 Existing Conditions:
- .1 Services utilities are still connected.
- .2 Fume hoods and storage cabinets below fume hoods will be emptied by authorized personnel before work begins.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Waste Management and Disposal:
- .1 Before commencing work notify Departmental Representative of:
  - .1 Location of hazardous materials disposal site;
  - .2 Method to be used for disposal of hazardous materials;
  - .3 Method of transporting removed hazardous materials from site to disposal site;
  - .4 Type of vehicles that will be used to transport hazardous materials.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 GENERAL PURPOSE FUME HOODS

.1 Conduct removal of fume hood in accordance with health and safety requirements. See attached DSS report for site conditions.

.2 Conduct removal of countertops in accordance with health and safety requirements. See attached DSS report for site conditions.

.3 Refer to Appendix A & B for AAFC Fume Hood Exhaust Ductwork Sampling Report and Site Designated Substances Survey Report.

3.2 BRIEFING OF PERSONNEL

.1 Brief personnel as to extent of work and potential hazards.

.2 Carefully, completely and accurately answer questions.

3.3 PROJECT CONTROL

.1 Ensure safety of workers through careful supervision and direction by supervisors experienced and qualified in this work.

3.4 PERSONAL PROTECTIVE EQUIPMENT

.1 Personnel directly involved in dismantling, removal and disposal of GP fumes hoods to wear Tyvek disposable type coveralls, neoprene gloves and full face shield.

3.5 PROCEDURES FOR DE-COMMISSIONING AND REMOVAL OF GP FUME HOODS

.1 Dismantle fume hood in reverse order of assembly.

.2 Remove hoods with exhaust fan in operation to aid in fibre containment.

.3 Disconnect mechanical, natural gas, electrical services to areas involved. Remove outlets and connecting piping, conduit.

.4 Remove exterior wood trim.

.5 Remove sash and counterweight assemblies.

.6 Remove rear baffles by unscrewing adjusting handles.

.7 Disassemble interior housing by breaking panels if necessary.

.8 Shut off exhaust fan, cut duct at wall and install temporary plug.

.9 Separate exhaust fan from exhaust duct system by cutting flexible connections.

.10 Disconnect wiring and remove exhaust fan from its mounting.

.11 Install temporary plug in duct on discharge side of fan.

.12 Remove support system for exhaust fan and clean up.

3.7 EMERGENCY RESPONSE PLANS

.1 Prior to commencement of work, notify appropriate authority of proposed work and hazards involved.

.2 Have adequate number of fire extinguishers present in various locations of work site.

.3 Extinguish fires that may occur using foam.

.4 Ensure emergency escape routes are of adequate size and kept clear.

.5 Provide equipped and clearly marked emergency first aid equipment in easily accessible locations.

.6 Comply with requirements of local Fire Department.

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 05 50 00 – Metal Fabrications.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials International, (ASTM)
- .1 ASTM A36/A36M-14, Standard Specification for Carbon Structural Steel.
- .2 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .3 ASTM A193/A193M-17, Standard Specification for Alloy Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
- .4 ASTM A307-14e1, Standard Specification for Carbon Steel Bots and Studs, 60,000 PSI Tensile Strength.
- .5 ASTM F3125/F3125M-18, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.

.3 Canadian Standards Association (CSA)
- .1 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CSA S16-14, Design of Steel Structures.
- .3 CSA S136-16 Package, North American Specification for the Design of Cold-Formed Steel Structural Members.
- .4 CSA W47.1-09(R2014), Certification of Companies for Fusion Welding of Steel.
- .5 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
- .6 CSA W55.3-08(R2018), Certification of Companies for Resistance Welding of Steel and Aluminum.
- .7 CSA W59-18, Welded Steel Construction (Metal Arc Welding).

.4 Master Painters Institute
- .1 MPI-INT 5.1-08, Structural Steel and Metal Fabrications.
- .2 MPI-EXT 5.1-08, Structural Steel and Metal Fabrications.

.5 The Society for Protective Coatings (SSPC)
- .1 SSPC SP 6/NACE No. 3-06, Joint Surface Preparation Standard: Commercial Blast Cleaning.

1.3 ACTION AND INFORMATION SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Shop drawings: Submit drawings stamped and signed by professional engineer registered or licensed in province of Ontario, Canada.

.3 Erection drawings: indicate details and information necessary for assembly and erection purposes including:
.1 Description of methods.
.2 Sequence of erection.
.3 Type of equipment used in erection.
.4 Temporary bracings.

.4 Ensure Fabricator drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the province of Ontario, Canada.

.5 Fabricator reports:
.1 Provide structural steel Fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Deliver materials in manufacturer's original, undamaged containers with identification labels intact.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

.1 Design details and connections in accordance with requirements of CSA S16 to resist forces, moments, shears and allow for movements indicated.

.2 Shear connections:
.1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only is required.
.2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.

2.2 MATERIALS

.1 Structural steel: to CSA G40.20/G40.21 Grade as indicated, minimum 30% recycled content.

.2 Anchor bolts: to CSA G40.20/G40.21, Grade 300W, minimum 30% recycled content.

.3 Bolts, nuts and washers: to ASTM A307, minimum 30% recycled content.

.4 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.

.5 Hot dip galvanizing: galvanize steel, where indicated, to ASTM A123/A123M, minimum zinc coating of 600 g/m, Coating Grade 85.

2.3 FABRICATION

.1 Fabricate structural steel in accordance with CSA S16 and in accordance with reviewed shop drawings.

.2 All exterior structural steel shall be galvanized.

.3 Continuously seal members by continuous welds where indicated. Grind smooth.

2.4 SHOP PAINTING

.1 Clean, prepare surfaces and shop prime structural steel in accordance with CSA S16, except members to be galvanized.

.2 Clean members, remove loose mill scale, rust, oil, dirt and other foreign matter. Prepare surface according to SSPC-SP-6.

.3 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.

.4 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.

.5 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

PART 3 - EXECUTION

3.1 GENERAL

.1 Structural steel work: in accordance with CSA S16.

.2 Welding: in accordance with CSA W59.

.3 Companies to be certified under Division 01 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.2 CONNECTION TO EXISTING WORK

.1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Departmental Representative for direction before commencing fabrication.

3.3 MARKING

.1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

.2 Match marking: shop mark for fit and match.

3.4 ERECTION

.1 Erect structural steel, as indicated and in accordance with CSA S16 and in accordance with reviewed erection drawings.

.2 Field cutting or altering structural members: to approval of Departmental Representative.

.3 Clean with mechanical brush and touch up shop galvanize to scratched and damaged surfaces at completion of erection.

.4 Continuously seal members by continuous welds where indicated. Grind smooth.

3.5 FIELD QUALITY CONTROL

.1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Departmental Representative.

.2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Departmental Representative.

3.6 FIELD PAINTING

.1 Touch up damaged surfaces and surfaces without shop coat with primer to SSPC-SP-6/NACE No. 3 except as specified otherwise. Apply in accordance with CAN/CGSB-85.10.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 ASTM International
- .1 ASTM A53/A53M-18, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .2 ASTM A123/A123M-17, Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
- .3 ASTM A269/A269M-15a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- .4 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.

.2 CSA International
- .1 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CSA S16-14, Design of Steel Structures.
- .3 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
- .4 CSA W59-18, Welded Steel Construction (Metal Arc Welding).

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Safety Data Sheets (SDS).

.4 The Master Painters Institute (MPI)
- .1 Architectural Painting Specification Manual - current edition.

1.2 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 sections and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
- .1 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

1.3 QUALITY ASSURANCE

.1 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials 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 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 Steel sections and plates: to CSA G40.20/G40.21, Grade as indicated, minimum 30% recycled content.

.2 Welding materials: to CSA W59.

.3 Welding electrodes: to CSA W48 Series.

.4 Bolts and anchor bolts: to ASTM A307.

.5 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Where possible, fit and shop assemble work, ready for erection.

.3 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m², Coating Grade 85, to ASTM A123/A123M.

2.4 ISOLATION COATING

.1 Isolate aluminum from following components, by means of bituminous paint:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

.2 Concrete, mortar and masonry.

.3 Wood.

2.5 SHOP PAINTING

.1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.3 Clean surfaces to be field welded; do not paint.

2.6 PIPE RAILINGS

.1 Steel pipe: 48 mm nominal outside diameter, formed to shapes and sizes as indicated.

.2 Galvanize exterior pipe railings after fabrication.

2.7 ACCESS STAIRS

.1 Contractor to submit stamped drawings of stair design for approval of Departmental Representative.

.2 Stair stringers shall be coated in accordance with galvanizing requirements.

.3 Stair treads and tread accessories shall be aluminum.

.4 Drawing shall be stamped by a Professional Engineer licensed in the Province of Ontario.

2.8 BAR GRATING

.1 Contractor to submit stamped drawings of bar grating design and layout for approval of Departmental Representative.

.2 All grating shall be aluminum.

.3 Drawing shall be stamped by a Professional Engineer licensed ion the province of Ontario.

.4 Grating shall be designed for the loads shown on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications 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.

3.2 ERECTION – GENERAL

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Supply components for work by other trades in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CSA S16 or Weld field connection.

.7 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.3 PIPE RAILINGS

.1 Install pipe railings to all stair provided and surrounding mechanical roof enclosure as indicated.

.2 Set railings to new and existing louvres by field welding.

3.4 ACCESS STAIRS

.1 Install access stairs in locations as indicated.

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
- .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .2 CSA O121-17, Douglas Fir Plywood.
- .3 CAN/CSA-O141-05(R2014), Softwood Lumber.
- .4 CSA O151-17, Canadian Softwood Plywood.
- .5 CAN/CSA-O325-16, Construction Sheathing.

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 National Lumber Grades Authority (NLGA)
- .1 Standard Grading Rules for Canadian Lumber GR 2017.

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

1.2 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 [rough carpentry work] and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 MAINTENANCE MATERIALS SUBMITTALS

.1 Extra Stock Materials:
- .1 Provide electrical equipment backboards for mounting electrical equipment as indicated. Use 19 mm thick plywood on 19 x 38 mm furring around spacing, perimeter and at maximum 300 mm intermediate

1.4 QUALITY ASSURANCE

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: by grade mark in accordance with applicable CSA standards.

.3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

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 off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect [wood] from [nicks, scratches, and blemishes].
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Lumber: unless specified otherwise, softwood, S4S, S-DRY graded and stamped, in accordance with following standards:
.1 CAN/CSA-O141.
.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
.1 S2S is acceptable for blocking hidden in walls or roof.
.2 Board sizes: "Standard" or better grade.
.3 Dimension sizes: "Standard" light framing or better grade.
.4 Post and timbers sizes: "Standard" or better grade.

2.2 ACCESSORIES

.1 Fasteners: to ASTM A123/A123M, Coating thickness suitable for exterior work.

.2 Nails, spikes and staples: to CSA B111.

.3 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for rough carpentry 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 PREPARATION

.1 Treat surfaces of non-pressure treated material with wood preservative, before installation.

.2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and 1 minute soak on plywood.

.3 Treated material as follows:
.1 Wood cants, fascia backing, curbs, nailers, sleepers on roof deck.

3.3 INSTALLATION

.1 Comply with requirements of NBC, supplemented by the following paragraphs.

.2 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.

.3 Align and plumb faces of furring and blocking to tolerance of 1:600.

.4 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.5 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.

.6 Use caution when working with particle board. Use dust collectors and high quality respirator masks.

.7 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.8 Countersink bolts where necessary to provide clearance for other work.

3.4 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 in accordance with Section 01 74 00.

.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.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 ASTM International
- .1 ASTM C612-14, Standard Specification for Mineral Fibre Block and Board Thermal Insulation.
- .2 ASTM C726-17, Standard Specification for Mineral Fiber Roof Insulation Board.
- .3 ASTM C1289-18a, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- .4 ASTM E96/E96M-16, Standard Test Methods for Water Vapour Transmission of Materials.

.2 Canadian General Standards Board (CGSB)
- .1 CGSB 71-GP-24M-AMEND-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Safety Data Sheets (SDS).

.4 Underwriters Laboratories of Canada (ULC)
- .1 CAN/ULC-S604:2016, Standard for Factory-Built Type A Chimneys.
- .2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
- .3 CAN/ULC-S702-14, Standard for Mineral Fibre Insulation for Buildings.
- .4 CAN/ULC-S704-11, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

1.2 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 board insulation and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit 2 copies of WHMIS SDS. Indicate VOC's during application and curing.

.3 Shop Drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.4 Certificates:
- .1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.5 Test Reports:
- .1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions:
.1 Submit manufacturer's installation instructions.

1.3 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 off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect specified materials from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 INSULATION

.1 Extruded polystyrene (XPS) to CAN/ULC-S701 and ASTM C578.
.1 Type: 4.
.2 Compressive strength: 173 kPa.
.3 Thickness: as indicated.
.4 Edges: shiplapped.

.2 Rigid Cellular Polyisocyanurate:
.1 Faced: to ASTM C1289 and CAN/ULC-S704.
.1 Polyisocyanurate core: glass fibre reinforced.
.2 Surfaces:
.1 Back: reflective foil facer and non-reflective.
.2 Facers: glass fibre.
.3 Shape: flat.
.4 Thickness: as indicated.

.3 Mineral fibre board: to CAN/ULC-S702.
.1 Type: 2.
.2 Density: 72kg/m³.
.3 Surfaces: unsurfaced
.4 Thickness: as indicated.
.5 Breather membrane for type 2: minimum permeance 300 ng/(Pa.s.m²).
.6 Vapour barrier for type 3: maximum permeance 60 ng/(Pa.s.m²).

2.2 ADHESIVE

.1 Adhesive (for polystyrene): as recommended by manufacturer.

2.3 ACCESSORIES

.1 Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.

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 board insulation 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 and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install insulation after building substrate materials are dry.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 type A chimneys and CSA B149.1 and CSA B149.2 type B and L vents.

.5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.6 Offset both vertical and horizontal joints in multiple layer applications.

.7 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

3.3 RIGID INSULATION INSTALLATION

.1 Imbed insulation boards into vapour barrier type adhesive, applied as specified, prior to skinning of adhesive.

.2 Leave insulation board joints unbonded over line of expansion and control joints. Bond a continuous 150 mm wide 0.15 mm modified bituminous membrane over expansion and control joints using compatible adhesive and primer before application of insulation.

3.4 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 in accordance with Section 01 74 00.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.
- .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

1.2 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 vapour retarders and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Certificates:
- .1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.3 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 off ground,in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect specified materials from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 SHEET VAPOUR BARRIER

.1 Polyethylene film: to CAN/CGSB-51.34, 0.15 mm thick.

2.2 ACCESSORIES

.1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.

.2 Sealant: compatible with vapour retarder materials, recommended by vapour retarder manufacturer.

.3 Staples: minimum 6 mm leg.

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 vapour retarder 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 Ensure services are installed and inspected prior to installation of retarder.

.2 Install sheet vapour retarder on warm side of exterior wall, ceiling and floor assemblies prior to installation of gypsum board to form continuous retarder.

.3 Use sheets of largest practical size to minimize joints.

.4 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.3 EXTERIOR SURFACE OPENINGS

.1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

3.4 PERIMETER SEALS

.1 Seal perimeter of sheet vapour barrier as follows:
- .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
- .2 Lap sheet over sealant and press into sealant bead.
- .3 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.5 LAP JOINT SEALS

.1 Seal lap joints of sheet vapour barrier as follows:
- .1 Attach first sheet to substrate.
- .2 Apply continuous bead of sealant over solid backing at joint.

.3 Lap adjoining sheet minimum 150 mm and press into sealant bead.

.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.6 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 in accordance with Section 01 74 00.

.1 Remove insulation material spilled during installation and leave work area ready for application of wall board.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-19.13M-M87, Sealing Compound, One Component, Elastomeric Chemical Curing.
- .2 CAN/CGSB-19.24M-M90, Multi-Component, Chemical Curing Sealing Compound.
- .3 CGSB 19-GP-14M-84, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.

.2 Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Avoid spillage: immediately notify Departmental Representative if spillage occurs and start clean up procedures.

.4 Clean spills and leave area as it was prior to spill.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.5 AMBIENT CONDITIONS

.1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00.

.3 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

1.6 WARRANTY

.1 For sealant and sheet materials the 12 months warranty period prescribed in subsection GC3.13 of General Conditions is extended to 24 months.

.2 Warranty: include coverage of installed sealant and sheet materials which:
.1 Fail to achieve air tight and watertight seal.
.2 Exhibit loss of adhesion or cohesion.
.3 Do not cure.

PART 2 - PRODUCTS

2.1 SHEET MATERIALS

.1 Sheet Seal Type 1: self-adhesive bitumen laminated to high-density polyethylene film, nominal total thickness of 1.5 mm.

.2 Sheet Seal Type 2: thermofusable elastomeric bitumen membrane reinforced with a non-woven polyester.

.3 Liquid Seal Type 3: elastomeric bitumen, roller applied, nominal total thickness of 1 mm.

.4 Foam Seal Type 4: spray-applied medium density spray polyurethane foam insulation/air/vapour barrier.

.5 Sheet Seal Type 5: galvanized steel, Z275 zinc coating; 0.5 mm thick core steel.

.6 Sheet Seal Type 6: neoprene, black colour, 1.5 mm thick.

2.2 SEALANTS

.1 Sealants in accordance with Section 07 92 00.

.2 Butyl Sealant Type A: CGSB 19-GP-14M, butyl rubber base, single component, solvent release, non-skinning, Shore "A" Hardness Range of 10 to 30; black colour.

.3 Sealant Type B: CAN/CGSB-19.13M, single component, chemical curing, capable of continuous water immersion, non-sagging type, Shore "A" Hardness Range of 20 to 35; black colour.

.4 Polyurethane Sealant Type C: CAN/CGSB-19.24M, multi- component, chemical curing, non-sagging, Shore 'A' Hardness Range of 20 to 35, black colour.

.5 Silicone Sealant Type D: single component, solvent curing, non-sagging, Shore 'A' Hardness Range of 35 to 45, black colour.

.6 Primer: recommended by sealant manufacturer.

.7 Substrate Cleaner: non-corrosive type recommended by sealant manufacturer.

2.3 ADHESIVES

.1 Mastic Adhesive Type 1: compatible with sheet seal and substrate, thick mastic of uniform knife grade consistency.

.2 Adhesive Type 2: compatible with sheet seal and substrate, permanently non-curing.

2.4 ACCESSORIES

.1 Thinner and cleaner for Neoprene Sheet: as recommended by sheet material manufacturer.

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 GENERAL

.1 Perform Work in accordance with Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification requirements for materials and installation.

.2 Perform Work in accordance with National Air Barrier Association - Professional Contractor Quality Assurance Program and requirements for materials and installation.

.3 Perform Work in accordance with Canadian Urethane Foam Contractor's Association - Professional Contractor Quality Assurance Program and requirements for materials and installation.

3.3 EXAMINATION

.1 Verify that surfaces and conditions are ready to accept work of this section.

.2 Ensure surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer's requirements.

.3 Report unsatisfactory conditions to Departmental Representative in writing.

.4 Do not start work until deficiencies have been corrected.
.1 Beginning of Work implies acceptance of conditions.

3.4 PREPARATION

.1 Remove loose or foreign matter, which might impair adhesion of materials.

.2 Ensure substrates are clean of oil or excess dust; masonry joints struck flush, and open joints filled; and concrete surfaces free of large voids, spalled areas or sharp protrusions.

.3 Ensure substrates are free of surface moisture prior to application of self-adhesive membrane and primer.

.4 Ensure metal closures are free of sharp edges and burrs.

.5 Prime substrate surfaces to receive adhesive and sealants in accordance with manufacturer's instructions.

3.5 INSTALLATION

.1 Install materials in accordance with manufacturer's instructions.

.2 Lap sheet seal onto roof vapour retarder and seal with sealant.
- .1 Caulk to ensure complete air seal.
- .2 Position lap seal over firm bearing.

.3 Apply sealant within recommended application temperature ranges.
- .1 Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 00.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.7 PROTECTION OF WORK

.1 Protect finished work in accordance with Section 01 61 00.

.2 Do not permit adjacent work to damage work of this section.

.3 Ensure finished work is protected from climatic conditions.

3.8 SCHEDULES

.1 Wall Air/Vapour Barrier Over Exterior Surface of Gypsum Sheathing:
- .1 Place sheet seal Type G over sheathing surfaces with Adhesive Type E.
- .2 Seal with Type Y sealant.

.2 Roof System Air/Vapour Barrier Over Deck:
- .1 Gypsum sheathing, taped joints, apply membrane air seal Type K over sheathing surfaces with Adhesive Type D
- .2 Edge seal membrane with Type Y sealant.

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials, removal and installation of asphalt shingles and roll roofing.

1.2 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB).
- .1 CAN/CGSB-37.4-M89, Fibrated, Cutback Asphalt, Lap Cement for Asphalt Roofing.
- .2 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.
- .3 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.

.2 Canadian Roofing Contractors' Association (CRCA).
- .1 CRCA Roofing Specification Manual - 2011.

.3 Canadian Standards Association (CSA International).
- .1 CSA A123.5-16, Asphalt Shingles Made From Organic Felt and Surfaced With Mineral Granules/Asphalt Shingles Made From Glass Felt and Surfaced With Mineral Granules.
- .2 CSA A123.3-05(R2015), Asphalt Saturated Organic Roofing Felt.
- .3 CSA A123.51-14, Asphalt Shingle Application on Roof Slopes 1:6 and Steeper.
- .4 CSA B111-1974(R1998), Wire Nails, Spikes and Staples.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .1 Safety Data Sheets (SDS).

.5 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC).
- .1 CCMC-2002, Registry of Product Evaluations.

1.3 SUBMITTALS

.1 Submit proof of manufacturer's CCMC Listing and listing number to Departmental Representative.

.2 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence and cleaning procedures.

.3 Submit product data in accordance with Section 01 33 00.

.4 Submit WHMIS SDS - Safety Data Sheets acceptable to Health Canada for asphalt shingles.

.5 Submit product data sheets for asphalt shingles. Include:
- .1 Product characteristics.
- .2 Performance criteria.
- .3 Installation instructions.
- .4 Limitations.
- .5 Colour and finish.

1.4 SAMPLES

.1 Submit samples in accordance with Section 01 33 00.

.2 Submit duplicate samples of full size specified shingles.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00.

.2 Provide and maintain dry, off-ground weatherproof storage.

.3 Remove only in quantities required for same day use.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Remove from site and dispose of all 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 Divert unused asphalt shingle materials from landfill to asphalt recycling facility approved by Departmental Representative.

.6 Dispose of unused asphaltic cement type materials at official hazardous material collections site approved by Departmental Representative.

.7 Fold up metal banding, flatten and place in designated area for recycling.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00.

.2 All unused shingles remain property of Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Asphalt shingles: to CSA A123.5.
.1 Type: strip, self-seal standard, pattern rectangular.

.2 Sheathing paper: to CAN/CGSB-51.32, laminated type.

.3 Roofing felt: to CSA A123.3 glass fibre No. 15 felt.

.4 Asphaltic Cement:

.1 Plastic cement: to CAN/CGSB-37.5.
.2 Lap cement: to CAN/CGSB-37.4.

.5 Nails: to CSA B111, of galvanized steel, sufficient length to penetrate 19 mm into deck.

.6 Staples: chisel point galvanized steel 25 mm crown 1.5 mm thick, sufficient length to penetrate 20 mm into deck tubelock nails for soffit substrates.

PART 3 - EXECUTION

3.1 REMOVAL OF EXISTING ROOFING

.1 Remove existing roofing, flashings and underlay, and expose sheathing or shingle lath of roof.

.2 Withdraw existing shingle and flashing nails, set those which break off. Leave surfaces free from dirt and loose material.

.3 Departmental Representative to inspect roof sheathing.

.4 Remove portion of sheathing affected by fungal or insect attack as directed on site by Departmental Representative.

.5 Replace cut out portions of sheathing or lath with sheathing of equal sectional dimensions, and specified grade. Seat each end on rafter, with 25 mm bearing, and secure to rafter.

3.2 APPLICATION

.1 Do asphalt shingle work in accordance with CAN3-A123.51 and CRCA Specification Standards except where specified otherwise.

.2 Install drip edge along eaves, overhanging 12 mm, with minimum 50 mm flange extending onto roof decking. Nail to deck at 400 mm on centre.

.3 Install bottom step flashing (soaker base flashing) interleafed between shingles at vertical junctions.

.4 Install asphalt shingles on roof slopes 1:3 and steeper in accordance with CSA A123.51.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)
- .1 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
- .2 CGSB 37-GP-56M-80(1985), Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.

.2 Canadian Roofing Contractors Association (CRCA)
- .1 CRCA Roofing Specifications Manual-2011.

.3 Canadian Standards Association (CSA International)
- .1 CAN/CSA-A123.21-14, Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane Roofing Systems
- .2 CSA A231.1-14/A231.2-14, Precast Concrete Paving Slabs/Precast Concrete Paving.
- .3 CSA O121-17, Douglas Fir Plywood.
- .4 CSA O151-17, Canadian Softwood Plywood.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Safety Data Sheets (SDS).

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Convene pre-installation meeting one week prior to beginning waterproofing Work, with roofing contractor's representative and Departmental Representative in accordance with Section 01 32 16 to:
- .1 Verify project requirements.
- .2 Review installation and substrate conditions.
- .3 Co-ordination with other building subtrades.
- .4 Review manufacturer's installation instructions and warranty requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
- .1 Provide two copies of most recent technical roofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Provide two copies of WHMIS SDS, and indicate VOC content for:
  - .1 Primers.
  - .2 Asphalt.
  - .3 Sealers.

1.4 FIRE PROTECTION

.1 Fire Extinguishers:
- .1 Maintain one cartridge operated type.

.2 ULC labelled for A, B and C class protection.
.3 Size 1.14 kg on roof per torch applicator, within 6 m of torch applicator.

.2 Maintain fire watch for 1 hour after each day's roofing operations cease.

1.6 DELIVERY, STORAGE, AND HANDLING

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

.2 Storage and Handling Requirements:
.1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.
.2 Provide and maintain dry, off-ground weatherproof storage.
.3 Store rolls of membrane in upright position. Store membrane rolls with salvage edge up.
.4 Remove only in quantities required for same day use.
.5 Place plywood runways over completed Work to enable movement of material and other traffic.
.6 Store sealants at +5 degrees C minimum.

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.
.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
.2 Fold up metal banding, flatten and place in designated area for recycling.

1.7 FIELD CONDITIONS

.1 Ambient Conditions
.1 Do not install roofing when temperature remains below -18°C for torch application, or -5°C to manufacturers' recommendations for mop application.
.2 Minimum temperature for solvent-based adhesive is -5 degrees C.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

.1 Compatibility between components of roofing system is essential. Provide written declaration to Departmental Representative stating that materials and components, as assembled in system, meet this requirement.

.2 Roofing System: to CAN/CSA-A123.21 for wind uplift resistance.

2.2 DECK PRIMER

.1 Asphalt primer: to CGSB 37-GP-9Ma.

2.3 VAPOUR RETARDER

.1 Self adhesive vapour retarder waterproofing membrane strip, non-woven polyester reinforcement and elastomeric bitumen.

2.4 MEMBRANE

.1 Base sheet: to CGSB 37-GP-56M.
- .1 Styrene-Butadiene-Styrene (SBS) elastomeric polymer prefabricated sheet, polyester reinforcement, having nominal weight of 95 g/m².
- .2 Type 1 fully adhered.
- .3 Class A - granule surfaced.
- .4 Grade 1 - standard service.
- .5 Top and bottom surfaces:
  - .1 Sanded/sanded.
- .6 Base sheet membrane properties: to CGSB 37-GP-56M.

.2 Cap sheet membrane: to CGSB 37-GP-56M.
- .1 Styrene-Butadiene-Styrene(SBS) elastomeric polymer, prefabricated sheet, polyester reinforcement, having nominal weight of 180 g/m².
- .2 Type 1, fully adhered.
- .3 Class A-granule surfaced.
  - .1 Colour for granular surface: gray.
- .4 Grade 1-standard service.
- .5 Bottom surface sanded.
- .6 ULC certification: Class A.

2.5 ADHESIVE

.1 Adhesive for securing overlay board and insulation: asphalt extended vulcanized adhesive, two component unit, consisting of two liquids mixed on site to produce pourable adhesive.

2.6 OVERLAY BOARD

.1 Overlay Board: 6 mm thick asphalt based recovery board with non-woven glass facers, as recommended by the membrane manufacturer.
- .1 Install over insulation to provide torch safe surface.

2.7 BITUMEN

.1 Asphalt: to CAN/CSA-A123.4, Type 2.

2.8 SEALERS

.1 Plastic cement: asphalt.

.2 Sealing compound: rubber asphalt type.

2.9 CARPENTRY

.1 Refer to Section 06 08 99.

2.10 ROOF VENT AND CONDUIT FLASHINGS

.1 Refer to Section 07 62 00.

PART 3 - EXECUTION

3.1 QUALITY OF WORK

.1 Do examination, preparation and roofing Work in accordance with CRCA Roofing Specification Manual standards.

.2 Do priming in accordance with manufacturers written recommendations.

3.2 EXAMINATION OF ROOF DECKS

.1 Verification of Conditions:
  .1 Inspect with Departmental Representative deck conditions including roof curbs and openings to determine readiness to proceed.

.2 Evaluation and Assessment:
  .1 Prior to beginning of work ensure:
    .1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.
    .2 Curbs have been built.

.3 Do not install roofing materials during rain or snowfall.

3.3 PROTECTION OF IN-PLACE CONDITIONS

.1 Cover slopped roofs and adjacent work where materials hoisted or used.

.2 Use warning signs and barriers. Maintain in good order until completion of Work.

.3 Clean off drips and smears of bituminous material immediately.

.4 Protect roof from traffic and damage. Comply with precautions deemed necessary by Departmental Representative.

.5 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.

3.4 (EXPOSED) CONVENTIONAL MEMBRANE ROOFING (CMR) APPLICATION

.1 Overlay Board: adhesive application:
  .1 Adhere overlay board to insulation with vulcanized adhesive at the rate of one litre per m^2.

.2 Base sheet application:
  .1 Lap sheets 75 mm minimum for side and 150 mm minimum for end laps.
  .2 Application to be free of blisters, wrinkles and fishmouths.

.3 Cap sheet application:
- .1 Lap sheets 75 mm minimum for side laps and 150 mm minimum for end laps. Offset joints in cap sheet 300 mm minimum from those in base sheet.
- .2 Application to be free of blisters, fishmouths and wrinkles.
- .3 Do membrane application in accordance with manufacturer's recommendations.

.4 Flashings:
- .1 Complete installation of flashing base sheet stripping prior to installing membrane cap sheet.
- .2 Lap flashing base sheet to membrane base sheet minimum 150 mm and seal by mopping or torch welding.
- .3 Lap flashing cap sheet to membrane cap sheet 250 mm minimum and torch weld.
- .4 Provide 75 mm minimum side lap and seal.
- .5 Properly secure flashings to their support, without sags, blisters, fishmouths or wrinkles.
- .6 Do work in accordance with manufacturer's recommendations.

.5 Roof penetrations:
- .1 Install vent stack covers and other roof penetration flashings and seal to membrane in accordance with manufacturer's recommendations and details.

3.5 CLEANING

.1 Remove bituminous markings from finished surfaces.

.2 In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their documented instructions.

.3 Repair or replace defaced or disfigured finishes caused by work of this section.

.4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
- .1 Place materials defined as hazardous or toxic in designated containers.
- .2 Clearly label location of salvaged material's storage areas and provide barriers and security devices.
- .3 Ensure emptied containers are sealed and stored safely.
- .4 Dispose of unused adhesive, sealant and asphalt materials at official hazardous material collections site approved by Departmental Representative.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 The Aluminum Association Inc. (AAI)
- .1 AAI-Aluminum Sheet Metal Work in Building Construction-2002.
- .2 AAI DAF 45-03(R2009), Designation System for Aluminum Finishes.

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM A653/A653M-17, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 Canadian Roofing Contractors Association (CRCA)
- .1 Roofing Specifications Manual 2012.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
- .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
- .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

1.3 QUALITY ASSURANCE

.1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with contractor's representative and Departmental Representative in accordance with Section 01 31 19 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.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

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

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: 0.65 mm thickness (24 gauge), commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.

.2 Aluminum-zinc alloy coated steel sheet: to ASTM A792/A792M, commercial quality, grade 33 with AZ150 coating, surface, 0.65 mm base metal thickness (24 gauge).

2.2 PREFINISHED STEEL SHEET

.1 Prefinished steel with factory applied polyvinylidene fluoride.
- .1 Class F2S.
- .2 colour selected by Departmental Representative from manufacturer's standard range.

2.3 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB-37.5.

.3 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

.4 Fasteners: of same material as sheet metal, to CSA B111, ring thread, flat head roofing nails of length and thickness suitable for metal flashing application.

.5 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.6 Touch-up paint: as recommended by prefinished material manufacturer.

2.4 FABRICATION

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details.

.2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction.

.3 Form pieces in 2400 mm maximum lengths.
- .1 Make allowance for expansion at joints.

.4 Hem exposed edges on underside 12 mm.
- .1 Mitre and seal corners with sealant.

.5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.6 Form flashings for roof vent caps to suit opening size with overlap sealant and collar to allow secure mechanical attachment.

2.5 METAL FLASHINGS

.1 Form flashings, copings and fascias to profiles indicated of 0.65 mm thickness (24 gauge) prefinished steel.

2.6 PANS

.1 Form pans to receive roofing plastic from 1.2 mm thick galvanized prefinished steel sheet metal with minimum 75 mm upstand above finished roof and 100 mm continuous flanges with no open corners.
.1 Solder joints.
.2 Make pans minimum 50 mm wider than member passing through roof membrane.

2.7 ROOF SURFACE MECHANICAL VENT FLASHINGS

.1 Aluminum flashing sleeve with integral deck flange, two piece collar, EPDM pressure grommet seal.
.1 Deck flange to be bituminous painted suitable for roofing membrane application.
.2 Diameter and size to suit mechanical vent penetration.
.3 Conduit sleeve to extend to minimum 300mm above roof surface.

2.8 ROOF SURFACE ELECTRICAL CONDUIT FLASHINGS

.1 Aluminum flashing sleeve with integral deck flange, pre-moulded insulation liner, EPDM triple pressure grommet seal.
.1 Deck flange to be bituminous painted suitable for roofing membrane application.
.2 Diameter and size to suit electrical conduit penetration.
.3 Conduit sleeve to extend to minimum 300mm above roof surface.
.4 Conduit sleeve to be vertical pipe for fitted rigid conduit.
.5 Conduit sleeve to be gooseneck for liquid tight flexible conduit or small diameter auxiliary wire.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install sheet metal work in accordance with CRCA Roofing Specifications Manual standards and as detailed.

.2 Use concealed fastenings except where approved before installation.

.3 Provide underlay under sheet metal.
.1 Secure in place and lap joints 100 mm.

.4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.
.1 Flash joints using S-lock forming tight fit over hook strips.

.5 Lock end joints and caulk with sealant.

.6 Insert metal flashing under cap flashing to form weather tight junction.

.7 Caulk flashing at cap flashing with sealant.

.8 Install pans, where shown around items projecting through roof membrane.

.9 Install roof surface vent and conduit flashings in accordance with manufacturer's recommendations. Ensure deck flange is fully embedded in sealant and securely fastened to roofing assembly.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 00.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Leave work areas clean, free from grease, finger marks and stains.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Safety Data Sheets (SDS).

.2 National Research Council (NRC)
  .1 National Building Code (NBC) 2015.

.3 Underwriter's Laboratories of Canada (ULC)
  .1 CAN/ULC-S101-14, Standard Methods of for Fire Endurance Tests of Building Construction and Materials.
  .2 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  .3 CAN/ULC-S115-11, Standard Method of Fire Tests of Firestop Systems.

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 Continuity of Fire Separations: NBC 2015, Division B, Parts 3.1.8 and 3.1.9.1, 9.10.9:
  .1 Wall, partition or floor assemblies required to be a fire separation shall be: constructed as a continuous element; have a fire resistance rating; have openings protected by a closure; and have penetrations sealed by a firestop.

1.3 ACTION AND INFORMATION SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  .2 Submit two copies of WHMIS SDS - Safety Data Sheets in accordance with Section 01 33 00.

.3 Quality assurance submittals: submit following in accordance with Section 01 45 00.
.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.

1.4 QUALITY ASSURANCE

.1 Qualifications:
.1 All fire stopping material shall be from one manufacturer.
.2 All fire stopping installation work for entire project shall be by a single contractor experienced in firestopping. Individual disciplines shall NOT fire stop their own work.

.2 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative and Departmental Representative in accordance with Section 01 31 19 to:
.1 Verify project requirements.
.2 Review installation and substrate conditions.
.3 Co-ordination with other building subtrades.
.4 Review manufacturer's installation instructions and warranty requirements.

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.
.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 brand name, manufacturer, and ULC markings.

.2 Storage and Protection:
.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.

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

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 Fire stop system rating: F rating of 1 Hr.

.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.

.11 Fire Wrap:
- .1 Fire rating: 2 hour.
- .2 Shall be a high-temperature fibrous thermal insulation blanket encapsulated in a fiberglass-reinforced aluminized polyester foil.
- .3 Duct Wrap density shall be nominal 6 pcf (96 kg/m3) and have a nominal 1-1/2" (38.1mm) thickness.
- .4 The fiber blanket shall have a continuous use limit of 1000°C (1832°F).
- .5 The blanket thermal resistance (R-value) at ambient temperature shall be minimum 0.89 m2K/W.
- .6 Smoke Developed Index and Flame Spread Index of the bare blanket, and of the foil encapsulated blanket shall be 0/0.
- .7 The foil encapsulation shall be bonded to the core blanket material.

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 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.

3.3 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.

3.4 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.

3.5 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.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 00.

.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.

3.7 SCHEDULE

.1 Fire stop and smoke seal at:
- .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
- .2 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
- .3 Openings and sleeves installed for future use through fire separations.
- .4 Around mechanical and electrical assemblies penetrating fire separations.
- .5 Rigid ducts: greater than 129 cm^2: 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.
- .6 Fire separations are to be 1 Hr for corridors, room separations, stairways, mechanical shafts and floor separations.

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 C919-18, 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 ±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 ±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: ±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/mü 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.

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
- .1 ASTM A653/A653M-18, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM B29-14, Standard Specification for Refined Lead.
- .3 ASTM B749-14, Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
- .4 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- .5 ASTM E413-16, Classifications for Rating Sound Insulation.
- .6 ASTM E1332-16, Standard Classification for Rating Outdoor-Indoor Sound Attenuation.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA International)
- .1 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CSA W59-18, Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door Manufacturers' Association (CSDMA)
- .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.
- .2 CSDMA, Selection and Usage Guide for Commercial Steel Door and Frame Products, 2009.

.5 National Fire Protection Association (NFPA)
- .1 NFPA 80-2019, Standard for Fire Doors and Other Opening Protectives.
- .2 NFPA 252-2017, Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)
- .1 CAN/ULC-S104-15, Standard Method for Fire Tests of Door Assemblies.
- .2 CAN/ULC-S105:2016, Standard Specification for Fire Door Frames

1.2 SYSTEM DESCRIPTION

.1 Design Requirements:
- .1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC-S104 and NFPA 252 for ratings specified or indicated.
- .2 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC-S104 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Provide product data: in accordance with Section 01 33 00.

.3 Provide shop drawings: in accordance with Section 01 33 00.
.1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, arrangement of hardware and finishes.
.2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings finishes.
.3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

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

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653/A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

2.2 DOOR CORE MATERIALS

.1 Honeycomb construction:
.1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m^3 minimum sanded to required thickness.

.2 Stiffened: face sheets laminated, insulated core.
.1 Fibreglass: to CAN/ULC-S702, semi-rigid, Type 1, density 24 kg/m3.
.2 Expanded polystyrene: CAN/ULC-S701, Type 1, density 16 to 32 kg/m3.
.3 Polyurethane: to CGSB 51-GP-21M rigid, modified polyisocyanurate, closed cell board. Density 32 kg/m3.

.3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250°C at 60 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN/ULC-S104, ASTM E152 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

2.3 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.2 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 PRIMER

.1 Touch-up prime CAN/CGSB-1.181.

2.5 PAINT

.1 Field paint steel doors and frames in accordance with Section 09 91 23. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

2.6 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Interior top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

.4 Door bottom seal: Refer to hardware schedule.

.5 Metallic paste filler: to manufacturer's standard.

.6 Fire labels: metal rivited.

.7 Sealant:
.1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168.

.8 Glazing: single glazed unit.

.9 Make provisions for glazing as indicated and provide necessary glazing stops.
.1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screws.
.2 Design exterior glazing stops to be tamperproof.

2.7 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Interior frames: 1.6 mm welded type construction.

.4 Blank, reinforce, drill and tap frames for mortised, templated hardware, using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.5 Prepare frame for door silencers, 3 for single door, 2 at head for double door.

.6 Manufacturer's nameplates on frames and screens are not permitted.

.7 Conceal fastenings except where exposed fastenings are indicated.

.8 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

2.8 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

.4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.10 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

.2 Exterior doors: hollow steel, insulated core construction. Interior doors: honeycomb construction.

.3 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.4 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketting and hardware in accordance with ASTM E330/E330M.

.5 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.7 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.9 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN/ULC-S104 and NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

2.11 DOORS: HONEYCOMB CORE CONSTRUCTION

.1 Form face sheets for exterior doors from 2.0 mm sheet steel with polyurethane core laminated under pressure to face sheets.

.2 Form face sheets for interior doors from 1.6 mm sheet steel with honeycomb core laminated under pressure to face sheets.

2.12 HOLLOW STEEL CONSTRUCTION

.1 Form face sheets for exterior doors from 1.2 mm sheet steel.

.2 Form face sheets for interior doors from 1.2 sheet steel.

.3 Reinforce doors with vertical stiffeners, securely welded to face sheets at 150 mm on centre maximum.

.4 Fill voids between stiffeners of exterior doors with polyurethane core.

.5 Fill voids between stiffeners of interior doors with honeycomb or fire rated temperature rise core.

2.13 THERMALLY BROKEN DOORS AND FRAMES

.1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.

.2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate thermally broken frames separating exterior parts form interior parts with continuous interlocking thermal break.

.4 Apply insulation.

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 GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continuity of air barrier and vapour retarder.

3.4 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00.

.2 Provide even margins between doors and jambs and doors and finished floor as follows.
.1 Hinge side: 1.0 mm.
.2 Latch side and head: 1.5 mm.
.3 Finished floor, noncombustible sill and thresholds: 13 mm.

.3 Adjust operable parts for correct function.

.4 Install louvres.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.6 GLAZING

.1 Install glazing for doors and frames in accordance with Section 08 80 50.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Architectural Woodwork Manufacturers Association of Canada/ Woodwork Institute (AWMAC/WI):
- .1 AWMAC/WI North American Architectural Woodwork Standards, NAAWS Edition 3.2-2017.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-12.1-2017, Safety Glazing

.3 Canadian Standards Association (CSA International).
- .1 CSA B651-18, Accessible Design for the Built Environment.
- .2 CAN/CSA-O132.2 Series-90(R2003), Wood Flush Doors.
- .3 CAN/CSA-Z809-16, Sustainable Forest Management.
- .4 CSA Certification Program for Windows and Doors.

.4 National Fire Protection Association (NFPA).
- .1 NFPA 80-2019, Standard for Fire Doors and Other Opening Protectives.

.5 Underwriters' Laboratories of Canada (ULC).
- .1 CAN/ULC-S104-15, Standard Method of For Fire Tests of Door Assemblies.
- .2 CAN/ULC-S105:2016, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00.
- .2 Submit two copies of WHMIS SDS - Safety Data Sheets. Indicate VOC's:
  - .1 For caulking materials during application and curing.
  - .2 For door materials and adhesives.

.2 Shop Drawings:
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate door types and cutouts for louvres, sizes, core construction, transom panel construction and cutouts.

1.3 SAMPLES

.1 Show door construction, core, glazing detail and faces.

.2 Manufacturer's Instructions:
- .1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Wood fire rated doors: labelled and listed by an organization accredited by Standards Council of Canada.

.2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Protection:
.1 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.
.2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.
.3 Protect doors from scratches, handling marks and other damage. Wrap doors.
.4 Store doors away from direct sunlight.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Dispose of corrugated cardboard, polystyrene and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

.3 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.

.4 Divert unused adhesive material from landfill to official hazardous material collections site approved by Departmental Representative.

.5 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

PART 2 - PRODUCTS

2.1 WOOD FLUSH DOORS

.1 Solid core: to CAN/CSA-O132.2.1.
.1 Construction:
.1 Solid particleboard core: stile and rail frame bonded to particleboard core with wood blocking, 5-ply construction.
.2 Solid wood core:
.1 Glued block core with wood edge band.
.2 Framed block glued core.
.3 Framed block nonglued core.

.4 Stile and rail core.
.5 5-ply construction.

.3 Solid, wood block, lined core: with two core liners:
.1 Glued block [with wood edge band].
.2 Framed block glued core.
.3 Framed block nonglued core.
.4 Stile and rail core.
.5 7-ply construction.

.2 Face Panels:
.1 Hardwood; veneer grades: Grade I (Premium), birch species.
.2 Hardboard: composition face.
.3 Laminated plastic: with hardwood plywood subface.

.3 Adhesive: Type II (water resistant) for interior doors.

2.2 GLAZING

.1 Glass: 6 mm single glazed, tempered, to CAN/CGSB-12.1.

.2 Accessories: stainless steel stops.

2.3 TRANSOM AND SIDE PANELS

.1 Construction: to match adjacent door.

.2 Meeting edges of doors and transom panels: square.

.3 Veneer of doors and transom panels: end colour matched.

2.4 FABRICATION

.1 Vertical edge strips to match face veneer.

.2 Prepare doors for glazing. Provide hardwood species to match face veneer glazing stops with mitred corners.

.3 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.

.4 Radius vertical edges of double acting doors to 60 mm radius.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Unwrap and protect doors in accordance with CAN/CSA-O132.2 Series, Appendix A.

.2 Install labelled fire rated doors to NFPA 80.

.3 Install doors and hardware in accordance with manufacturer's printed instructions and CAN/CSA-O132.2 Series, Appendix A and CSA B651.

.4 Adjust hardware for correct function.

.5 Install glazing in accordance with manufacturer’s recommendations.

.6 Install stops.

.7 Secure transom and side panels by means of stops, concealed fasteners or countersunk screws concealed by means of wood plugs matching panel in grain and colour.

3.3 ADJUSTMENT

.1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

3.4 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking; clean doors and frames.

.3 Clean glass and glazing materials with approved non-abrasive cleaner.

.4 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/Builders Hardware Manufacturers Association (BHMA)
- .1 ANSI/BHMA A156.1-2016, American National Standard for Butts and Hinges.
- .2 ANSI/BHMA A156.2-2017, Bored and Preassembled Locks and Latches.
- .3 ANSI/BHMA A156.4-2013, Door Controls - Closers.
- .4 ANSI/BHMA A156.5-2014, Auxiliary Locks and Associated Products.
- .5 ANSI/BHMA A156.6-2015, Architectural Door Trim.
- .6 ANSI/BHMA A156.8-2015, Door Controls - Overhead Stops and Holders.
- .7 ANSI/BHMA A156.16-2013, Auxiliary Hardware.
- .8 ANSI/BHMA A156.18-2016, Materials and Finishes.
- .9 ANSI/BMHA A156.22-2017, Door Gasketing and Edge Seal Systems.

.2 Canadian Standards Association (CSA)
- .1 CSA B651-18, Accessible Design for the Built Environment.

.3 Canadian Steel Door Manufacturers' Association (CSDMA)
- .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

1.2 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 door hardware and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Hardware List:
- .1 Submit contract hardware list.
- .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.4 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

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

1.4 MAINTENANCE MATERIALS SUBMITTALS

.1 Extra Stock Materials:
- .1 Supply maintenance materials in accordance with Section 01 78 00.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements:
.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.6 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 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.4 Storage and Handling Requirements:
.1 Store materials indoors and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect door hardware from nicks, scratches, and blemishes.
.3 Protect prefinished surfaces with wrapping.
.4 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 HARDWARE ITEMS

.1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

.1 Locks and latches:
.1 Bored and preassembled locks and latches: to ANSI/BHMA A156.2, Series 4000, Grade 1, designed for function and keyed as stated in Hardware Schedule.
.2 Lever handles: plain design.
.3 Escutcheons: round.
.4 Normal strikes: box type, lip projection not beyond jamb.
.5 Cylinders: key into keying system.
.6 Finish: C26D, Satin Chrome.

.2 Butts and hinges:
.1 Butts and hinges: to ANSI/BHMA A156.1, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.

.3 Door Closers and Accessories:

.1 Door controls (closers): to ANSI/BHMA A156.in accordance with ANSI/BHMA A156.4, table A1, Grade 1.

.4 Architectural door trim: to ANSI/BHMA A156.6.
.1 Door protection plates: kick plate, 1.27 mm thick stainless steel.

.5 Overhead Stop: concealed type, slide track design.

.6 Astragal: overlapping, extruded aluminum frame with vinyl insert.

.7 Flush Bolts: lever extension, 19 mm bolt, dust proof strike.

2.3 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.5 Use fasteners compatible with material through which they pass.

2.4 KEYING

.1 Doors, padlocks and cabinet locks to be keyed alike.

.2 Supply keys in duplicate for every lock in this Contract.

.3 Hand over permanent cores and keys to Departmental Representative.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Supply manufacturers' instructions for proper installation of each hardware component.

.4 Install hardware to standard hardware location dimensions in accordance with CSDMA Canadian Metric Guide for Steel Doors and Frames.

.5 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.6 Use only manufacturer's supplied fasteners.
.1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

3.2 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to ensure tight fit at contact points with frames.

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 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
.3 Remove protective material from hardware items where present.
.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.

.2 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 door hardware installation.

3.5 SCHEDULE

.1 Double Doors D01:
.1 3 pairs hinges A5111, 114 x 101 mm 630.
.2 1 lockset 301D, MK and KD 630.
.3 2 flush bolts, RO 555.
.4 1 closer, SA 1431 O.
.5 1 concealed overhead stop, RF 236.
.6 2 kickplates 203 mm high 630.
.7 1 Astragal.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)
- .1 ANSI A108/A118/A136.1:2013 American National Standards for the Installation of Ceramic Tile:
  - .1 ANSI A108.1-2013, part of ANSI A108/A118/A136.1:2013.

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM C136/C136M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .2 ASTM C207-06(2018), Standard Specification for Hydrated Lime for Masonry Purposes.
- .3 ASTM C847-18a, Standard Specification for Metal Lath.

.3 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-8.1-M88, Sieves, Testing, Woven Wire, Metric.
- .2 CAN/CGSB-25.20-95, Surface Sealer for Floors.
- .3 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .4 CGSB 71-GP-29M-79, Adhesive, Elastomeric, for Installation of Quarry Tiles.
- .5 CGSB 71-GP-30M-79, Adhesive, Epoxy and Modified Mortar Systems, for Installation of Quarry Tiles.
- .6 CAN/CGSB-75.1-M88, Tile, Ceramic.

.4 Canadian Standards Association (CSA International)
- .1 CSA A123.3-05(R2015), Asphalt Saturated Organic Roofing Felt.
- .2 CAN/CSA-A3000-18, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.5 Canadian Standards Association (CSA International)/International Organization for Standardization (ISO)
- .1 CAN/CSA-ISO 9001:16, Quality Management Systems Requirements.
- .2 CAN/CSA-ISO 14001:16, Environmental Management Systems.

.6 Terrazzo, Tile and Marble Association of Canada (TTMAC)
- .1 Tile Installation Manual 2016/2017.

1.2 SUBMITTALS

.1 Provide product data in accordance with Section 01 33 00.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:
- .1 Deliver, store and handle materials in accordance with Section 01 61 00.
- .2 Deliver, store and handle products in manner to avoid damage.
- .3 Have materials delivered to job site just prior to installation.

.4 Deliver products to job site in manufacturer's unopened cartons with labels intact and legible.
.5 Keep cartons dry and protected from vandalism and away from heavy traffic areas.
.6 Store cartons in upright position.
.7 Handle furan resin mortar and grout with care and abide by safety labels found on each unit and product WHMIS SDS's.

1.4 AMBIENT CONDITIONS

.1 Ventilation:
.1 Provided continuously during and after installation. Run system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of installation.

.2 Temperature:
.1 For cement mortars, bond coat, dry-set mortars or latex cement mortars, maintain ambient temperature of not less than 12 degrees C from 72 hours before installation until fully cured.
.2 For rapid-set dry-set mortars or latex modified mortars, maintain ambient temperature of not less than 5 degrees C from 72 hours before installation until fully cured.
.3 For epoxy mortars and grouts, maintain ambient temperature of not less than 20 degrees C or above 35 degrees C from 72 hours before installation until fully cured.

PART 2 - PRODUCTS

2.1 TILES

.1 Quarry tile: to CAN/CGSB-75.1, Type 4, Type FT1, size to match existing, plain face, square edges, colour to match existing.

2.2 MORTAR AND ADHESIVE MATERIALS

.1 Cement: to CAN/CSA-A3000.

.2 Sand:
.1 Crushed or pit run consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
.2 Gradations to be within limits specified when tested to ASTM C 136. Sieve sizes to CAN/CGSB-8.1.
.3 Table:

Sieve Designation	% Passing
4.75 mm	100
2.36 mm	95-100
1.18 mm	60-100
0.600 mm	35-80
0.300 mm	15-50
0.150 mm	2-15
0.075 mm	0-5

.4 Hydrated lime: to ASTM C207.

.5 Latex additive: formulated for use in cement mortar.
.6 Water: potable and free of minerals which are detrimental to mortar and grout mixes.
.7 Dry set mortar:
.1 To ANSI A108.1
.2 Water retentive cement mortar.
.8 Elastomeric adhesive: to CGSB 71-GP-29M.
.9 Epoxy adhesive: to CGSB 71-GP-30M, Type 1.
.10 Modified Mortar adhesive: to CGSB 71-GP-30M, Type 2.
.11 Adhesives: in accordance with Section 07 90 00.
.1 Maximum VOC limit 65 g/L to SCAQMD Rule 1168.
.12 Colour pigment: nonfading mineral oxides, unaffected by lime or cement and which will not stain tile.

2.3 GROUT

.1 Cement grout: to ANSI/CTI A108.1.

.2 Grout preparation: to manufacturer's instructions.

2.4 ACCESSORIES

.1 Reinforcing mesh: 50 x 50 x 1.6 mm galvanized steel wire mesh.

.2 Divider strips: to match existing.

.3 Floor sealer: to CAN/CGSB-25.20, Type 1.

.4 Protective coating: to tile and grout manufacturer's recommendations.

2.5 MIXES

.1 Scratch coat: 1 part cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand, 1 part water. Adjust water volume depending on water content of sand.

.2 Slurry bond coat: cement and water mixed to creamy paste. Latex additive may be included.

.3 Mortar bed for floors: 1 part cement, 4 parts sand, 1 part water. Adjust water volume depending on water content of sand. Latex additive may be included.

.4 Levelling coat: 1 part cement, 4 parts sand, minimum 1/10 part latex additive, 1 part water, including latex additive.

.5 Bond or setting coat: 1 part cement, 1/3 part hydrated lime, 1 part water.

.6 Mortar ingredients: measured by volume.

.7 Dry set mortar: mixed to manufacturer's instructions.

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 WORKMANSHIP

.1 Do tile work in accordance with TTMAC Tile Installation Manual 2016/2017.

.2 Apply mortar bed or bond coat to clean and sound surfaces.

.3 Fit tile units around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Make cut edges smooth and even.

.4 Maximum surface tolerance: 1:800.

.5 Make joints between tiles uniform and approximately 6 mm wide, plumb, straight, true, even and with adjacent units flush. Align patterns.

.6 Sound tiles after setting and replace hollow sounding units to obtain full bond.

.7 Make internal angles square, external angles rounded.

.8 Construct base to match existing.

.9 Use round edged tiles at termination of wall tiles, except where tiles but projecting surface or differing plane.

.10 Install divider strips at junction of tile flooring and dissimilar material.

.11 Clean installed tile surfaces after installation cured.

.12 Keep building expansion joints free of mortar or grout.

3.3 SETTING SYSTEM

.1 Install tile and bases on substrate in accordance with TTMAC standards to suit site conditions.

3.4 FLOOR SEALER AND PROTECTIVE COATING

.1 Apply 2 coats in accordance with manufacturer's printed instructions.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 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 CLEANING

.1 Proceed in accordance with Section 01 74 00.

3.7 PROTECTION

.1 Protect new floors from after application of sealer and protective coating until application of final sealer and protective coating.

.2 Prohibit traffic on floor for 48 hours after installation.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Environmental Protection Agency (EPA)
- .1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, EPA Method 24 - Surface Coatings.
- .2 SW-846, Test Method for Evaluating Solid Waste, Physical/Chemical Methods.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Safety Data Sheets (SDS).

.3 Master Painters Institute (MPI)
- .1 Architectural Painting Specification Manual - 2018.
- .2 Standard GPS-1-12, MPI Green Performance Standard.
- .3 Standard GPS-2-12, MPI Green Performance Standard.

.4 Society for Protective Coatings (SSPC)
- .1 Systems and Specifications, SSPC Painting Manual 2011.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Scheduling
- .1 Schedule new additions to existing building coordinate painting operations with other trades.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide in accordance with Section 01 33 00.

.2 Product Data:
- .1 Provide manufacturer's instructions, printed product literature and data sheets for paint and paint products and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit 2 copies of WHMIS SDS in accordance with Section 01 35 29.
- .3 Confirm products to be used are in MPI's approved product list.
- .4 Upon completion, provide 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 numbers.
  - .4 MPI Environmentally Friendly classification system rating.
  - .5 Manufacturer's WHMIS Safety Data Sheets (SDS).

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials:
- .1 Provide maintenance materials in accordance with Section 01 78 00.
- .2 Submit 1 one litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

1.5 QUALITY ASSURANCE

.1 Qualifications:
- .1 Qualified journeypersons as defined by local jurisdiction to be engaged in painting work
- .2 Apprentices: may be employed provided they work under direct supervision of qualified journeyperson in accordance with trade regulations.
- .3 Conform to latest MPI requirements for exterior painting work including preparation and priming.
- .4 Materials: in accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.
- .5 Retain purchase orders, invoices and documents to prove conformance with noted MPI requirements when requested by Departmental Representative.
- .6 Standard of Acceptance:
  - .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
  - .2 Soffits: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.
  - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.6 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.
- .1 Labels: to indicate:
  - .1 Type of paint or coating.
  - .2 Compliance with applicable standard.
  - .3 Colour number in accordance with established colour schedule.

.3 Storage and Handling Requirements:
- .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Observe manufacturer's recommendations for storage and handling.
- .3 Store materials and supplies away from heat generating devices.
- .4 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.
- .5 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Departmental Representative. After completion of operations, return areas to clean condition to approval of Departmental Representative.
- .6 Remove paint materials from storage only in quantities required for same day use.

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

.9 Replace defective or damaged materials with new.

1.7 SITE CONDITIONS

.1 Ambient Conditions:
.1 Heating, Ventilation and Lighting:
.1 Do not perform painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10 degrees 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 Co-ordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.
.4 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
.5 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities to be provided by General Contractor.
.2 Temperature, Humidity and Substrate Moisture Content Levels:
.1 Unless specifically pre-approved by specifying body, Paint Inspection Agency and, applied product manufacturer, perform no painting work when:
.1 Ambient air and substrate temperatures are below 10 degrees C.
.2 Substrate temperature is over 32 degrees 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 Relative humidity is above 85% or when dew point is less than 3 degrees C variance between air/surface temperature.
.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
.2 Perform no painting work when maximum moisture content of substrate exceeds:
.1 12% for concrete and masonry (clay and concrete brick/block).

.2 15% for hard wood.
.3 17% for soft wood.
.4 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 Application Requirements:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.

.5 Do not apply paint when:

.1 Temperature is expected to drop below 10 degrees C before paint has thoroughly cured.

.2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.

.3 Surface to be painted is wet, damp or frosted.

.6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.

.7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.

.8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

.9 Paint occupied facilities in accordance with approved schedule only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

.1 Environmental Performance Requirements:

.1 Provide paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA Method 24) content levels.

.2 Green Performance in accordance with MPI Standard GPS-1.

2.2 MATERIALS

.1 Only paint materials listed in latest edition of MPI Approved Products List (APL) are acceptable for use on this project.

.2 Paint materials for paint systems: to be products of single manufacturer.

.3 Only qualified products with E2 "Environmentally Friendly" ratings are acceptable for use on this project.

.4 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, to be as follows:
- .1 Be manufactured without compounds which contribute to ozone depletion in upper atmosphere.
- .2 Be manufactured without compounds which contribute to smog in the lower atmosphere.
- .3 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 processes, including disposal of waste products arising there from, 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, hexavelant chromium or their compounds.

.7 Water-borne surface coatings and recycled water-borne surface coatings must have flash point of 61.0 degrees 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 Hexavelant 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.

2.3 COLOURS

.1 Selection of colours will be from manufacturers' full range of colours.

.2 Where specific products are available in restricted range of colours, selection will be based on limited range.

.3 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats if requested by Departmental Representative.

.4 For deep and ultra deep colours 4 coats may be required.

2.4 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 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.

.3 Add thinner to paint manufacturer's recommendations. Do not use kerosene or organic solvents to thin water-based paints.

.4 Thin paint for spraying according in 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.

.6 Deep and ultra deep colors; 4 coats may be required.

2.5 GLOSS/SHEEN RATINGS

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

Gloss Level Category/	Units @ 60 Degrees/	Units @ 85 Degrees/
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

.2 Gloss level ratings of painted surfaces [as specified] [and] [as noted on Finish Schedule].

2.6 EXTERIOR PAINTING SYSTEMS

.1 Structural Steel and Metal Fabrications:
- .1 EXT 5.1C - W.B. light industrial semi-gloss coating (over alkyd metal primer).
- .2 EXT 5.1D - Alkyd semi-gloss (over alkyd metal primer) finish.
- .3 EXT 5.1M - W.B. light industrial semi-gloss coating (over w.b. epoxy primer).
- .4 EXT 5.1R - W.B. Light Industrial semi-gloss coating (over epoxy primer and h.b epoxy).

.2 Galvanized Metal: not chromate passivated
- .1 EXT 5.3B - Alkyd semi-gloss (over cementitious primer) finish.
- .2 EXT 5.3K - W.B. light industrial semi-gloss coating (over epoxy primer).

2.7 SOURCE QUALITY CONTROL

.1 Perform following tests on each batch of consolidated post-consumer material before surface coating is reformulated and canned. Testing by laboratory or facility which has been accredited by 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.

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 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable to be painted 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.

.2 Exterior surfaces requiring repainting: inspected by painting contractor who will notify Departmental Representative in writing of defects or problems, prior to commencing repainting work, or after surface preparation if unseen substrate damage is discovered.

.3 Where assessed degree of surface degradation of DSD-1 to DSD-3 before preparation of surfaces for repainting is revealed to be DSD-4 after preparation, repair or replacement of such unforeseen defects discovered are to be corrected, as mutually agreed, before repainting is started.

3.4 PREPARATION

.1 Perform preparation and operations for exterior painting in accordance with MPI Maintenance Repainting Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

.3 Clean and prepare exterior surfaces to be repainted in accordance with MPI Maintenance Repainting Manual requirements. Refer to the MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and 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. Allow sufficient drying time and test surfaces using electronic moisture meter before commencing work.
.5 Use water-based cleaners in place of organic solvents where surfaces will be repainted using water based paints.
.6 Many water-based paints cannot be removed with water once dried. Minimize use of kerosene or such organic solvents to clean up water-based paints.

.4 Clean metal surfaces to be repainted by removing rust, dirt, oil, grease and foreign substances in accordance with MPI requirements. Remove such contaminates from surfaces, pockets and corners to be repainted by brushing with clean brushes, blowing with clean dry compressed air, or brushing/vacuum cleaning as required.

.5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before priming and between applications of remaining coats. Touch-up, spot prime, and apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.6 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

.7 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.

3.5 EXISTING CONDITIONS

.1 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.

.2 Maximum moisture content as follows:
.1 Stucco: 12%.
.2 Concrete: 12%.
.3 Clay and Concrete Block/Brick: 12%.
.4 Hard Wood: 15%.
.5 Soft Wood: 17%

3.6 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 factory finished products and equipment.

.3 Protect building occupants in and about building.

.4 Remove light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Store items and re-install after painting is completed.

.5 Move and cover exterior furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.6 As painting operations progress, place "WET PAINT" signs in pedestrian and vehicle traffic areas to approval of Departmental Representative.

3.7 APPLICATION

.1 Method of application to be as approved by Departmental Representative. Apply paint by brush, roller, air sprayer or airless 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 to 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 runs and sags.
- .5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.
- .6 Wood, stucco, concrete, cement masonry units CMU's and brick; if sprayed, must be back rolled.

.4 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access and when specifically authorized by Departmental Representative.

.5 Apply coats of paint as continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.

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

3.8 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, duct work and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.

.2 Do not paint over nameplates.

3.9 FIELD QUALITY CONTROL

.1 Standard of Acceptance:
- .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
- .2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.
- .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

.2 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 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.

3.10 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 in accordance with Section 01 74 00.

3.11 RESTORATION

.1 Clean and re-install 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.

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 09 91 13 - Exterior Painting.

1.2 REFERENCE STANDARDS

.1 Architectural Painting Specifications Manual, Master Painters Institute (MPI), 2018.

.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).

1.3 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.

1.4 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.

1.5 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.

1.6 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).

1.7 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.

1.8 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.

1.9 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.

1.10 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.

1.11 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.

1.12 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, hexavelant 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 Hexavelant 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 Category	Units @ 60°	Units @ 85°
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

.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.

.5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Engineer.

.5 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 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.

.9 Finish inside of cupboards and cabinets as specified for outside surfaces.

.10 Finish closets and alcoves as specified for adjoining rooms.

.11 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.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCE STANDARDS

.1 National Air Duct Cleaners Association (NADCA)
  .1 ACR Standard, 2013 edition: Assessment, Cleaning and Restoration of HVAC Systems.

1.3 DEFINITIONS

.1 HVAC System: complete air duct system from outside air intake louvers to furthest air supply terminal unit and including:
  .1 Rigid supply and return ductwork;
  .2 Flexible ductwork;
  .3 Mixing plenum boxes;
  .4 Return air plenums including ceiling plenums;
  .5 Cooling and heating coils and compartments;
  .6 Condensate drain pans, eliminator blades and humidifiers;
  .7 Fans, fan blades and fan housing;
  .8 Filter housing and frames;
  .9 Acoustically insulated duct linings;
  .10 Diffusers, registers and terminal units;
  .11 Dampers and controls;

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Site Evaluation: conduct site visits 2 weeks before start of work to establish specific coordinated video survey and cleaning plan to establish specific coordinated video survey and cleaning plan determining how areas of facility and HVAC systems will be protected during cleaning operations.
  .1 Organize and lay out plan for video survey and identify camera and cleaning apparatus insertion points.
  .2 Ensure plan identifies sequence and schedule of survey and cleaning operations for each individual HVAC system and for complete facility.
    .1 Take account of elbows, bends, turning vanes, dampers, transitions, take-offs, and other internal features.
  .3 Departmental Representative to review video survey and cleaning plan 1 week minimum prior to start of work.
    .1 Proceed with survey and cleaning work only after receiving written approval from Departmental Representative.

.2 Scheduling: Hours of Operation: complete work during quiet hours as indicated in Section 01 14 00.

.3 Project Coordination: assign Project Coordinator to oversee air duct cleaning processes.
  .1 Provide Departmental Representative with contact information of Project Coordinator including: name, telephone number, cell phone number.

.4 Damaged or broken equipment and components found during initial testing and inspection will be repaired or replaced by Departmental Representative.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 23 05 00.

.2 Submit video survey and cleaning plan developed during site evaluation.
.1 Ensure plan includes sequence of operation, identification of camera and cleaning apparatus insertion points and schedule for work.

1.6 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 23 05 00.

.2 Post Cleaning Inspection Report: submit 4 copies of Final Inspection Report, including data collected, observations and recommendations as well as following information:
.1 Name and address of facility;
.2 Name and address of HVAC cleaning contractor;
.3 Description of HVAC systems with sketches identifying systems cleaned;
.4 Identification scheme for location points in systems that were inspected with accompanying notes describing methods of inspection or tests used;

.3 Record post cleaning video survey: submit 2 copies of video survey USB Drive media, and include on video survey following:
.1 Areas tested for particulate analysis or microbial growth evaluation;
.2 Areas of special interest and location;
.3 Special internal features;
.4 Problems such as broken or damaged controls or components;
.5 Ensure system tested, locations, observations, actions taken and recommendations are clearly identified in English on video using text or voice over.

.4 Submit verification of delivery of hazardous or toxic waste materials to contaminated waste facility.

1.7 QUALITY ASSURANCE

.1 Contractor: verification of 5 years minimum experience in work similar to or exceeding work of this Section.
.2 Project Coordinator: verification of 5 years minimum experience in work similar to or exceeding work of this Section.

PART 2 - PRODUCTS

2.1 AIR DUCT CLEANING EQUIPMENT

.1 Manually propelled full contact brushes:
.1 Ensure brushes are specifically manufactured and shaped to fit individual ducts, equipment and components of HVAC system.
.1 Ensure brushes are sized to fit various duct sizes in HVAC system.

.2 Ensure brushes make scrubbing motion and full contact with HVAC system interior surfaces to be cleaned.

.2 Brushes: manually propelled with integrally-mounted motor and other non-metallic material bristles.
.1 Ensure motor has capacity to continue to push brush after bristles are distorted.
.2 Replace worn and ineffective brushes when required.

2.2 MULTI-FUNCTIONAL ROBOTIC CLEANING SYSTEM

.1 Self-propelled emote controlled, wheeled drive equipped with: halogen lights: reciprocating brushes, air supply nozzle, vacuum.
.1 Ensure brushes are specifically manufactured and shaped to fit individual ducts, equipment and components of HVAC system.
.2 Ensure brushes make scrubbing motion and full contact with HVAC system interior surfaces.
.3 Replace worn and ineffective brushes when required.

.2 Camera: fully rotational remote control focus and dustproof digital with 480 lines of resolution, capable of storing 4 hours of recorded media.
.1 Camera Light: 2 x 20 watt Halogen with dimmer

2.3 HEPA FILTER EVACUATION FAN

.1 Evacuation Fan: includes fan, HEPA filter, flexible hose and motor capable of maintaining debris and particulates airborne in airstream until they reach evacuation fan and maintaining system under negative pressure.
.1 Ensure HEPA filters are clean and maintain evacuation fan and HEPA filter to run efficiently.

2.4 HEPA VACUUM UNIT

.1 Vacuum Unit: includes vacuum fan, integral HEPA filter, suction hose and vacuum head, capable of maintaining HVAC System debris and particulates airborne in air stream until they reach vacuum unit and maintaining system under negative pressure.
.1 Ensure HEPA filters are clean and maintain vacuum unit and HEPA filter to run efficiently.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Close down HVAC system.

.2 Locate and identify externally visible HVAC system features which may affect cleaning process including:
.1 Control devices;
.2 Fire and smoke control dampers;
.3 Balancing dampers: indicate and record positions for resetting;
.4 Air volume control boxes: indicate and record positions for resetting;
.5 Fire alarm devices;

.6 Monitoring devices and controls;

.3 Use existing openings or terminations. Cutting new openings is not permitted.

.4 Remove and reinstall ceiling tiles to gain access to HVAC system as required.
.1 Replace ceiling tiles damaged or soiled by air duct cleaning procedures.

3.2 EXAMINATION/PRE-CLEANING INSPECTION

.1 Verification of Conditions:
.1 Make visual inspection of interior of HVAC system using remote controlled robotic camera.
.2 Insert camera at pre-established strategic locations to evaluate condition and cleanliness of HVAC systems and components.

.2 Evaluation and Assessment:
.1 Identify location and type of internal components.
.2 Identify extent of potential problems.
.3 If toxic or hazardous materials or deposits are suspected after initial inspection immediately stop work and inform Departmental Representative.
.1 Do not proceed further with inspection operations until written approval from Departmental Representative.

3.3 DUCT CLEANING

.1 Do duct cleaning in accordance with NADCA ACR Standard.

.2 Isolate and clean sections in zones to ensure that dirt deposits and debris from zone being cleaned does not pass through other zones which has already been cleaned.
.1 Isolate zone of duct using closed-cell polyurethane foam before cleaning.

.3 Ensure vacuum units and evacuation fans are securely in place before starting cleaning operation of isolated section of HVAC air duct system.

.4 Install HEPA filter evacuation fan at one end of zone section and insert full contact brushes at other end.

.5 Clean exhaust, return, transfer ductwork and plenums, equipment and components where particulate sample collected from surfaces is greater than 75 mg of particulate per 0.01 square meters.

.6 Energize brushes to travel from insertion point to HEPA filter evacuation fan.
.1 Pass brushes through sections as often as necessary to achieve required cleanliness.
.2 Change brush sizes as required to ensure positive contact with duct and component interiors.
.3 Clean corners and pockets where dirt and debris can accumulate.

.7 Clean equipment, components and other features in isolated zone before moving to next zone of HVAC air duct system.

.8 Clean diffusers, registers, louvers and other terminal units.

.9 Remove perforated supply diffusers from suspended tee-bar ceiling.
.1 Dismantle and clean perforated plates and supply diffuser duct collars.
.2 Re-assemble perforated plate diffusers and reconnect to HVAC system using supply diffuser duct collar after cleaning.

.10 Advise Departmental Representative 72 hours minimum before deactivation of fire alarm and smoke detectors duct cleaning operations.
.1 Departmental Representative will pay for costs of deactivation of fire alarm and smoke detector system.

3.4 COMPONENTS AND EQUIPMENT CLEANING

.1 When cleaning equipment and components by brushing and vacuuming is inappropriate or insufficient, dismantle and remove equipment or component and move to area designated by Departmental Representative for cleaning.
.1 Pressure wash with water and cleaning solution until required cleanliness is achieved.
.2 Clean equipment and components in place only if there is no hazard to adjacent materials.

.2 Compressed air and manual cleaning is acceptable only for cleaning individual components and small areas as follows and only after written approval from Departmental Representative:
.1 Fan blades;
.2 Dampers;
.3 Turning vanes;
.4 Controls;
.5 Sensor bulbs;
.6 Fire alarms;
.7 Smoke detectors;

3.5 FIELD QUALITY CONTROL/FINAL INSPECTIONS

.1 Post Cleaning Inspection: carry out final inspection using robotic camera and other visual inspection methods after final cleaning has been completed.
.1 Carry out video survey as directed by Departmental Representative.
.2 Include in final survey areas inspected by Departmental Representative prior to cleaning.
.3 Identify on HVAC system record drawings access points used for inspection and cleaning.
.4 Re-collect and analyse particulates collected at same locations where original samples were collected before cleaning.
.5 Reset components including dampers and sensors, which have been disturbed during cleaning operations.

3.6 SYSTEM STARTUP

.1 Install new system filters after cleaning operations are completed.

.2 Cover each inspection opening with access door or panel and secure in place after inspection and cleaning are completed.

.3 Restart each HVAC system.

3.7 CLEANING

.1 Cleaning in accordance with Section 23 05 00.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 23 05 93.13 – Testing, Adjusting and Balancing of Fume Hoods.

1.2 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 new work and include product characteristics, performance criteria, physical size, finish and limitations.

.3 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: 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.

.2 Operation and Maintenance Data: submit operation and maintenance data for all newly install equipment for incorporation into manual.
- .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
- .2 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.
- .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.
- .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 93.13.

.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.

.7 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.

.8 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.

.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.4 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect all materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials as specified in accordance with Section 01 74 20.

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 for new work 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 PAINTING REPAIRS AND RESTORATION

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.4 DEMONSTRATION

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.3 Instruction duration time requirements as follows:
- .1 HPF-01 and air valves: 4 hours.

.4 Departmental Representative will record these demonstrations on video tape for future reference.

3.5 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 in accordance with Section 01 74 00.

.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.

3.6 PROTECTION

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

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 02 41 16.01 – Structure Demolition

.2 Section 23 05 00 - Common Work Results for HVAC.

1.2 REFERENCE STANDARDS

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

1.3 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.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 23 05 00.

.2 Landfill Records: Indicate receipt and acceptance of selective demolition waste and hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.5 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 with Section 02 41 16.01 and schedule staged occupancy and worksite activities in accordance with Section 01 32 16.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: Perform work of this Section in accordance with the following
- .1 Workplace Safety and Insurance Board
- .2 Occupational Health and Safety Act (OHSA)

1.7 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.

.3 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 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 Contractor under a separate contract or as a change to the Work.
- .6 Proceed only after written instructions have been received from Departmental Representative.

1.8 SALVAGE AND DEBRIS MATERIALS

.1 Demolished items become Contractor's property and will be removed from Project site.

PART 2 - PRODUCTS

2.1 MATERIAL

.1 General Patching and Repair Materials: Refer to Section 02 41 16.01 for listing of patching and repair materials incidental to removal or demolition of components associated with work of this Section.

.2 HVAC 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.

.3 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 Coordinate timing of demolition with Departmental Representative to minimize equipment downtimes.

3.3 EXECUTION

.1 Demolition and Removal: Coordinate requirements of this Section with information contained in Section 02 41 16.01 and as follows:

.1 Disconnect and cap gas supply and electrical 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).

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCE STANDARDS

.1 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 B51-14, Boiler, Pressure Vessel and Pressure Piping Code.
- .4 CSA-W117.2:19, Safety in Welding, Cutting and Allied Processes.
- .5 CSA W178.1-18, Certification of Welding Inspection Organizations.
- .6 CSA W178.2-18, Certification of Welding Inspectors.

1.3 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.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 23 05 00.

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 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.

.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 Visual examinations: include entire circumference of weld externally and wherever possible internally.

.3 Failure of visual examinations:
- .1 Upon failure of welds by visual examination, perform additional testing as directed by Departmental Representative.

3.6 REPAIR OF WELDS WHICH AILED TESTS

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

3.7 CLEANING

.1 Cleaning in accordance with Section 23 05 00.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 SUBMITTALS

.1 Submit in accordance with Section 23 05 00 – Common Work Results for HVAC.
  .1 Submit manufacturer's instructions, printed product literature and data sheets for products of this section and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 23 05 00.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:
  .1 Equipment: manufacturer's name, model, size, serial number, capacity.
  .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:
  .1 Hazardous: red letters, white background.
  .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:
  .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:
  .1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Identification for PWGSC 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 Before starting work, obtain written approval of identification system from Departmental Representative.

.2 Label each duct with the system number of the fumehood, similar to the existing labeling system.

2.4 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stenciled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: back or coordinated with base colour to ensure strong contrast.

2.5 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.

2.6 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.

2.7 LANGUAGE

.1 Identification in English.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TIMING

.1 Provide identification only after painting has been completed.

3.3 INSTALLATION

.1 Provide ULC or CSA registration plates as required by respective agency.

.2 Identify systems, equipment to conform to PWGSC PMSS.

3.4 NAMEPLATES

.1 Locations:
.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:
.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:
.1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

3.7 CLEANING

.1 Cleaning in accordance with Section 23 05 00.

PART 1 GENERAL

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 RELATED REQUIREMENTS

.1 Section 23 05 93.13 Testing, Adjusting and Balancing of Fume Hoods.

1.3 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-1-2016.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-2005.

.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.

1.4 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.

1.5 EXCEPTIONS

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

1.6 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.

.3 TAB shall be performed following the completion of each fume hood batch.

1.7 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.

1.8 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.

1.9 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.

1.10 START OF TAB

.1 Notify Departmental Representative 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, and caulking.

.5 Pressure, leakage, other tests specified elsewhere Division 23.

.6 Provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 Outlets installed, volume control dampers open.

1.11 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 Laboratory HVAC systems: plus 10 %, minus 0 %.

1.12 ACCURACY TOLERANCES

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

1.13 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.

1.14 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit, prior to commencement of TAB:

.1 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.15 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.

1.16 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

1.17 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.

1.18 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.

1.19 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

1.20 AIR SYSTEMS

.1 Standard: TAB to most stringent of this section, TAB standards of AABC, NEBB, SMACNA, and ASHRAE.

.2 Do TAB of following systems, equipment, components, controls: and systems, equipment, components, controls specified Division 23.

.1 HPF-01.

.3 Qualifications: personnel performing TAB qualified to standards of AABC and NEBB.

.4 Quality assurance: perform TAB under direction of supervisor qualified by NEBB and AABC.

.5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.21 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

.2 Laboratory fume hoods:

.1 Standard: ASHRAE 110 and PWGSC MD15128-2013.

.2 TAB procedures: as described in Section 23 05 93.13 Testing, Adjusting and Balancing of Fume Hoods and standard.

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 23 05 00 - Common Work Results for HVAC.

.2 The scope of fume hood test is for the 16 existing fume hoods to be connected to the new central exhaust system. The test and certification activities shall be carried out in phases as outlined in the tender document including design drawings and after the construction completion of each phase. Prior to the completion of test and certification of one phase, the work cannot be started for the next phase.

1.2 REFERENCE STANDARDS

.1 Public Works and Government Services Canada (PWGSC)
  .1 PWGSC MD15128-2013, Laboratory Fume Hoods.

.2 American National Standards Institute (ANSI)
  .1 ANSI/ASHRAE Std 110-2016, Method of Testing Performance of Laboratory Fume Hoods.
  .2 ASSP/AIHA Z9.5-2012, Laboratory Ventilation.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 23 05 00.
  .1 Submit proof of qualifications of test agency in accordance with requirements of this Section.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 23 05 00.
  .1 Submit reports of all tests performed in accordance with requirements of this Section and include report in O&M manual submission.

1.5 QUALITY ASSURANCE

.1 Test Agency: fume hood tests to be performed by qualified independent testing agency with proven experience in Work of this Section and in accordance with PWGSC MD15128.

.2 Test Agency Qualification: submit proof of qualifications to Departmental Representative to demonstrate:
  .1 Minimum 3 years experience in testing of fume hoods.
  .2 Attendance at laboratory HVAC design course, by US Eagleson Institute or equivalent.
  .3 Attendance at ASHRAE 110 Testing Workshop, by US Eagleson Institute or Fume Hood Testing Seminar for Certified Professionals by National Environmental Balancing Bureau (NEBB).
  .4 TAB contractor and technician working on this project shall hold NEBB certification for fume hood performance testing, adjusting and balancing of environmental systems.
  .5 Full comprehension of the contents of MD 15128: Laboratory Fume Hoods.

PART 2 - PRODUCTS

2.1 TESTING EQUIPMENT

.1 Test equipment to ASSP/AIHA Z9.5 and PWGSC MD 15128 Table 6-6.

.2 Data logger:
- .1 Speed: Minimum 0.5 seconds or better.
- .2 Memory: Minimum 900 data points, and sufficient to allow data collection for duration of test.

.3 In-duct flow sensor to measure flow response:
- .1 Speed: 10 Hz.
- .2 Range: 95 L/s to 950 L/s.
- .3 Accuracy: ± 5%.

.4 Thermal anemometer:
- .1 Mounting: on stand with probe fixed at each traverse grid location.
- .2 Include: averaging function over twenty second period for each location or output recorded for 20 seconds minimum at a rate of one reading/second on data logger.
- .3 Range: 0.25 to 2.0 m/s.
- .4 Accuracy:
  - .1 Below 0.50 m/s: ± 0.025 m/s.
  - .2 0.50 m/s and over: ± 5%.
- .5 Time Constant:
  - .1 For face velocity: 20 seconds.

.5 Detector for tracer gas containment:
- .1 Type: continuous reading.
- .2 Minimum Detectable Level (MDL): 0.01 ppm.
- .3 Range: up to 100 ppm.
- .4 Accuracy: concentrations below 0.1 ppm: ±25%; concentrations above 0.1 ppm: ±10%.

.6 Smoke generator:
- .1 Use smoke generator and diffuser complying with PWGSC MD15128.

PART 3 - EXECUTION

3.1 AS INSTALLED (AI) AND INTEGRATED SYSTEMS TESTS

.1 Perform AI tests as follows:
- .1 After entire laboratory HVAC and exhaust systems have been tested and balanced (TAB), and TAB and Performance Verification (PV) reports have been submitted and accepted.
- .2 HVAC and exhaust systems are in full operation.
- .3 Room temperatures are maintained between 22 degrees C and 24.5 degrees C., recorded and submitted with fume hood test documentation.
- .4 At specified laboratory space pressurization.
- .5 Under deviation of space pressurization due to laboratory door opening and closing, change of laboratory operating modes, upset conditions, and other causes of change in laboratory air pressure.

.2 After installation, test each fume hood to ANSI/ASHRAE 110 and PWGSC MD15128 at design sash position to ensure compliance with design criteria in PWGSC MD15128.

.3 CAV fume hood testing should commence only after cross draft testing has been completed, including corrective measures if required.

.4 Perform the following CAV fume hood tests:
1. Face velocity
2. Bypass effectiveness
3. Visualization
4. Tracer gas—design sash position
5. Tracer gas—peripheral scan
6. Tracer gas—sash movement effect
7. Monitor/alarm accuracy and enunciation
8. Static pressure drop
9. Noise level

3.2 "AI" TESTS FOR CAV BYPASS AND FUMEHOODS

.1 Cross draft tests:
- .1 Test air currents external to fume hood to PWGSC MD15128.
- .2 Ensure velocity of cross draft does not exceed 0.25 m/s average face velocity.
- .3 Record measurements as follows:
  - .1 Using thermal anemometer take readings 1.5 m above floor, 500 mm from sash, at centre, and left and right posts of fume hood.
  - .2 Take readings at 1 reading/second, recorded to obtain average, and maximum and minimum values over a duration of 20 seconds at each location.
  - .3 Ensure that departmental representative reduces excessive values to less than 0.25 m/s average face velocity before proceeding with further fume hood testing.

.2 Visualization (smoke) tests:
- .1 Extent of tests and performance criteria: to PWGSC MD15128.

.3 Face velocity and flow response test pass ratings: to PWGSC MD15128 and ANSI/ASHRAE 110.
- .1 Average face velocity for CAV bypass fume hoods: 0.5 m/s± 0.02 m/s
- .2 Variation allowed for individual readings: ± 20% of average.
- .3 CAV bypass effectiveness at 150 mm sash opening; 1.25 m/s maximum average face velocity.

.4 Tracer Gas tests:
- .1 Performance criteria: to PWGSC MD15128.
- .2 Conduct tests at target average face velocity.
- .3 Use approved tracer gas.
- .4 Perform tests with probe at height of 660 mm above work surface.
- .5 Leakage with sash at normal operating position:
  - .1 Average leakage: <0.05 ppm.
  - .2 Peak reading: <0.25 ppm.
- .6 Peripheral scan:

.1 Record significant peak readings and their locations.
.2 Record 30 second rolling averages.
.3 Maximum 0.25 ppm for any 30 second rolling average.
.4 Include readings in test report.

.7 Sash Movement Effect (SME), to determine potential for escape after movement of sash to ANSI/ASHRAE 110 procedures:
.1 Maximum 45 second rolling average: <0.05 ppm.

3.3 FUME HOOD MONITOR AND ALARM TESTS

.1 Fume Hood Monitor:
.1 Provide 3-point calibration.
.2 Ensure each monitor initiates alarms (audible, visual, and BMS) when unsafe velocity conditions occur.
.3 Ensure monitor readings are displayed in meters per second, to 2 decimal places.

.2 Fume Hood Monitor/Alarm testing:
.1 Monitor accuracy test: ensure monitor is accurate within 5% of average face velocity.
.2 Alarm enunciation test: ensure alarm occurs beyond ±10% of design flow set point.
.3 Alarm response enunciation test: ensure alarm delay is 10 seconds maximum.

3.4 FUME HOOD STATIC PRESSURE TEST

.1 With sash at design position and face velocity at target setting, fume hood static pressure: less than 62 Pa.

3.5 NOISE LEVEL TEST

.1 With sash at design position and face velocity at target setting, noise level at working position in front of fume hood: less than 70 dBA.

3.6 VERIFICATION LABELS

.1 Affix label to front of fume hood indicating verification, name of testing agency, and date.

3.7 REPORTS

.1 Ensure test reports are signed by testing agency before submitting to Departmental Representative.

.2 Certificates and test results must be placed in the O&M Manual.

3.8 CLEANING

.1 Cleaning in accordance with Section 23 05 00.

3.9 PROTECTION

.1 Protect adjacent materials from work associated with testing and maintenance of fume hoods.

PART 1 - GENERAL

1.1 GENERAL

.1 Ducts over 5 m in length, forming part of a supply, return or exhaust ductwork system directly or indirectly connected to air handling equipment to be pressure tested for leaks.

1.2 TIMING

.1 Ducts to be tested before installation of insulation or any other form of concealments.

.2 Test after seals have cured.

.3 Test when ambient temperature will not affect effectiveness of seals, gaskets, etc.

1.3 REFERENCE STANDARDS

.1 SMACNA HVAC Air Duct Leakage Test Manual, 2012.

1.4 TEST PROCEDURES

.1 Maximum lengths of ducts to be tested to be consistent with capacity of test equipment.

.2 Section of duct to be tested to include:
.1 Fittings, branch ducts, tap-ins.

.3 Repeat tests until specified pressures are attained. Bear costs for repairs and repetition to tests.

.4 Base partial system leakage calculations on Reference Standard.

.5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

1.5 TESTING AGENCY

.1 Installing Contractor.

1.6 VERIFICATION

.1 Departmental Representative to witness tests and to verify reported results.

.2 To be certified by the same TAB agency approved by Departmental Representative to undertake TAB on this project.

1.7 TEST INSTRUMENTS

.1 Testing agency to provide instruments for tests.

.2 Test apparatus to include:
- .1 Fan capable of producing required static pressure.
- .2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.
- .3 Flow measuring instrument compatible with the orifice plate.
- .4 Calibration curves for orifice plates used.
- .5 Flexible duct for connecting to ductwork under test.
- .6 Smoke bombs for visual inspections.

.3 Test apparatus to be accurate to within +/- 3% of flow rate and pressure.

.4 Submit details of test instruments to be used to Departmental Representative at least three months before anticipated start date.

.5 Test instruments to be calibrated and certificate of calibration deposited with Departmental Representative no more than 28 days before start of tests.

.6 Instruments to be re-calibrated every six months thereafter.

1.8 SYSTEM LEAKAGE TOLERANCES

.1 System leakage tolerances specified herein are stated as a percentage of total flow rate handled by the system. Therefore, when testing sections of ductwork this acceptable leakage shall be pro-rated to entire system. Leakage for sections of duct systems shall not exceed the total allowable leakage.

.2 Leakage tests not to exceed specified leakage rates for Class B seals in accordance with SMACNA HVAC Duct Construction Standards.

.3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

1.9 EQUIPMENT LEAKAGE TOLERANCES

.1 Equipment and system components permissible leakage: as per Class B seals in accordance with SMACNA HVAC Duct Construction Standards.

1.10 REPORT FORMS

.1 Submit proposed report form and test report format to Departmental Representative for approval at least three months before proposed date of first series of tests. Do not start tests until approval received in writing from Departmental Representative.

1.11 PRESSURE TEST REPORTS

.1 Prepare report of results and submit to Departmental Representative within 24 hours of completion of tests. Include:
- .1 Schematic of entire system.
- .2 Schematic of section under test showing test site.
- .3 Required and achieved static pressures.
- .4 Orifice differential pressure at test sites.
- .5 Permissible and actual leakage flow rate (L/s) for test sites.
- .6 Witnessed certification of results.

.2 Include test reports in final TAB report.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

.2 Section 23 31 13.02 – Metal Ducts.

1.2 REFERENCE STANDARDS

.1 Definitions:
- .1 For purposes of this section:
  - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" - means "not concealed" as previously defined.
  - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
- .2 TIAC Codes:
  - .1 CRD: Code Round Ductwork,
  - .2 CRF: Code Rectangular Finish.

.2 Reference Standards:
- .1 ASTM International Inc. (ASTM)
  - .1 ASTM B209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
  - .2 ASTM C335/C335M-17, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
  - .3 ASTM C449-07(2013), Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .4 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
  - .5 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .2 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102(2018), 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 23 05 00.
- .1 Submit manufacturer's instructions, printed product literature and data sheets for products of this section 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 23 05 00.

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE RATING

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

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket (as scheduled in PART 3 of this Section).

2.3 JACKETS

.1 Canvas:
- .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .2 Lagging adhesive: compatible with insulation.

.2 Aluminum:
- .1 To ASTM B209M with moisture barrier as scheduled in PART 3 of this section.
- .2 Thickness: 0.50 mm sheet.
- .3 Finish: Smooth.
- .4 Jacket banding and mechanical seals: 19mm wide, 0.5 mm thick stainless steel.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:
- .1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:
- .1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.

.4 Outdoor Vapour Retarder Mastic:
- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².

.5 Tape: self-adhesive, aluminum, plain, 50 mm wide minimum.

.6 Contact adhesive: quick-setting

.7 Canvas adhesive: washable.

.8 Tie wire: 1.5 mm stainless steel.

.9 Banding: 19 mm wide, 0.5 mm thick stainless steel.

.10 Fasteners: 4 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PRE-INSTALLATION REQUIREMENTS

.1 Pressure test ductwork systems complete, witness and certify.

.2 Ensure surfaces are clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer’s instructions and as indicated.

.3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
.1 Ensure hangers, and supports are outside vapour retarder jacket.

.5 Hangers and supports in accordance with Section 23 31 13.02.
.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Exhaust duct inside	C-1	no	50
Round ducts outside	C-1	special	50

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

.1 Finishes: conform to following table:

	TIAC Code
Round	
Indoor	CRD/2
Outdoor	CRD/4

3.5 CLEANING

.1 Cleaning in accordance with Section 23 05 00.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

.2 Section 25 10 10 – Automatic Control System – Extend Existing EMCS

1.2 SUMMARY

.1 A Laboratory Airflow Control System (LACS) shall be furnished and installed under this section. The LACS shall be capable of operating as a standalone system or as a system integrated with the Building Management System (BMS) or Building Automation System (BAS).

1.3 REFERENCE STANDARDS

.1 International Organization for Standardization (ISO)
  .1 ISO 9001:2015, Quality management systems - Requirements.

.2 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
  .1 ASHRAE 130-2016, Laboratory Methods of Testing Air Terminal Units (ANSI Approved)

1.4 Abbreviations and Acronyms

.1 BMS – Building Management System

.2 BAS – Building Automation System

.3 LACS – Laboratory Airflow Control System

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination
  .1 The LACS representative shall coordinate all details of the installation with the Contractor. This effort shall include complete coordination of the sheet metal layout drawings to assure that the ductwork layout and sizing is based on the actual sizes of the airflow control valves for this project.

.2 Pre-installation Meetings
  .1 The LACS representative shall review the proper installation of the system with the Contractor.
  .2 Project Installation Phase – The LACS representative shall make periodic visits to the project jobsite to assure that the system is being installed properly to assure optimal performance and that the location and orientation of the control valves is consistent for proper operation and future maintenance. Any discrepancies shall first be brought to the attention of the Contractor. If no action is taken by the contractor, the LACS representative shall bring these issues to the Departmental Representative for resolution.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 23 05 00.
  .1 Submit manufacturer's instructions, printed product literature and data sheets for products of this section and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submittals shall contain, at a minimum, the following information:
.1 Product Data Sheets
.1 Equipment Schedule Sheets containing Room#, Tag#, Min/Max flows, Catalog# and other configuration data as required to provide a fully engineered LACS.
.2 Installation Instructions
.3 Project-specific Wiring Diagrams
.4 Points Lists

1.7 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 23 05 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for all newly installed equipment of this section for incorporation into manual.
.1 Include as-built wiring diagrams and component lists for LACS.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 23 05 00.

1.9 QUALITY ASSURANCE

.1 Certifications
1. The laboratory airflow system provider shall be an entity that designs, develops, manufactures and sells products and services to control the environment and airflow of critical spaces using a Quality Management System registered to ISO 9001:2008.
2. The Laboratory airflow system provider shall be ROHS compliant in all its products
3. The Venturi valves shall be calibrated on NVLAP accredited air stations.

.2 Once the integration to the BMS or BAS is completed, perform a final acceptance test of the integration, with the presence of the Contractor and LACS representative. This testing shall include:
.1 Testing points to ensure communication
.2 Testing setpoints such as temperature, occupancy, room offset, etc.
.3 Testing various alarms in different parts of the system
.4 Testing to ensure that equipment will cycle after a power loss

1.10 WARRANTY

.1 The Warranty shall commence upon the date of shipment and extend for a period of 60 months for all airflow control devices and 36 months for all other control system components.

PART 2 - PRODUCTS

2.1 LABORATORY AIRFLOW CONTROL SYSTEMS

.1 A LACS shall be furnished and installed to control the airflow into and out of laboratory rooms. The LACS shall be capable of operating as a standalone system or as a system integrated with the Building Management System (BMS).

2.2 COMPONENTS

.1 The airflow at the fume hood shall be constant, with a fixed face velocity through the hood sash opening, and the balance of the air being pulled from the hood bypass damper.

2.3 AIRFLOW CONTROL DEVICE

.1 The airflow control device shall be a pressure independent venturi valve.

.2 The valve assembly manufacturer's Quality Management System shall be registered to ISO 9001:2008.

.3 Airflow control device shall be OSHPD tested and certified per 2013 CBC, 2012, IBC, ASCE 7-10, and ICC-ES-AC-156.

.4 All Components of the valve, its controllers, and wiring shall be ROHS compliant.

.5 The airflow control device shall be mechanically pressure independent over its specified differential static pressure operating range. An integral pressure independent assembly shall respond and maintain specific airflow within one second of a change in duct static pressure irrespective of the magnitude of pressure and/or flow change (within product specifications) or quantity of airflow controllers on a manifolded system.

.6 The airflow control device shall maintain accuracy within ±5% of signal to set point over an airflow turndown range of no less than 16 to 1.

.7 No minimum entrance or exit duct diameters shall be required to ensure accuracy and/or pressure independence.

.8 No rotational/axial orientation requirements shall be required to ensure accuracy and/or pressure independence.

.9 The airflow control device shall maintain pressure independence regardless of loss of power. "Electronically pressure independent" devices will not be acceptable.

.10 Airflow control devices utilizing ASHRAE 130 minimum operating pressure as a rating for minimum design pressure at required flow will not be acceptable on basis on minimum operating pressure alone. Valve manufacturer will provide minimum required differential pressure in writing for each size valve they offer.

.11 Airflow control device shall be able to achieve its maximum turndown ratio at its stated minimum operating differential pressure. I.E. if minimum operating pressure is 0.6" wc dp, a 10" air valve must be able to achieve its minimum of 50cfm and its maximum of 1000 cfm at stated 0.6" wc dp. Devices that require duct static pressure to be increased to achieve maximum flow shall not be acceptable.

.12 The airflow control device shall be constructed as a Class D device for extremely corrosive airstreams, such as acid digestion fume hoods, and shall have a PVDF (polyvinylidene fluoride fluoropolymer) coating. The device's shaft shall be made of 316 stainless steel with a Teflon coating. The shaft support brackets shall be made of 316 stainless steel with PVDF coating. The pivot arm and internal mounting link shall be made of 316 or 303 stainless steel with PVDF coating. The pressure independent springs shall be a spring-grade stainless steel with Teflon (PTFE) coating. The internal nuts, bolts and rivets shall be stainless steel with PVDF coating. All shaft bearing surfaces shall be made of Teflon or PPS (polyphenylene sulfide) composite. Only devices clearly defined as “extremely corrosion resistant” on project drawings will require this construction.

.13 Actuation

.1 A CE certified, UL Listed, IP56 rated for dust and water, high-speed electronic actuator shall be factory mounted to the valve. Loss of main power shall cause the valve to position itself in a normally open-maximum position. This position shall be maintained constantly without external influence, regardless of external conditions on the valve (within product specifications).
In fail safe conditions the Airflow Control Device must remain pressure independent and in control of airflow at its failed position. I.E. if a device fails in position at 500 cfm, the airflow control device must remain pressure independent regardless of having power/controller operating and will deliver the 500cfm at that given control point regardless of duct pressure. Airflow control devices with single or dual blades that fail in position or fail open will not be acceptable as the airflow delivered cannot be guaranteed due to device not being mechanically pressure independent.

.2 During normal operation, the high speed actuated airflow control device shall initiate valve movement and achieve the commanded airflow value with no more than 5% overshoot or undershoot within 1 second or less.

.14 The controller for the airflow control devices shall be microprocessor based and operate using peer-to-peer control architecture.

.15 The LACS shall have the option of digital integration with the BMS or BAS. If digital integration device is lost or offline or fails, then the valve controllers shall have distributed controllability and will keep the basic room functions of zone balance operating to maintain a safe and comfortable zone.

.16 NVLAP Accreditation (Lab Code 200992-0)

.1 Each airflow control device shall be factory characterized on air stations NVLAP Accredited (a program administered by NIST) to ISO/IEC 17025:2005 standards.

.2 Each airflow control device shall be factory characterized to the job specific airflows as detailed on the plans and specifications using NVLAP Accredited air stations and instrumentation having a combined accuracy of no more than ±1% of signal (5,000 to 250cfm), ±2% of signal (249 to 100cfm) and ±3% of signal (199 to 35cfm). Electronic airflow control devices shall be further characterized and their accuracy verified to ±5% of signal at a minimum of 48 different airflows across the full operating range of the device.

.3 Each airflow control device shall be marked with device-specific factory characterization data. At a minimum, it should include the room number, tag number, serial number, model number, eight-point characterization information (for electronic devices), date of manufacture and quality control inspection numbers. All information shall be stored by the manufacturer for use with as-built documentation. Characterization data shall be stored indefinitely by the manufacturer and backed up off site for catastrophic event recovery.

2.4 AIRFLOW DEVICE CONTROLLER

.1 The airflow control device shall be a microprocessor-based design and shall use closed loop control to linearly regulate airflow based on a digital control signal. The device shall generate a digital feedback signal that represents its airflow.

.2 During normal operation the airflow control device shall initiate valve movement and achieve the commanded airflow value with no more than 5% overshoot or undershoot within 1 second or less with high speed actuation.

.3 The airflow control device shall store its control algorithms in non-volatile, re-writeable memory. The device shall be able to stand-alone or to be networked with other room-level digital airflow control devices using an industry standard protocol.

.4 The airflow control device shall use industry standard 24 VAC power.

.5 The airflow control device shall have built-in integral input/output connections that can address fume hood control, temperature control, humidity control occupancy control, emergency control, and non-network sensors switches and control devices. At a minimum, the airflow controller shall have:

.1 Three universal inputs capable of accepting 0 to 10 VAC, 4 to 20 mA, 0 to 65 K ohms, or Type 2 or Type 3 10 K ohm @ 25 degree C thermistor temperature sensors.

.2 One digital input capable of accepting a dry contact or logic level signal input.

.3 Two analog outputs capable of developing either a 0 to 10 VAC @ 1 mA (10Kohm min) or 4 to 20 mA (500 ohm max) linear control signal.

.4 One Form C (SPDT) relay output capable of driving up to 1 A @ 24 VAC/VAC.

.6 The airflow control device shall meet FCC Part 15 Subpart J Class A, CE, and CSA Listed per file #228219.

.7 The airflow control device shall be ROHS compliant.

2.5 WIRING

.1 Install all wiring in conduit as specified in Section 25 10 10.

2.6 OPERATION SEQUENCES

.1 The airflow control devices shall utilize peer-to-peer, distributed control architecture to perform control functions. Master-slave control schemes shall not be acceptable. Control functions shall include, at a minimum, volumetric offset pressurization, as well as respond to hood flow demands.

.2 Provide alarm signals to the BAS from the airflow control device in the event the airflow device is unable to achieve the design airflow rate, there is a loss of static pressure indicating improper fan operation, or there is a loss of power to the airflow control device.

.3 The laboratory control system shall be segregated into subnets to isolate network communications to ensure room-level control functions and BMS communications are carried out reliably.

.4 All points shall be available through the interface to the BMS for trending, archiving, graphics, alarm notification and status reports. LACS performance (speed, stability and accuracy) shall be unaffected by the quantity of points being monitored, processed or controlled.

2.7 INTERFACE TO BUILDING MANAGEMENT SYSTEMS

.1 The LACS network shall have the capability of digitally interfacing with the BMS. The required software interface drivers shall be developed and housed in one or more dedicated interface devices furnished by the LACS supplier.

.2 Integration Points
As a minimum, the device shall provide these integration points.

Table 1. Integration Points

Point Name	**Description**	**Data Type**
EFF_VLV_FLOW_CMD	Valve flow set point	AO
VLV_FLOW_FDBK	Valve flow feedback	AI
LOW_AIR	Low Airflow Alarm	DI
LOW_STATIC	Low Static Pressure Alarm	DI
NO_POWER	Loss of Power to Airflow Control Device	DI

.3 LACS critical environment integration shall support distributed network architecture from LON FTT-10 bus to a dedicated BACnet MS/TP segment, building BACnet/Ethernet, or BACnet/IP building backbone using single or multiple IP addresses. Backbone communication protocol must be field selectable/upgradable.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 The contractor shall install an appropriately sized and fused 24 VAC transformer suitable for NEC Class II wiring.

.2 All cable shall be furnished and installed by the contractor. The contractor shall terminate and connect all cables as required. The contractor shall utilize cables specifically recommended by the LACS supplier.

.3 The contractor shall install all airflow control devices in the ductwork and shall connect all airflow control valve linkages.

3.2 SYSTEM START UP

.1 Start-up shall provide electronic verification of fume hood exhaust airflow, system programming and integration to BMS.

.2 The contractor shall be responsible for final verification and reporting of all airflows. For all field flow measurement devices the balancer shall produce a flow report that documents field flows vs device flow and associated error. This to be tabulated for each device location at several flows including min and max. Cost and responsibility to meet the specified performance to be carried by the LACS.

3.3 CLOSEOUT ACTIVITIES

.1 Training

.1 The LACS supplier shall furnish a minimum of eight hours of owner training by factory trained and certified personnel. The training will provide an overview of the job specific airflow control components, verification of initial fume hood monitor calibration, general procedures for verifying airflows of air valves and general troubleshooting procedures.

.2 Operation and maintenance manuals, including as-built wiring diagrams and component lists, shall be provided for each training attendee.

3.4 CLEANING

.1 Cleaning in accordance with Section 23 05 00.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 07 84 00 – Fire Stopping.

.2 Section 23 05 00 - Common Work Results for HVAC.

.3 Section 23 05 17 – Pipe Welding.

.4 Section 23 05 94 - Pressure Testing of Ducted Air Systems.

1.2 REFERENCE STANDARDS

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.1 ASTM International (ASTM)
- .1 ASTM A480/A480M-18a, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, ANSI/SMACNA 012-2006.
- .2 SMACNA HVAC Air Duct Leakage Test Manual, ANSI/SMACNA 016-2012.

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 new work and include product characteristics, performance criteria, physical size, finish and limitations.

.3 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: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 23 05 00.

PART 2 - Products

2.1 DUCTWORK

.1 Material:
- .1 To ASTM A480/A480M, Type 316.
- .2 Finish: number 4.
- .3 Thickness, fabrication and reinforcement: to ASHRAE.
- .4 Joints, Seams: to be continuous inert gas welded.

.2 Construction: round.
- .1 Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA.
- .2 Transverse joints up to 900 mm: continuous inert gas welded.
- .3 Transverse joints over 900 mm: continuous inert gas welded.
- .4 Fittings:
  - .1 Elbows: smooth radius. Centreline radius: 1.5 x diameter.
  - .2 Branches: conical transition with conical branch at 45 degrees and 45 degrees elbow.

.3 Construction: rectangular:
- .1 Ducts: to SMACNA
- .2 Transverse joints: welded.
  - .1 All ductwork shall be welded unless indicated otherwise.
- .3 Fittings:
- .4 Joints, Seams: to be continuous inert gas welded.
  - .1 Elbows: smooth radius; centreline radius 1.5 x width of duct. No vanes.
  - .2 Branches: with conical branch at 45 degrees and 45 degrees elbow.

.4 Fire stopping:
- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00.
- .2 Coordinate with 07 84 00 to ensure fire stopping materials and installation does not distort duct.

2.2 SEALED CLASSIFICATION

.1 Lab exhaust ductwork to be all-welded construction to requirements of Section 23 05 17.

2.3 SEALANT

.1 Oil resistant, water-borne polymer type flame resistant high velocity duct sealing compound.
- .1 Temperature range of minus 30 degrees C to plus 93 degrees C.

2.4 TAPE

.1 Tape: polyvinyl treated, open weave fibre glass, 50 mm wide.

2.5 HANGARS AND SUPPORTS

.1 Hangers and supports:
  .1 Band hangers: use on round and oval ducts up to 500 mm diameter, of same material as duct but next sheet metal thickness heavier than duct.
  .2 Trapeze hangers: ducts over 500 mm diameter or longest side, to ASHRAE.
  .3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE.
  .4 Upper hanger attachments:
    .1 For concrete: manufactured concrete inserts.
    .2 For steel joist: manufactured joist clamp or steel plate washer.
    .3 For steel beams: manufactured beam clamps:

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 metal duct 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 GENERAL

.1 Do work in accordance with ASHRAE.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.
  .1 Visually inspect substrate in presence of Departmental

.3 Support risers in accordance with SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

3.3 HANGERS

.1 Band hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.4 SEALING AND TAPING

.1 Apply sealant in accordance with to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturer's recommendations.

3.5 LEAKAGE TESTS

.1 Refer to Section 23 05 94.

.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Perform leakage tests in sections.

.4 Perform trial leakage tests, as instructed to demonstrate quality of work.

.5 Do not install additional ductwork until trial tests have been achieved.

.6 Test section minimum of 30 m long with not less than 3 branch takeoffs and two 90 degrees elbows.

.7 Complete tests before performing insulation or concealment Work.

3.6 CLEANING

.1 Cleaning in accordance with Section 23 05 00.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)
- .1 ANSI/AMCA Standard 204-05(R2012), Balance Quality and Vibration Levels For Fans.
- .2 ANSI/AMCA Standard 210-16, Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.
- .3 ANSI/AMCA Standard 211-13(REV.10-18), Certified Ratings Program - Product Rating Manual for Fan Air Performance.
- .4 ANSI/AMCA Standard 300-14, Reverberant Room Method for Sound Testing of Fans.
- .5 ANSI/AMCA Standard 311-16, Certified Ratings Program Product Rating Manual for Fan Sound Performance.

.2 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.3 ASTM International (ASTM)
- .1 ASTM B117-18, Standard Practice for Operating Salt Spray (Fog) Apparatus.
- .2 ASTM D2247-15, Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
- .3 ASTM D2794-93(2019), Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 23 05 00.
- .1 Submit manufacturer's instructions, printed product literature and data sheets for products of this section and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 23 05 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for all newly install equipment of this section for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 23 05 00.

PART 2 - PRODUCTS

2.1 DESCRIPTION

.1 Provide factory assembled fume hood exhaust fans with air handling unit casing in configuration as indicated on drawings with fan motors, belts and drives outside the exhaust air stream for easy maintenance access without fan shutdown and/or decontamination requirement. Unit shall include all specified components installed at the factory. Field fabrication of units and their components will not be accepted.

.2 The unit shall be designed to be supported by a perimeter structure.

.3 Units too large to fit on a standard tractor trailer may be shipped to site in sections. Otherwise units shall be shipped in one piece.

.4 The common exhaust plenum shall be designed to provide stable static pressure control to accommodate multiple exhaust ducts connections as outlined on the design drawings and to be separated with fan motors compartment with sealed construction. Manufacturer shall indicate the proposed static pressure sensor location on shop drawing submission.

.5 Physical limitations: refer to the equipment schedule on design drawings for maximum unit weight and physical dimensions.

2.2 ACOUSTICAL PERFORMANCE

.1 Published acoustical performance for the air handling unit shall be verified by an independent testing laboratory and proven during the shop drawing submission.

.2 Sound power shall not exceed the following, when operating with one fan in use. Note that regular operation uses two fans in tandem:
 .1 100% airflow, at bypass damper inlets: 84 dBA
 .2 100% airflow, at fan assembly discharge: 84 dBA
 .3 60% airflow, at bypass damper inlets: 74 dBA
 .4 60% airflow, at fan assembly discharge: 80 dBA

2.3 CASING

.1 Walls and roofs shall be constructed of 16 gauge galvanized steel 100mm thick acoustic thermal panels. The inner liner shall be 22 gauge solid 316 stainless steel. Insulation shall be 100mm thick 1.81 kg density mineral fiber. Provide mylar liner to seal insulation in sections with perforated panels. All permanently joined flanged panel surfaces shall be sealed with an individual strip of 3.175mm X 9.525mm tape sealer. Wall (and roof) seams shall be turned inward to provide a clean flush exterior finish. All panel seams shall be sealed during assembly to produce an airtight unit.

.2 Outdoor units shall have roof panels broken outward to provide a lapped joint watertight seal. Outdoor roofs shall be sloped a minimum of 15.875 mm away from the access side.

.3 On outdoor units, screws and other similar fastening devices shall not penetrate the roof deck or the top of standing seems.

2.4 INSULATION

.1 All insulation used in air handling unit walls, roof and base shall have a Flame spread rating of less than 25 and a Smoke Developed rating of less than 50 per ASTM E84 and UL 723 and Can/ULC S102-M88.

.2 Insulation shall meet NFPA 90A and 90B.

2.5 STRUCTURAL BASE CONSTRUCTION

.1 Units shall be constructed from a minimum C6x8.2 lb./sq.ft. channel structural steel perimeter base, with 2x2x1/4 intermediate structural steel channel and angle iron supports. Perimeter structural steel base shall be designed to directly support the weight of the walls. Intermediate structural steel and angle iron shall support the weight of all internal components (i.e. fans, coils, enthalpy wheels, etc.). Maximum base deflection shall be 6.35mm on unsupported spans of 3658mm. Structural steel base shall be designed so that it can be point loaded or set on an unlevel surface and shimmed by the contractor within 3658mm spans without deflecting more than 6.35mm. The structural steel base shall be either I-beam construction or C-channel (not box channel) so that the base will shed all water. Base shall be provided with lifting lugs, minimum four (4) per shipping split. Formed metal bases formed from sheet metal will not be acceptable. Base shall prevent wall panel joints from separating during lifting, transportation and rigging.

.2 Lifting lugs shall be located and engineered to properly support the loads within. Manufacturers shall provide a load point calculation along with detailed lifting lug information as part of the shop drawing package.

.3 A 3.048mm thick aluminum checker plate floor shall be installed on the base. Floor seams shall be continuously welded providing a completely flat unit floor. Standing seems will not be accepted in any section. Steel checker plate floor shall be coated with grey epoxy paint. A 38.1mm perimeter collar shall be provided to ensure the unit is internally watertight. The collar shall be alternately screwed down and tack welded to the unit base on one (1) foot centers. Caulk joint to be watertight.

.4 The base shall be insulated with 76.2mm thick, 0.68 kg density fibreglass insulation and sheeted with a 22 gauge galvanized steel liner. The base liner shall be broken, tack welded and sealed for rigidity and vapour barrier integrity.

2.6 ACCESS DOORS

.1 Access door construction and width shall match the rest of the unit casing. Corners shall be welded for rigidity. Spot welding of corner seems will not be accepted. 1.81 kg density insulation shall be sandwiched between the outer and inner skins. A 254mm x 254mm (double pane) tempered glass window shall be provided in each door.

.2 Provide Two chrome plated "Ventlok" Model #310 high pressure latches operable from either side of the door. Hinges shall be continuous piano type stainless steel. Door openings shall be fully gasketed with continuous 12.7mm closed cell hollow round black gasket with a metal encapsulated reinforced backing that mechanically fastens to the door opening perimeter. Door frames shall be framed from 16 gauge galvanized steel with the outside of the door flush to the unit. Minimum door width shall be as shown on the plans but in no case shall an access door be less than 457mm. Door height shall be the maximum permitted by the height of the unit up to 1829mm.

.3 Doors shall open against positive pressure.

2.7 FANS

.1 All fans shall be tested in accordance with AMCA Standards 210-70 and 310 Test Codes for Air Moving Devices. Backward inclined fans shall bear the AMCA sticker for both air and sound performance.

.2 Fans shall be selected in accordance with ASHRAE application guidelines. All manufacturers shall submit plume height calculations based on discharge velocities which are calculated using the outlet area at the exit of the windband or discharge cone. Plume calculations based on fan discharge velocities upstream of the windband, or nozzle outlet velocities will not be accepted. Submit calculations for Departmental Representative review. Calculations based on 2007 guidelines will not be accepted.

.3 Fan Wheels and Shafts: Provide air foil blades on all fans wheels. Provide forward curved blades where scheduled. Provide solid shafts keyed to the fan wheel. Coat fan shaft with rust inhibitor. Hollow shafts will not be acceptable.

.4 Fans scroll housing and impeller shall be made of 316SS. Each fan shall have a backdraft shutoff damper at its inlet, damper shall be made of 316SS. All components exposed to the airstream shall be made of 316SS.

.5 Fan bearings shall be self aligning pillow block, grease lubricated, extra heavy duty anti-friction ball or spherical roller type selected for an L10 life of 200,000 hours at design operating conditions. Bearings are to be mounted on the integral fan scroll bracing. (Provide an easily removable 610mm" x 610mm" access panel in the unit casing adjacent to the motor side bearing for ease of fan shaft/bearing replacement).

.6 Fan and motor shall be mounted on an all welded, structural steel, prime coated and internal isolation base. The outlet of the fan shall be separated from the unit casing by means of a factory installed flexible connection. The internally mounted motor shall be provided on a slide rail base to allow proper adjustment of belt tension.

.7 Provide an OSHA approved fully enclosed metal belt guard having side of galvanized steel and expanded metal face. Belt guard shall be sized to allow either sheave to be increased by two sizes.

.8 Provide fixed pitch sheaves rated at 150% of motor nameplate H.P. Allow for one (1) drive change for air balancing purposes (parts only, labour by air balancer).

.9 On air handling units with variable speed drives, (flush) mount the VSD on the unit. Factory wire between the VSD and fan motors. Ensure all casing penetrations are sealed to be air tight. Provide a terminal block within the VSD for field termination of line side wiring. (The VSD shall not increase the width of the AHU).

.10 Provide plenum fan inlets on the fan wall and air outlets from the casing with a smooth bellmouth fitting with radius to match casing thickness, and free of protruding structural members and flanges.

.11 Plenum fan assembly must have an enclosed safety screen as per OSHA Standards.

2.8 DILUTION NOZZLE

.1 Unit shall incorporate a double concentric accelerator fiberglass reinforced plastic (FRP) induction nozzle selected for optimal performance per the plans and specifications. Nozzles shall be mounted on top on the unit, in line with the fans inside the unit. Nozzle shall be constructed and designed to avoid extreme variations in velocity flows across the outlet, even against wind loading. Where required, CFD shall be provided demonstrating this on submitted nozzle. Bifurcated designs shall not be allowed.

.2 Induction nozzle shall be constructed and designed to efficiently handle up to 35.56 m/s outlet velocity and shall have an optimally matched accelerator for the specified design conditions.

2.9 MOTORS

.1 Motors shall be designed for severe duty in accordance with IEEE 841 standards and shall meet NEMA MG1 Part 31. Motors shall be operable at 575 Volts, 60 Hz, 3-phase.

.2 Motor enclosure shall be totally enclosed fan cooled and rated to IP55. A non metallic cooling fan shall be provided. Frame, end bells and fan cowl shall be manufactured of heavy duty cast iron. The end plates shall be sealed to the frame joints. Enclosure shall be epoxy coated and rated for ASTM B117-90 96 hour salt spray test.

.3 Motor windings shall have class F insulation with class B temperature rise ratings. Windings shall be 200C inverter spike resistant wire. Motor windings shall withstand 2000V transients. Motor service factor shall be 1.15 on sine wave power and 1.0 on VFD power.

.4 Bearings shall be regreasable without disassembly and provide for the elimination of purged grease. Bearing life shall be a minimum of L10 at 50000 hours.

.5 Motors shall be balanced to less than 0.08 inches per second (filter out) and the vibration test data shall be shipped with the motor.

.6 Nameplates shall be stainless steel and contain both NEMA data and bearing data.

.7 Motors used with variable frequency drives shall be provided with a brush system to electrically ground the shaft and discharge any induced voltage on the motor shaft, with a direct path to ground.

.8 Motor shall be provided with a 3 year warranty.

2.10 VIBRATION ISOLATION

.1 An integral all weld steel vibration isolation base shall be provided for the fan and motor.

.2 Provide open spring mounts with iso stiff springs, sound deadening pads and leveling bolts.

.3 Horizontal stiffness shall be equal to vertical stiffness.

.4 Spring deflection shall be 50mm.

.5 Isolators shall have earthquake restraints. Upon request, the unit manufacturer shall submit a restraint detail certified by a professional engineer.

2.11 LIGHTS

.1 Marine lights with protective cast metal cage and glass globes complete with duplex receptacles shall be installed on the wall beside the access doors. One (1) switch with an indicator light shall be installed on the exterior of the unit. Factory wire from switch to all lights in EMT conduit with liquid tight connections. At all split sections, provide a 305mm long piece of flexible conduit, with the extra wire spooled, for reconnection on site by the installing contractor. Electrical power shall be 120V/1/60.

2.12 LOUVERS

.1 Louver blades shall be fixed on a 45° angle. Blades shall be 100mm wide, made of extruded aluminum construction.

.2 Bird screen shall be galvanized mesh with 12.7mm x 12.7mm openings and shall be fixed to the rear with cadmium plated screws.

.3 Finish shall be natural mill finish.

2.13 HOODS

.1 Fresh air (and exhaust air) hoods shall be provided complete with 12.7mm x 12.7mm birdscreen and finished to match the unit. A rain gutter shall be provided on all edges of the hood. Outside air hoods shall be sized for maximum inlet velocity of 3.05m/s.

2.14 ALUMINUM AIRFOIL DAMPERS

.1 Aluminum airfoil frames and blades shall be a minimum of 12 gauge extruded aluminum. Blades to be 152mm wide single air foil design.

.2 Frames shall be extruded aluminum channel with grooved inserts for vinyl seals. Standard frames 51mm x 102mm x 15.9mm on linkage side, 25.4mm x 102mm x 25.4mm on the other sides.

.3 Pivot rods shall be 11.11mm hexagon extruded aluminum interlocking into blade section. Bearings to be double sealed type with a Celcon inner bearing on a rod within a Polycarbonate outer bearing inserted into frame so that the outer bearing cannot rotate.

.4 Bearing shall be designed so that there are no metal-to-metal or metal-to-bearing riding surfaces. Interconnecting linkage shall have a separate Celcon bearing to eliminate friction in linkage.

.5 Blade linkage hardware is to be installed in frame out of airstream. All hardware to be on non-corrosive reinforced material or cadmium plated steel.

.6 Damper seals shall be designed for minimum air leakage by means of overlapping seals.

.7 Internal hollows shall be insulated with 22.2mm thick polyurethane foam with R factor of 5.0 per inch. Blades shall be 100% thermally broken. Frame shall be insulated with polystyrene, R factor of 5.0 per inch.

.8 Damper blades shall be maximum 1016mm long per section.

.9 Dampers greater than 2 sections wide shall be provided with a jackshaft.

2.15 DAMPER OPERATORS

.1 Provide factory installed electric damper operators with all linkage and hardware internally mounted.

.2 Ensure operators are mounted in easily accessible sections of the air handling unit.

2.16 TEST PORTS

.1 Provide 25mm diameter test ports for unit air stream testing in each plenum section between each component within the AHU. Test ports shall have a tube that extends between the inside and outside of the unit and a screwed cap on the exterior to allow access. The test ports shall have been flanged on the exterior to allow air seal and shall be flanged on the interior to cover the penetration of the casing.

2.17 ELECTRICAL

.1 Factory wire and test all air handling units. Have units approved by CSA or ETLc.

.2 Supply three @ 575 V/60 Hz/3 Ph power connections for motors and other large electrical devices and one @ 120 V/208V/60 Hz/1 Ph power connection for lights, controls, heaters, etc. (Provide a minimum 2kVA transformer fed from the main power source to power the lighting circuit.).

.3 Provide a separate 120 V/ 1 phase feed for a 20 amp convenience outlet.

.4 Provide necessary circuit breakers and/or fuses for each type of electric device.

.5 A bonding wire shall be provided between the motor loads and the electrical panel. Use of the air handling unit casing for a bond will not be accepted.

.6 Label and number code all wiring and electrical devices in accordance with the unit electrical diagram. Mount the devices in a control panel inside the unit's service enclosure or on the outside. Ensure the control panel meets the CSA or Canadian Electrical Code (CEC) standard for the specific installation.

.7 Provide a system of motor control including all necessary terminal blocks, motor contactors, motor overload protection, grounding lugs, auxiliary contactors and terminals for the connection of external control devices or relays. Individually fuse all fan and branch circuits.

.8 Wire from the motors to the motor control in accordance with the local electrical code and contained by EMT conduit with liquid tight connections. Seal the casing penetrations in a manner that eliminates air leaks. At all split sections, provide a 1 foot long piece of flexible conduit, with the extra wire spooled, for reconnection on site by the installing contractor.

.9 External disconnects shall be provided in a NEMA 4 enclosure for superior water protection. Disconnects must be interlocked with the electrical panels for added personnel safety.

2.18 FINISH

.1 Unit shall be finished painted with two components, etch bond primer and finish painted with alkyd enamel, color as selected by Owner. All uncoated steel shall be painted with grey enamel. All metal surfaces shall be prepainted with vinyl wash primer to ensure paint bonds to metal. Outdoor unit shall be finish coated with polyurethane paint. Paint for outdoor units shall be tested to ATSM B117 for 5000hr salt spray endurance.

.2 Interior finish of common exhaust plenum shall have chemical resistance and is suitable for fume hood exhaust application.

2.19 VIBRATION TESTING AND BALANCING

.1 Fans and motors shall be dynamically balanced to exceed a BV-5 criterion as per AMCA 204-96. The test shall be conducted after the fan and motor base assembly has been completed. The entire fan assembly including fan wheels,

shafts, bearings, drives, belts, motors, isolation bases shall be tested. During the test, the fan and motor base shall be supported by its isolators which are set in the freely floating operating position. (In cases where a concrete inertia base is provided, the factory poured concrete shall be installed at the time of the vibration test).

.2 The required measurement points are as follows: one horizontal measurement and one vertical measurement shall be taken for each fan and motor bearing and one axial measurement shall be taken for each shaft. (A total of 10 points for a typical belt driven fan-motor assembly). The measurements shall be taken using calibrated, magnetically mounted accelerometers and a calibrated measuring instrument.

.3 Vibration measurement locations shall be as close as possible to the bearing or shaft centerlines. Measurements shall be taken from the bearing housings, bearing pedestals, or motor casings. Measurements shall not be taken from flexible covers or shields.

.4 Fans and motors shall be tested at the design RPM and the maximum overall filter-in vibration levels at each measurement point shall be less than or equal to 3.81mm/second peak velocity at the operating speed. If any measurements exceed the above criterion, the assembly shall be rebalanced and re-tested until the criterion is achieved.

.5 Certified measurements shall be provided to the department representative.

PART 3 - Execution

3.1 EXAMINATION

.1 Verification of Conditions in accordance with Section 23 05 00.

3.2 REFERENCE STANDARDS

.1 Install in accordance with manufacturer's instructions.

.2 Install units on a flat surface level within 3.18mm inch and of sufficient strength to support the units.

.3 Provide components furnished as per manufacturer's literature.

.4 Provide all water piping so water circuits are serviceable, without having to dismantle excessive lengths of pipe.

.5 Provide valves in water piping upstream and downstream of each coil for isolating the coils for maintenance and to balance and trim the system.

.6 Provide drain valves and vent cocks to each coil.

.7 Provide strainers ahead of all pumps and automatic modulating valves.

.8 Provide certified wiring schematics to the electrical division for the equipment and controls.

.9 Provide all necessary control wiring as recommended by the manufacturer.

.10 Provide condensate traps in accordance with manufacturers recommendations.

.11 Insulate all piping and equipment mounted inside the corridor.

3.3 SEQUENCE OF OPERATION

.1 Day Mode:

.1 Operate fans at full speed. Two fans to be in operation, with third fan on standby. Cycle lead and lag fans weekly. Full speed to equal scheduled fan inlet airflow.

.2 When static pressure sensor reading increases above setpoint, open bypass dampers to meet static pressure setpoint.

.3 When static pressure sensor decreases below setpoint, close bypass dampers to meet static pressure setpoint.

.4 If static pressure sensor is below setpoint and bypass dampers are fully closed, send low pressure alarm to BAS.

.2 Night Mode:

.1 When in night mode (schedule is user-adjustable), run fans at 60% airflow and adjust air valves to 60% airflow. Operate bypass dampers and alarms as per day mode operation.

.3 Emergency Mode:

.1 When the fire alarm activates, transition fan system into emergency operating mode. Run one fan and leave two fans on standby. Modulate air valves to 50% airflow and set design airflow to 50% for bypass damper operation.

Table 1. Integration Points

Point Name	Description	Data Type
Fan_1_Speed	Fan Speed	AO
Fan_2_Speed	Fan Speed	AO
Fan_3_Speed	Fan Speed	AO
Fan_1_Status	Fan on/off status	DI
Fan_2_Status	Fan on/off status	DI
Fan_3_Status	Fan on/off status	DI
Damper_123_Pos	Bypass Damper Positions, as a single common point	AO
dP_Reading	Static Pressure in Plenum	AI
dP_Setpoint	Static Pressure setpoint in Plenum	AO
Low_Pressure	Low static pressure alarm	DO (virtual)
Op_Mode	Day/Night/Emergency Mode Toggle	AO (virtual)
Fire_Alarm	Signal from fire alarm system	DI

3.4 CLEANING

.1 Cleaning in accordance with Section 23 05 00.

PART 1 - GENERAL

1.1 GENERAL

.1 The "provide" in this Division shall be interpreted as "supply, install, and connect".

.2 Energy Monitoring and Control System (EMCS) shall include Direct Digital Control (DDC)of mechanical systems as specified for this project.

.3 Building Automation System (BAS) shall include the EMCS as specified for this project.

1.2 DESCRIPTION OF SYSTEM

.1 Extend the existing Networked DDC Control System to meet the requirements specified for this project. The new and extended DDC products and services shall be fully compatible with the existing JCI Controls system. The extended Control System shall consist of but is not limited to the following:
- .1 Software required to implement a complete and operational system.
- .2 Local control units (TCUs) as required to connect points shown in design.

1.3 ACCEPTABLE SYSTEM MANUFACTURERS AND PRODUCTS

.1 The System Manufacturer must have maintained local office within 400 kilometers of job site for at least 5 years with technical staff to provide technical information, routine and emergency maintenance on the system and all system components, and to provide training instructions to O&M staff.

.2 The System Manufacturer must have proven record of successful experience on projects of similar type and size.

.3 Submit the following information for review by Departmental Representative:
- .1 Location of local office.
- .2 Names and phone numbers of technical staff.
- .3 Specification sheets for Master Control Units, Local Control Units and Terminal Control Units.
- .4 Data communication network performance information including network protocols to be used, data rate, maximum number of nodes per Local Area Network (LAN).

1.4 CO-ORDINATION

.1 Contractor shall co-ordinate its work with Divisions 23 and 26. Unless noted otherwise, the Contractor shall provide all interface devices, control wiring, and controls as required to provide the control operation specified.

.2 Unless noted in Division 26, Contractor shall provide line voltage and low voltage control wiring for equipment specified in Division 25. Refer to Division 26 for power wiring, starters, disconnect switches, etc., to be provided for mechanical equipment.

.3 Contractor shall provide all necessary power and dedicated circuits as required from local 120 volt branch circuits panel board for all Master Control Units. Install tamper locks on breakers of circuit panel.

.4 Unless noted otherwise, all other installation work required for the complete installation of EMCS, including all interface devices, control and power wiring, controls and controlled devices shall be provided by the Contractor.

1.5 LOCKABLE PANELS

.1 Provide lockable panel for each MCU or LCU. All panels shall be EEMAC rated to environment requirements with hinged doors.

.2 Equip all panels for Master Control Units with standard keyed-alike cabinet locks, keyed to same key.

1.6 NAMEPLATES

.1 Provide nameplates on all control items listed or shown in the submittal and approved control diagrams.

.2 Identify all panels and items mounted on panel face by laminated plastic nameplates 3 mm thick. Lettering shall be accurately aligned and engraved into the white core. Size of nameplates shall be 20 mm by 100 mm minimum. Lettering shall be minimum 5 mm high normal black lettering.

.3 Identify Field Sensors and Controlled Devices by plastic encased cards attached to the device by chain.

.4 Warning signage: provide each motor starter under remote automatic control (DO point on I/O Point Schedules) with signage warning of automatic starting under control of EMCS. (i.e. "Caution - this equipment is under automatic remote control of EMCS").

1.7 SHOP DRAWINGS

.1 Submit shop drawings and product data in accordance with Section 23 05 00. Submit control shop drawings within 15 days of Award of Contract.

.2 Shop drawings shall include:
- .1 Description of software programs included.
- .2 Specification sheets for each piece of equipment or control devices to be provided.
- .3 Equipment and DDC Controllers location drawings.
- .4 Mechanical control schematics.
- .5 Sequence of operation for each mechanical system.
- .6 DDC control point schedules.

1.8 INSTALLATION AND COMPLETION TESTS

.1 Installation and Calibration:
- .1 Set control points and calibrate sensors immediately after installing controls.

.2 Completion Tests:
- .1 After installation of each part of the system and completion of mechanical and electrical start-up, perform tests to confirm correct installation and operation of equipment.
- .2 Check and calibrate each AI using a calibrated digital thermometer, humidistat, velometer or transducer.
- .3 Check each DI to insure proper settings and switching contacts.
- .4 Check each AO to insure proper operation of valves and dampers. Verify tight closing, input and output signals.
- .5 Check each DO to insure proper operation and lag time.
- .6 Check all operating software.
- .7 Check all application software. Provide samples of all logs and commands.
- .8 Debug all software.
- .9 The contractor shall be responsible for fine tuning and adjusting all control devices and make modifications as required to provide a fully operational EMCS.
- .10 Submit test report with checklist showing all input/output control points and all software programs.

.3 All reported results are subject to verification by the Departmental Representative.

1.9 SYSTEM STARTUP VERIFICATION TESTING

.1 The Contractor shall provide technical personnel and instrumentation to conduct startup verification testing.

.2 Verification:
- .1 Perform point-by-point verification of entire system.
- .2 Verify the calibration of all AI devices individually.
- .3 Verify the calibration of all DI devices individually.
- .4 Verify all AO devices are functional, start and span are correct, direction and normal positions are correct.
- .5 Verify that all DO devices operate properly and that the normal positions are correct.
- .6 Verify the system sequences of operation. Simulate all modes of operation.
- .7 Verify the stability of all DDC loops and optimum start/stop routines.
- .8 Check each alarm separately.
- .9 Verify interlocks and conditional control response.
- .10 Simulate alarm conditions to check the initiating value of variable and interlock action.

.3 The contractor shall complete and submit System Startup Verification Forms. Each item on the verification forms shall be signed off as verified (yes), or not verified (no) and actual date of verification.

1.10 OPERATION AND MAINTENANCE MANUAL

.1 The manual shall be custom designed for this project and contain only information relevant to this project.

.2 The manual shall provide full and complete coverage of the following subjects:

.1 Operational Requirements: This document shall describe, in concise English terms, all the functional and operational requirements for the system and its functions that have been implemented.

.2 System Operation: Complete step by step procedures for operation of the system, including required actions at each operator station; operation of computer peripherals; input and output formats; and emergency, alarm, and failure recovery. Step-by-step instructions for system startup, back-up equipment operation, and execution of all system functions and operating modes shall be provided.

.3 Maintenance: Documentation of all maintenance procedures for each and all system component including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective module.

.4 Test Procedures and Reports: The test implementation shall be recorded with a description of the test exercise script of events and documented as Test Procedures. A provision for the measurement or observation of results, based on the previously published Test Specification, forms the Test Reports.

.5 Configuration Control: Documentation of the basic system design and configuration with provisions and procedures for planning, implementing, and recording any hardware or software modifications required during the installation, test, and operating lifetime of the system.

1.11 TRAINING

.1 Provide the services of competent instructors who will provide instruction to designated personnel in the adjustment, operation and maintenance, including pertinent safety requirements, of the equipment and system specified. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach.

1.12 WARRANTY AND MAINTENANCE

.1 The Contractor shall provide all services; materials and equipment necessary for the maintenance of the Automatic Control Systems for a period of 12 months concurrent with the warranty period.

.2 The Contractor shall provide three minor inspections or as required by the manufacturer and one major inspection per year, and all service for the required maintenance. Major inspection shall be scheduled in April or November. A major inspection shall involve a point by point check and/or calibration. Provide dated database log to indicate executed point to point system check.

.3 Emergency Service: The Owner will initiate service calls when there is indication that the Automatic Control System is not functioning properly. The Contractor shall have qualified personnel available during the contract period to provide service to the "critical" overall control system components whenever required at no additional cost to the owner. The contractor shall furnish the Departmental Representative with a telephone number where the service personnel can be reached at all times. The service technician shall be on the job ready to service the control system within 4 hours after receiving a request for service. The work shall be performed continuously until the control system is back in reliable operating condition. This service shall be provided on a 24 hours basis 7 days a week.

.4 Upon completion of each inspection or emergency service, submit fully detailed report in writing to Departmental Representative.

PART 2 - PRODUCTS

2.1 BAS DATA COMMUNICATION NETWORK

.1 The existing controls EMCS on-site is a JCI BACnet system. New controls work must be compatible with the existing controls system. The new fumehood controls system shall operate as a standalone system, and will communicate points to the EMCS for monitoring. Contractor must be trained to modify the existing JCI BACnet system to provide updated graphics and alarms as indicated in the specification.

.2 The Contractor shall provide the data communication network components necessary to connect any new devices to the existing EMCS.

.3 The data communication network shall include EMCS-LAN, EMCS-BUS, modems, network interface cards, network management hardware and software, and all network components including cables, connectors, repeater, hubs, and routers necessary for the internet work.

.4 EMCS Communication Bus (EMCS-BUS): a local secondary bus or subnetwork that links Local Control Units (LCUs) and Terminal Control Units (TCUs) to a Master Control Unit (MCU). The combined quantity of LCU's and TCUs directly connected to one EMCS-BUS subnetwork shall not exceed 50. Data transmission rate to be 9600 Baud minimum. Acceptable secondary Communication Bus: RS-485 LAN, Lontalk.

.5 Local Control Units (LCUs): Stand-alone fully user programmable DDC Controllers that reside on EMCS-BUS.

2.2 GRAPHICS SOFTWARE

.1 The Contractor shall utilize the existing graphics software to generate the custom Control Schematic Diagrams for this project.

2.3 LOCAL CONTROL UNITS (LCU)

.1 The Local Control Unit is to be a standalone DDC controller with the following characteristics:

.1 LCU shall incorporate a programmable microprocessor, non-volatile program memory, random access memory, power supplies and appropriate communication interfaces as required to perform specified functions.

.2 LCU shall incorporate a communication interface port for communication to the Master Control Unit (MCU).

.3 LCU shall execute its logic and control (Direct Digital or Closed Loop Process Control) of associated equipment without interacting with any other Processor.

.4 Basic functional requirements to include scanning of digital/analog inputs, digital change of state (alarm) monitoring, analog input (alarm) monitoring, on-off digital control with configurable logic, analog control using configurable logic (including PID) with adjustable dead bands and deviation alarms, control of HVAC systems, specified under sequence of operation instructions.

.2 Minimum addressable memory shall be sufficient to support all performance and technical specifications. All operating system, executive, application, subroutine, and other configuration definition software, shall reside in non-volatile memory such as EPROM. All control description logic, applicable functions and operating data shall reside in battery backed RAM 72 hours or EEPROM and hence modifiable on-line through the operator panel or remote operator interface. All operating data must be downline loadable from Operator Workstations.

.3 Each LCU shall have sufficient capacity for its assigned D1, D0, A1, A0 points as indicated on the DDC Input/Output Point Schedules. All points associated with one mechanical system shall be connected directly to the same LCU.

.4 The LCU shall include as a minimum 2 interface ports for connection of MCU controller and local computer terminal.

.5 In the event of loss of communications with, or failure of the MCU, this controller shall continue to perform control of the associated equipment. Controllers that use defaults or fail to open or closed position will not be acceptable.

.6 Unless noted otherwise, LCUs shall not be used to control any major mechanical equipment. LCUs shall be used to control packaged and distributed equipment such as packaged air handling units, radiation, and exhaust fans, and multi-zone VAV boxes.

2.4 LCU SOFTWARE

.1 Software shall include but not be limited to definitions and operating systems executive, communications, control description logic, operator interface.

.2 Control description logic shall be written in general control type or high level language.

.3 Control description logic shall have access to values or status of all points available to the controller including global or common values, allowing cascading and interlocking control.

.4 Software to be generic and configurable from computer terminal or to be downloaded from operator workstations.

2.5 CONDUIT AND WIRE

.1 Use type FT6 plenum rated cable for low voltage EMCS wiring in ceiling return plenum. Support FT6 cables in ceiling return plenum using Thomas & Betts TY-RAP cable straps and clamps screwed on to ceiling slab. Spacing to be 2m maximum. Do not use ceiling suspension wires for fastening cables. Exact routings shall suit site conditions and shall be to the approval of the Departmental Representative.

.2 Use EMT conduit for wiring in mechanical, electrical, janitor rooms or equipment rooms.

.3 Field wiring for each digital input and output shall be No. 20 AWG, stranded twisted pair. For multi-conductor wire having four or more conductors, wire size shall be not less than No. 22 AWG solid copper. Analog input shall be wired with shielded No. 20 AWG, stranded twisted pair, copper wire. Analog output shall be wired with 3 shielded No. 20 AWG stranded twisted copper wires.

.4 Where conduits pass through fire rated walls or floors, provide schedule 40 steel sleeves filled with fire stopping material and approved sealant around conduits to maintain fire rating integrity.

2.6 RESPONSIBILITY FOR QUANTITIES

.1 Failure to carry the correct lengths or sizes of conduit or correct types of wire or the correct number of DDC panels is the Contractor's responsibility and shall not be basis for additional charges by the Contractor.

2.7 WIRING IDENTIFICATION

.1 Provide numbered tape markings on all branch control wiring, and pneumatic tubing.

.2 At all junction boxes, splitters, cabinets and outlet boxes, maintain identification system.

.3 Use colour coded wires in communication cables, matched throughout system.

.4 Identify all power sources at each panel location.

2.8 CONDUIT IDENTIFICATION

.1 Colour code all Control System conduits.

.2 Coding to be located on all conduits and cables exposed after completion of construction in all locations including suspended accessible ceilings, tunnels and shafts.

.3 Coding to be plastic tape or paint at all points where conduit or cable enters wall, ceiling, or floor, and at 15000 mm intervals.

.4 Coding to be 25 mm wide, and fluorescent orange. Colour to be confirmed by the Contractor with the Departmental Representative at commencement of the project.

2.9 MANUFACTURER'S AND CSA LABELS

.1 Manufacturers' nameplates and CSA labels to be visible and legible after equipment is installed.

2.10 STATIC PRESSURE TRANSMITTERS

.1 Requirements:

.1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.

.2 Calibrated span: not to exceed 150 % of duct static pressure at maximum flow.

.3 Accuracy: 0.4 % of span.

.4 Repeatability: within 0.5 % of output.

.5 Linearity: within 1.5 % of span.

.6 Deadband or hysteresis: 0.1 % of span.

.7 External exposed zero and span adjustment.

.8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit

.9 Unit shall be 316 stainless steel construction.

PART 3 - EXECUTION

3.1 GENERAL

.1 All equipment shall be installed in according to manufacturers' published instructions.

.2 Provide programming for the system and adhere to the sequence of operation specified.

3.2 BUILDING AUTOMATION SYSTEM (BAS) NETWORK ARCHITECTURE

.1 Building Automation System (BAS) Network Architecture as shown on the Mechanical Drawings.

3.3 DDC INPUT/OUTPUT POINT SCHEDULE

.1 DDC inputs in accordance with Section 23 09 95. Display all information on EMCS that is available at fume hood monitor, and provide all alarms triggered at fume hood monitor.

.2 Naming convention: PWGSC Standardized Identifiers and Expansions of Building Names, System Names and Point Names shall be used for identification. Identifiers shall be not more than 10 alphanumeric characters, and Expansions shall not more than 40 characters.

3.4 SEQUENCE OF OPERATION FOR Laboratory Airflow Control System (LACS)

.1 Refer to Section 23 09 95.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings

1.2 REFERENCES

.1 Definitions:
  .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

.2 Reference Standards:
  .1 CSA Group
    .1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.
    .2 CAN/CSA-C22.3 No.1-15, Overhead Systems.
    .3 CAN3-C235-83(R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

  .2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
    .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

  .3 Ontario Provincial Standards
    .1 Ontario Electrical Safety Code (OESC)-2018, and Electrical Safety Authority Bulletins.

  .4 Other Standards
    .1 Ontario Building Code (OBC), 2015.
    .2 National Building Code (NBC), 2015.
    .3 National Fire Code (NFC), 2015.
    .4 CAN-ULC-S524-2014, Standard for Installation of Fire Alarm
    .5 CAN-ULC-S537-2004, Verification of Fire Alarm Systems

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 electrical equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit for review single line electrical diagrams in glazed frames and locate in:
  .1 Electrical distribution system in main electrical room.

.4 Submit for review fire alarm riser diagram, plan and zoning of building in glazed frames at fire alarm control panel and annunciator.

.5 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 electronic copies of drawings and product data to authority having jurisdiction.
- .5 If changes are required, notify Departmental Representative of these changes before they are made.

.6 Certificates:
- .1 Provide CSA certified equipment and material.
- .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special 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, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
- .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

.7 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.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
  - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
  - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
  - .3 Safety precautions.
  - .4 Procedures to be followed in event of equipment failure.
  - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.5 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 off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect equipment 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 and labels for control items in English.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00.

.2 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: below 50 V which are related to control systems specified in mechanical sections and as indicated on mechanical drawings.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction Departmental Representative.

.2 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 and labels as follows:
.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, matt white finish face, black 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 and labels to be approved by Departmental Representative prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and 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.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, 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
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	

2.9 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
.1 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1-1958.

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 electrical 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

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

.2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.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 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.5 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

3.6 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.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.8 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
.3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers and motor control centers, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 45 00.
.1 Power distribution system including phasing, voltage, grounding and load balancing.
.2 Circuits originating from branch distribution panels.
.3 Lighting and its control.
.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
.5 Systems: fire alarm.
.6 Insulation resistance testing:
.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
.7 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
.1 Check resistance to ground before energizing.

.3 Carry out tests in presence of Departmental Representative.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 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.

3.9 SYSTEM STARTUP

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

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with aspects of its care and operation.

3.10 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 in accordance with Section 01 74 00.

PART 1 - GENERAL

1.1 SUMMARY

.1 This Section includes requirements for selective demolition and removal of electrical communications and safety and security components including removal of conduit, junction boxes, and panels to source (home run removal) and incidentals required to complete work described in this Section ready for new construction.

1.2 RELATED REQUIREMENTS

.1 Not Applicable.

1.3 REFERENCE STANDARDS

.1 CSA Group (CSA)

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

1.4 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 Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Action Submittals: Provide in accordance with Section 01 33 00 before starting work of this Section.

1.6 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.

1.7 QUALITY ASSURANCE

.1 Regulatory Requirements: Perform work of this Section in accordance with:
.1 Provincial/Territorial Workers' Compensation Boards/Commissions
.2 Provincial/Territorial Occupational Health and Safety Standards and Programs.

1.8 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 Discovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in Work; immediately notify Departmental Representative if materials suspected of containing hazardous substances are encountered and perform following activities:
.1 Refer to Section 01 41 00 for directives associated with specific material types.
.2 Hazardous substances will be as defined in Hazardous Products Act.
.3 Stop work in area of 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 Work.
.6 Proceed only after written instructions have been received from Departmental Representative.

1.9 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.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 General Patching and Repair Materials: Refer to Division 2 for listing of patching and repair materials incidental to removal or demolition of components associated with work of this Section.

.2 Electrical Repair Materials: Use only new materials, CSA or ULC labelled as appropriate and matching components remaining after work associated with components identified for removal or demolition are completed.

.3 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 will 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 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 Demolition and Removal:
- .1 Disconnect electrical circuits and panel feeders; maintain electrical service and main distribution panel as is, ready for subsequent Work.
- .2 Remove existing luminaires, electrical devices and equipment including associated conduits, boxes, wiring, and similar items.
- .3 Disconnect and remove existing fire alarm system including associated conduits, boxes, wiring, and similar items.

.4 Disconnect and remove communication systems including associated conduits, boxes, cabling, and similar items unless specifically noted otherwise.

.5 Perform demolition work in a neat and workmanlike manner:

.1 Remove 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.

.6 Disconnect panel feeders back to main distribution panel and re label respective circuit breaker as "SPARE".

.7 Remove existing conduits, boxes, cabling and wiring associated with removed luminaires, electrical devices and equipment.

.8 Grind off conduits and make flush with surface of concrete where conduits are cast into concrete; seal open ends of conduit with silicone sealant and leave in place.

.9 Seal open ends of conduit with silicone sealant and leave in place where they are inaccessible or cannot be removed without damaging adjacent construction.

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).

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
- .1 CSA C22.2 No.18.1-13, Metallic outlet boxes (Tri-national standard, with UL 514A and ANCE NMX- J-023/1).
- .2 CSA C22.2 No.18.2-06(R2016), Nonmetallic Outlet Boxes.
- .3 CSA C22.2 No.18.3-12, Conduit, tubing, and cable fittings (Tri-national standard, with ANCE NMX-J-017 and UL 514B).
- .4 CSA C22.2 No.18.4-15, Hardware for the Support of Conduit, Tubing, and Cable (Bi-National standard, with UL 2239).
- .5 CSA C22.2 No. 18.5-13, Positioning devices (Bi-national standard, with UL 1565).
- .6 CSA C22.2 NO. 65-18, Wire connectors (Tri- national standard, with UL 486A-486B and NMX-J-543-ANCE).

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
- .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

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

1.4 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.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to NEMA to consist of:
.1 Connector body and stud clamp for copper conductors.
.2 Clamp for copper conductors.
.3 Clamp for stranded conductors.
.4 Stud clamp bolts.
.5 Bolts for copper conductors bar.
.6 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, TECK cable, aluminum sheathed cable and flexible conduit as required to: CSA C22.2 No.18.

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 wire and box connectors 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 Remove insulation carefully from ends of conductors and cables and:
.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
.3 Install fixture type connectors and tighten to CSA C22.2 No.65. Replace insulating cap.
.4 Install bushing stud connectors in accordance with NEMA.

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 in accordance with Section 01 74 00.

PART 1 - GENERAL

1.1 PRODUCT DATA

.1 Provide product data in accordance with Section 01 33 00.

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 1000 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Non Jacketted.

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 05 00.

.2 Conductors:
- .1 Grounding conductor: copper.
- .2 Circuit conductors: copper, size as indicated.

.3 Insulation:
- .1 Ethylene propylene rubber EP.
- .2 Cross-linked polyethylene XLPE.
- .3 Rating: 1000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

.7 Fastenings:
- .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
- .2 Channel type supports for two or more cables at 1500 mm centers.
- .3 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:
- .1 Watertight, approved for TECK cable.

2.3 CONTROL CABLES

.1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:
- .1 Insulation: thermoplastic.
- .2 Sheath: thermoplastic jacket, and armour of closely wound aluminum wire.

.2 Type: low energy 300 V control cable: solid annealed copper conductors sized as indicated LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: polyethylene.
.2 Shielding: braid over each over conductors.
.3 Overall covering: PVC jackets.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.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 Terminate cables in accordance with Section 26 05 20.

.2 Cable Colour Coding: to Section 26 05 00.

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.7 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.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable concealed, securely supported by straps.

3.5 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for connectors and terminations.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)
- .1 CSA C22.2 No.41-13, Grounding and Bonding Equipment.
- .2 CSA C22.2 No.65-13, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

PART 2 - PRODUCTS

2.1 CONNECTORS AND TERMINATIONS

.1 Copper compression connectors to CSA C22.2 No. 65 as required sized for conductors.

.2 Contact aid for aluminum cables where applicable.

.3 2-way joint boxes dry location type.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2 No.41.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
  .1 ANSI/IEEE 837-2014, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

.2 CSA International
  .1 CSA Z32-15, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

1.2 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 grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

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

1.4 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.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, soft annealed, size as required.

.3 Grounding conductors: bare stranded copper, soft annealed, size as required.

.4 Insulated grounding conductors: green, copper conductors, size as required.

.5 Ground bus: copper, complete with insulated supports, fastenings, connectors.

.6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
- .1 Grounding and bonding bushings.
- .2 Protective type clamps.
- .3 Bolted type conductor connectors.
- .4 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. Where EMT is used, run ground wire in conduit.

.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.

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

3.3 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary 120V, 240V, 208V system.

3.4 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, frames of motors, motor control centres, starters, control panels, distribution panels and cable trays.

3.5 COMMUNICATION SYSTEMS

.1 Install grounding connections for fire alarm system as required.

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.2 Perform ground continuity and resistance 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.

.4 Disconnect ground fault indicator during tests.

3.7 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 in accordance with Section 01 74 00.

PART 1 - GENERAL

1.1 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 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 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.

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 poured concrete with expandable inserts.

.2 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.3 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.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 53 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 53 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 For surface mounting of two or more conduits use channels at 1500 mm on centre spacing.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 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.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

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 in accordance with Section 01 74 00.

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.1-18, Canadian Electrical Code, Part 1, 24th Edition.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

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

PART 2 - PRODUCTS

2.1 SPLITTERS

.1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

2.2 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 flat covers.

PART 3 - EXECUTION

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

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

3.3 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00.

.2 Identification Labels: size 2 indicating voltage and phase or as indicated.

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.1-18, Canadian Electrical Code, Part 1, 24th Edition.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

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

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

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

2.6 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 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)
- .1 CSA C22.2 NO. 18.1-13, Metallic Outlet Boxes.
- .2 CSA C22.2 NO. 18.2-06(R2016), Nonmetallic Outlet Boxes.
- .3 CSA C22.2 No. 18.3-12, Conduit, Tubing, and Cable Fittings (Tri-National standard, with ANCE NMX-J-017 and UL 514B).
- .4 CSA C22.2 No. 18.4-15, Hardwa1re for the Support of Conduit, Tubing, and Cable.
- .5 CSA C22.2 No. 45.1-07(R2012), Electrical Rigid Metal Conduit - Steel (Tri-National standard, with UL 6 and NMX-J-534-ANCE-2007).
- .6 CSA C22.2 No. 56-13, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit
- .7 CSA C22.2 No. 83-M1985(R2013), Electrical Metallic Tubing.
- .8 CSA C22.2 No. 211.2-06(R2016), Rigid PVC (Unplasticized) Conduit.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.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.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

PART 2 - PRODUCTS

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

- .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Identify cables for exclusively dc applications.

2.2 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.

.2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.3 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.3 CONDUIT FASTENINGS

.1 One-hole steel straps to secure surface conduits 50 mm and smaller.
.1 Two-hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1500 mm on centre.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

.1 Fittings: to CSA C22.2 No. 18.3 and CSA C22.2 No. 18.4, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for [NPS 1] [25 mm] and larger conduits.

.3 Watertight connectors and couplings for EMT.
.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 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 mechanical and electrical service rooms.

.3 Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical injury, except in cast concrete.

.4 Use rigid PVC conduit underground and in corrosive areas.

.5 Use flexible metal conduit for connection to motors in dry areas.

.6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.7 Install conduit sealing fittings in hazardous areas.
.1 Fill with compound.

.8 Minimum conduit size for lighting and power circuits: 21 mm.

.9 Bend conduit cold:
.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.10 Mechanically bend steel conduit over 19 mm diameter.

.11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.12 Install fish cord in empty conduits.

.13 Remove and replace blocked conduit sections.
.1 Do not use liquids to clean out conduits.

.14 Dry conduits out before installing wire.

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 Proceed in accordance with Section 01 74 00.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Electrical Equipment Manufacturers Association of Canada (EEMAC)

1.2 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 motor control centre buckets and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
- .1 Indicate on drawings:
  - .1 Outline dimensions.
  - .2 Configuration of identified compartments.
  - .3 Dimensioned position and size of busbars and details of provision for future extension.
  - .4 Schematic and wiring diagrams of all starters.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for motor control centre buckets for incorporation into manual.
- .1 Include data for each type and style of starter.

1.4 EXTRA STOCK MATERIALS

.1 Submit maintenance materials in accordance with Section 01 78 00.

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 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION

.1 New buckets required for existing MCCs to be compatible with existing manufacturer and product.

2.2 MOTOR STARTERS AND DEVICES

.1 Motor starters to be compatible with existing MCC and sized as indicated.

2.3 STARTER UNIT COMPARTMENTS

.1 Units EEMAC size 5 and smaller, circuit breaker units 225A and smaller, to match existing product and manufacturer requirements.

2.4 WIRING IDENTIFICATION

.1 Provide wiring identification in accordance with Section 26 05 00.

2.5 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.
.1 Individual compartment nameplates: size No. 5, engraved as indicated.

2.6 FINISHES

.1 Apply finishes in accordance with Section 26 05 00.

.2 Paint motor control centre exterior light gray and interiors white.

2.7 SOURCE QUALITY CONTROL

.1 Provide manufacturer's type test certificates including short circuit fault damage certification up to short circuit values specified under bus bracing.

.2 Departmental Representative to witness standard factory testing of complete motor control centre including operation of switches, circuit breakers, starters and controls.

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 motor control centres 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 Make field power and control connections as indicated.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.2 Ensure moving and working parts are lubricated where required.

.3 Operate starters in sequence to prove satisfactory performance of motor control centre during 8 hours period.

3.4 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 in accordance with Section 01 74 00.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 CSA International
- .1 CSA C22.2 No.42-10(R2015), General Use Receptacles, Attachment Plugs and Similar Devices.
- .2 CSA C22.2 No.42.1-13(R2017), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
- .3 CSA C22.2 No.55-15, Special Use Switches.
- .4 CAN/CSA-C22.2 No.111-18, General-Use Snap Switches (Bi-national standard, with UL 20 and NMX-J-005-ANCE).

1.2 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 wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

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

1.4 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.

PART 2 - PRODUCTS

2.1 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:
- .1 Ivory urea moulded housing.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Eight back wired entrances, four side wiring screws.
- .5 Triple wipe contacts and rivetted grounding contacts.
- .6 Specification Grade.

.2 Duplex receptacles, CSA type 5-20 R, 125 V, 20 A, U ground, to: CSA C22.2 No.42 with following features:
- .1 Ivory urea moulded housing.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Eight back wired entrances, four side wiring screws.
- .5 Triple wipe contacts and rivetted grounding contacts.
- .6 Specification Grade.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles 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 Stainless steel, cover plates, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.

.4 Cast cover plates for wiring devices mounted in surface-mounted FD type conduit boxes.

.5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.6 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

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 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 Receptacles:
- .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
- .2 Mount receptacles at height in accordance with local codes.
- .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .4 Install GFI type receptacles as indicated.

.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.
- .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.

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.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

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

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
- .1 Provide fuse performance data characteristics for each fuse type and size above 30 A. Performance data to include: average melting time-current characteristics.

.3 Shop Drawings:
- .1 Provide shop drawings in accordance with Section 01 33 00.
- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Store fuses in original containers in moisture free location.

1.4 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00.

PART 2 - PRODUCTS

2.1 FUSES - GENERAL

.1 Fuses: product of one manufacturer.

2.2 FUSE TYPES

.1 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.

.2 Class C fuses.

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.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 CSA International (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.

.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.

1.3 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.

PART 2 - PRODUCTS

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers and 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 Plug-in moulded case circuit breakers: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.4 Common-trip breakers: with single handle for multi-pole applications.

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 and shall match and be compatible with the existing product.

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 in accordance with Section 01 74 00.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 CSA Group
- .1 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, Fuseholder Assemblies.

1.2 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 disconnect switches - fused and non-fused and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 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.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Fusible, Non-fusible, and Horsepower rated disconnect switch in CSA enclosure to CSA C22.2 No.4 size as indicated.

.2 Provision for padlocking in off switch position by 3 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.

.5 Fuseh olders: to CSA C22.2 No.39 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.

.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.
  .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.

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 International Electrotechnical Commission (IEC)
  .1 IEC 60947-4-1-2009, Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.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.
    .1 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.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance materials in accordance with Section 01 78 00.

.2 Submit operation and maintenance data for each type and style of motorstarter for incorporation into maintenance manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Starters: to IEC 60947-4-1 with AC4 utilization category.

2.2 MANUAL MOTOR STARTERS

.1 Three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
- .1 Switching mechanism, quick make and break.
- .2 Three overload heaters, manual reset, trip indicating handle.

.2 Accessories:
- .1 Toggle switch: heavy duty labelled as indicated.
- .2 Indicating light: heavy duty type and colour to match existing site configuration.
- .3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
- .1 Contactor solenoid operated, rapid action type.
- .2 Motor overload protective device in each phase, manually reset from outside enclosure.
- .3 Wiring and schematic diagram inside starter enclosure in visible location.
- .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Combination type starters to include fused disconnect switch with operating lever on outside of enclosure to control disconnect, and provision for:
- .1 Locking in "OFF" position with up to 3 padlocks.
- .2 Independent locking of enclosure door.
- .3 Provision for preventing switching to "ON" position while enclosure door open.

.3 Accessories:
- .1 Selector switches: heavy duty labelled as indicated.
- .2 Indicating lights: heavy duty type and color as indicated.
- .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.4 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 ACCESSORIES

.1 Pushbutton: heavy duty, oil tight as required.

.2 Selector switches: heavy duty, oil tight as required.

.3 Indicating lights: heavy duty, oil tight, type and colour as indicated.

2.6 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00.

2.7 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

.2 Manual starter designation label, white plate, black letters, size engraved as indicated.

.3 Magnetic starter designation label, white plate, black letters, size engraved as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install starters and control devices in accordance with manufacturer's instructions.

.2 Install and wire starters and controls as indicated.

.3 Ensure correct fuses installed.

.4 Confirm motor nameplate and adjust overload device to suit.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 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.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

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,

Stephen Heikkila, P.Eng.
Project Manager, Environment

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	– 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	– 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.

TABLE OF CONTENTS

EXECUTIVE SUMMARY VI

1 INTRODUCTION 1

1.1 BACKGROUND 1

1.2 Site Description 1

1.3 Regulatory Context 2

1.3.1 Federal Legislation 2

1.3.2 Provincial Legislation (Ontario) 2

1.4 Survey Objectives 3

1.5 Scope of Work 3

2 METHODOLOGY 4

2.1 ASBESTOS SURVEY METHODOLOGY 4

3 SITE OVERVIEW 6

4 LIMITATIONS 7

TABLES

TABLE 1 – ASBESTOS SURVEY FINDINGS AT LONDON RESEARCH AND DEVELOPMENT CENTRE VII

TABLE 2 - MINIMUM NUMBER OF BULK SAMPLES TO BE COLLECTED UNDER O. REG. 278/05 ACCORDING TO MATERIAL AREA, APPLICATION AND FRIABILITY 4

APPENDICES

A BUILDING 11 – FIELD LABORATORY (HOUSE)

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 *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)

TABLE OF CONTENTS

1 OBSERVATIONS AND RESULTS....1

1.1 Asbestos-Containing Materials....1

1.2 Summary of Bulk Samples Identified as “Non-Asbestos”2

TABLES

TABLE 1 – ASBESTOS-CONTAINING MATERIALS....1
TABLE 2 – SUMMARY OF BULK SAMPLES IDENTIFIED AS “NON-ASBESTOS” 2

ATTACHMENTS

SITE PHOTOGRAPHS

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 m^2 (2,766 ft^2) 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]
2nd 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

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 551801490
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: 2/13/2018

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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray/White	0%	100%	None Detected	

EMSL Canada Inc.
2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS129-C **Lab Sample ID:** **551801490-0008**
Sample Description: EXTERIOR WHITE INNER FRAME WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	White	<1%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS131-E **Lab Sample ID:** **551801490-0016**
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Tan/Beige	33%	67%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS134-A **Lab Sample ID:** **551801490-0023**
Sample Description: WHITE CAULKING ALONG STAIRWELL

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	White/Beige	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS136-C **Lab Sample ID:** **551801490-0031**
Sample Description: WHITE CAULKING AROUND COUNTER TOP

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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**

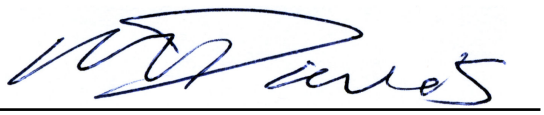
Sample Description: FIELD STONE MORTAR

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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:



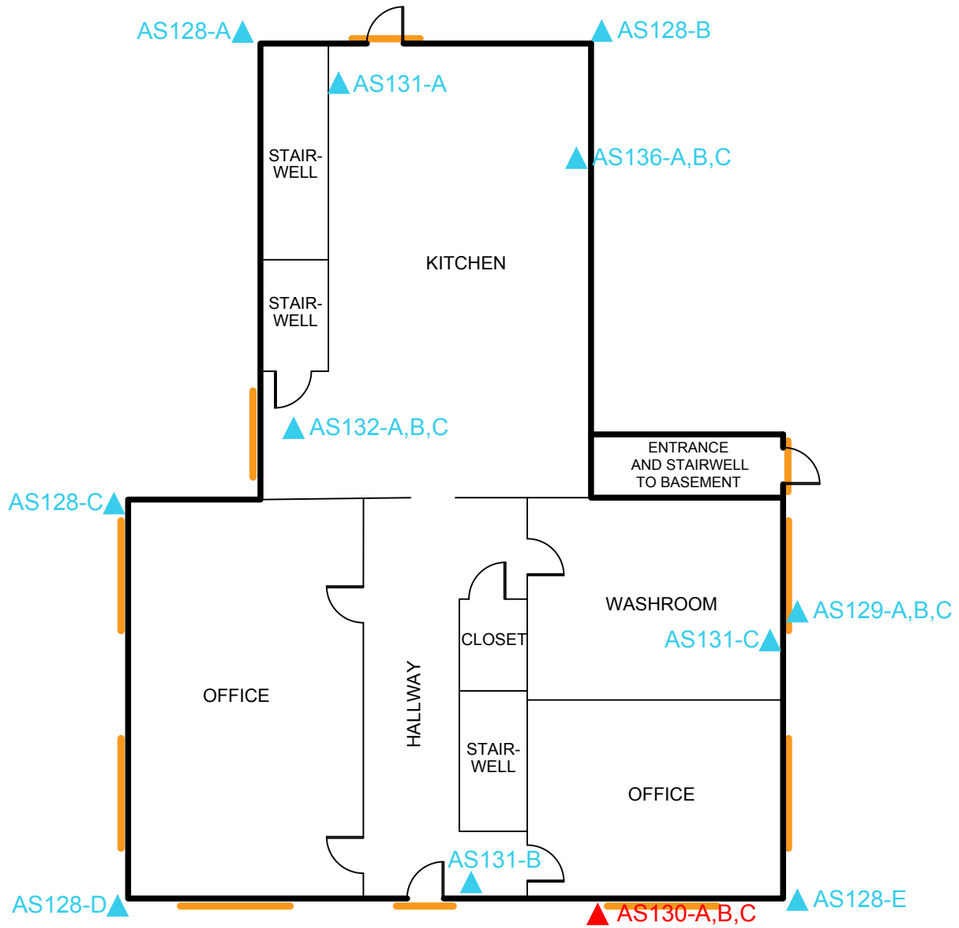
Matthew Davis or other approved signatory
or Other Approved Signatory

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: 02/12/201815:30:47

DRAWINGS



FIRST 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
- ASBESTOS BULK SAMPLE LOCATION
- CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION
- EXTERIOR WHITE CAULKING

WSP Project No:	181-00742-00
PSPC No:	R.095602.001
Date:	MARCH 2018
Drawn By:	NN
App'd By:	SWH

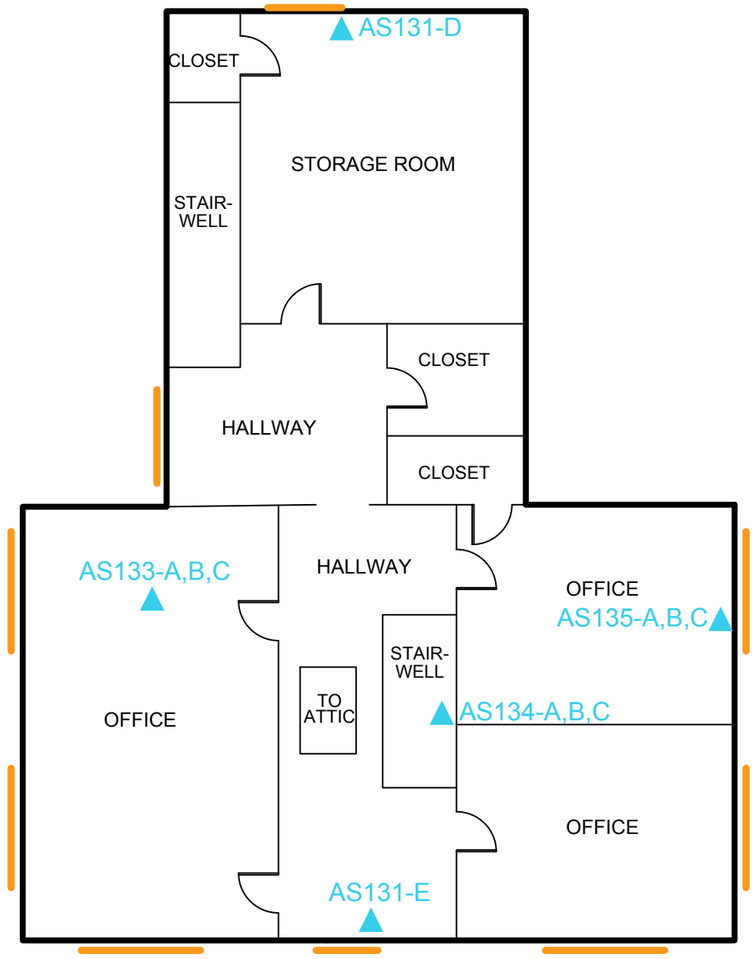
Client: PUBLIC SERVICES AND PROCUREMENT CANADA
on behalf of
AGRICULTURE AND AGRI-FOOD CANADA

Site Location:
1391 SANDFORD STREET,
LONDON, ONTARIO

LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 11 FIELD LABORATORY

Figure No: **A-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: Exterior white caulking.

LEGEND
- ASBESTOS BULK SAMPLE LOCATION
- CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION
- EXTERIOR WHITE CAULKING

WSP Project No:	181-00742-00
PSPC No:	R.095602.001
Date:	MARCH 2018
Drawn By:	NN
App'd By:	SWH

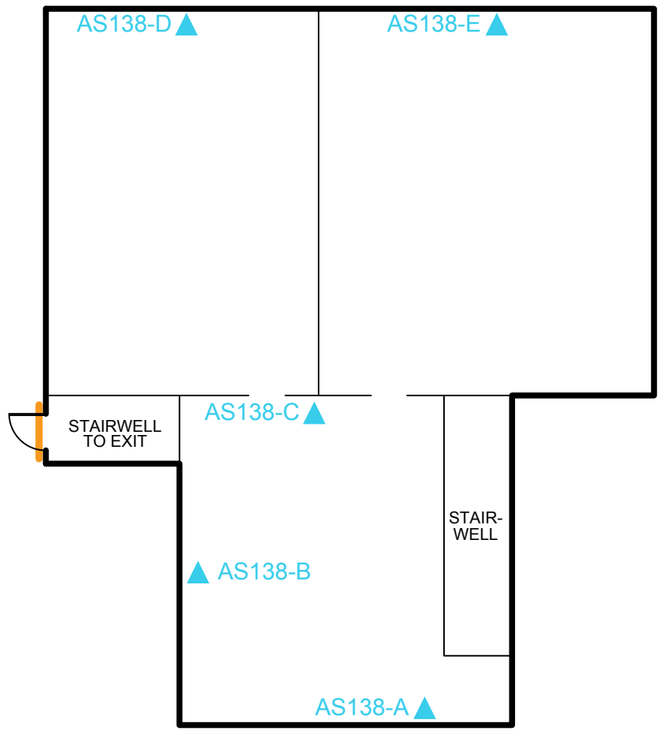
Client: PUBLIC SERVICES AND PROCUREMENT CANADA
on behalf of
AGRICULTURE AND AGRI-FOOD CANADA

Site Location:
1391 SANDFORD STREET,
LONDON, ONTARIO

LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 11 FIELD LABORATORY

Figure No: **A-2**

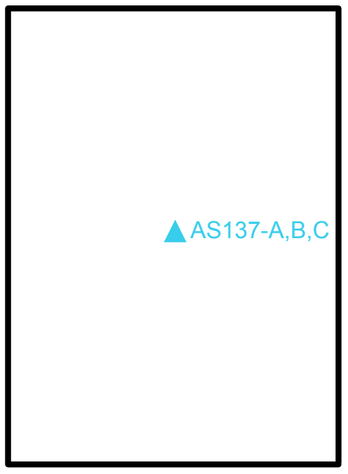
wsp



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.

LEGEND ▲ ASBESTOS BULK SAMPLE LOCATION ▲ CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION EXTERIOR WHITE CAULKING	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 11 FIELD LABORATORY**	Figure No: **A-3**



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.

LEGEND
- ASBESTOS BULK SAMPLE LOCATION
- CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION
- EXTERIOR 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 11 FIELD LABORATORY

Figure No: **A-4**

wsp

APPENDIX

B

BUILDING 12 – IMPLEMENT BARN

TABLE OF CONTENTS

1 OBSERVATIONS AND RESULTS.....1

1.1 Asbestos-Containing Materials.....1

TABLES

TABLE 1 – SUMMARY OF BULK SAMPLES IDENTIFIED AS "NON-ASBESTOS" 1

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 m^2 (1,787 ft^2) 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

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	White	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

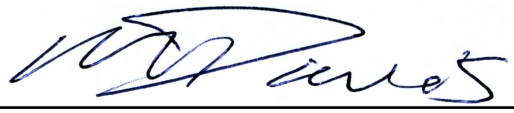
EMSL Canada Order 551801452
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

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:



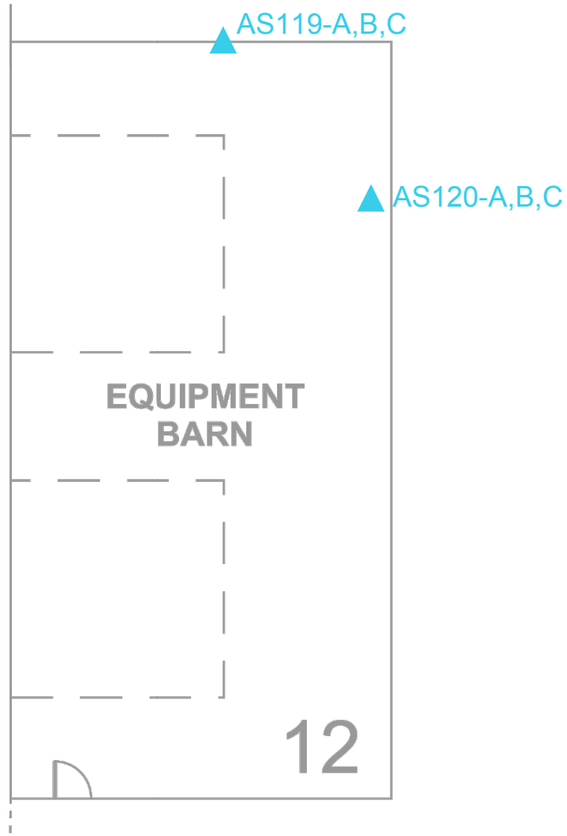
Matthew Davis or other approved signatory
or Other Approved Signatory

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: 02/12/201814:00:51

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.

LEGEND
- ▲ ASBESTOS BULK SAMPLE LOCATION
- ▲ CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION

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 12
IMPLEMENT BARN

Figure No: **B-1**

wsp

APPENDIX

C BUILDING 13 - PUMPHOUSE

TABLE OF CONTENTS

1 OBSERVATIONS AND RESULTS.....1

1.1 Asbestos-Containing Materials.....1

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 m^2 (23 ft^2) 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.

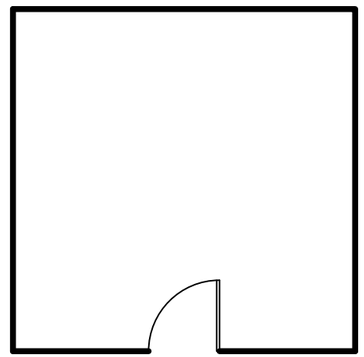
During the survey, suspected asbestos-containing materials were not observed. As such, bulk material samples were not collected for analysis of asbestos content.

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.

LEGEND
- ASBESTOS BULK SAMPLE LOCATION
- CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION

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 13 PUMPHOUSE

Figure No: **C-1**

wsp

APPENDIX

D

BUILDING 14 – OFFICE/LABORATORY BUILDING

TABLE OF CONTENTS

1 OBSERVATIONS AND RESULTS....1

1.1 Asbestos-Containing Materials....1

1.2 Summary of Bulk Samples Identified as “Non-Asbestos”3

TABLES

TABLE 1 – ASBESTOS-CONTAINING MATERIALS....1
TABLE 2 – SUMMARY OF BULK SAMPLES IDENTIFIED AS “NON-ASBESTOS” 3

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 m^2 (33,971 ft^2) in area. Phase 2 was constructed in 2001 and is approximately 890 m^2 (9,580 ft^2) in area. Phase 3 was constructed in 2015 and is approximately 1,312 m^2 (14,122 ft^2) 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 *(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

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 *(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
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 *(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.	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 *(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.	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/ 2nd Floor mechanical area and penthouse of 1988 phase	B14-AS43-A,B,C
Interior grey door caulking/ 2nd 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

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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
Thornhill, ON L3T 0A1

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 Fibrous	Non-Fibrous	Asbestos	Comment
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 WIDE FISSURES WITH LOTS OF PINS CEILING TILES

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 WIDE FISSURES WITH LOTS OF PINS CEILING TILES

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	White	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS3-B **Lab Sample ID:** **551801387-0008**
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	White	30%	70%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS4-C **Lab Sample ID:** **551801387-0016**
Sample Description: PARGING ON FIBREGLASS ENDS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	Gray	80%	20%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS8-B **Lab Sample ID:** **551801387-0031**
Sample Description: CONCRETE BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS9-C **Lab Sample ID:** **551801387-0039**
Sample Description: GREY CAULKING AROUND DUCT

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS12-B **Lab Sample ID:** **551801387-0047**
Sample Description: CEMENTITIOUS FIRE STOP

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	White	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS15-A **Lab Sample ID:** **551801387-0055**
Sample Description: WHITE DOOR CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray	15%	85%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS17-C **Lab Sample ID:** **551801387-0063**
Sample Description: PARGING ON BOILER SYSTEM

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Brown	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS20-B **Lab Sample ID:** **551801387-0071**
Sample Description: INTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Brown	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS21-C **Lab Sample ID:** **551801387-0079**
Sample Description: BROWN CAULKING AROUND BRICK WALL & EXPANSION JOINT CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	White	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS23-B **Lab Sample ID:** **551801387-0084**
Sample Description: CREAM SINK ACOUSTIC UNDERCOATING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	Gray	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS26-A **Lab Sample ID:** **551801387-0092**
Sample Description: TEXTURED CEILING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	Gray	0%	100%	None Detected	No mastic

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS28-A **Lab Sample ID:** **551801387-0098**
Sample Description: GREY/BROWN WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	White	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS29-F **Lab Sample ID:** **551801387-0106**
Sample Description: STUCCO INTERIOR

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018				Positive Stop (Not Analyzed)	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	Brown	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS36-C **Lab Sample ID:** **551801387-0128**
Sample Description: GREY CAULKING AROUND WINDOWS/DOORS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Yellow	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS38-C-Linoleum ***Lab Sample ID:*** **551801387-0134**

Sample Description: BLUE/GREEN WITH COLOUR FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	Brown	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS41-A-Linoleum ***Lab Sample ID:*** **551801387-0141**
Sample Description: GREY/BLUE WITH GREY FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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/BLUE WITH GREY FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Yellow	0%	100%	None Detected	

Client Sample ID: B14-AS41-B-Linoleum ***Lab Sample ID:*** **551801387-0142**
Sample Description: GREY/BLUE WITH GREY FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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/BLUE WITH GREY FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Yellow	0%	100%	None Detected	

Client Sample ID: B14-AS41-C-Linoleum ***Lab Sample ID:*** **551801387-0143**
Sample Description: GREY/BLUE WITH GREY FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	Gray	0%	100%	None Detected	

Client Sample ID: B14-AS41-C-Mastic ***Lab Sample ID:*** **551801387-0143A**
Sample Description: GREY/BLUE WITH GREY FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Beige	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS42-B-Linoleum ***Lab Sample ID:*** **551801387-0145**
Sample Description: CREAM WITH BEIGE PATTERN LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS44-B **Lab Sample ID:** **551801387-0151**
Sample Description: GREY DOOR CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS46-D **Lab Sample ID:** **551801387-0159**
Sample Description: CONCRETE BLOCK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	Gray	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS48-B **Lab Sample ID:** **551801387-0167**
Sample Description: CREAM DOOR CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	White	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS49-G **Lab Sample ID:** **551801387-0175**
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	Gray	80%	20%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	Black	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	Black	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS57-A **Lab Sample ID:** **551801387-0197**
Sample Description: GREY WITH LIGHT FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	Beige	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS59-B-Linoleum ***Lab Sample ID:*** **551801387-0204**
Sample Description: BLUE/GREEN WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	Beige	0%	100%	None Detected	

EMSL Canada Inc.
2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS60-C-Linoleum ***Lab Sample ID:*** **551801387-0208**
Sample Description: BLUE/GREY WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	Black	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS62-A **Lab Sample ID:** **551801387-0212**
Sample Description: BLACK WINDOW GLAZING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	Black	40%	60%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS64-C **Lab Sample ID:** **551801387-0220**
Sample Description: TAR PAPER WITHIN TUNNEL

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/13/2018	Gray	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS67-A-Mastic **Lab Sample ID:** **551801387-0227A**
Sample Description: CREAM AND GREY WITH FLECK LINOLEUM VINYL FLOORING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Brown/Red	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Brown	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	White	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS75-E **Lab Sample ID:** **551801387-0257**
Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Brown	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS77-C **Lab Sample ID:** **551801387-0265**
Sample Description: DARK BROWN WINDOW CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS80-B ***Lab Sample ID:*** **551801387-0273**
Sample Description: EXTERIOR BRICK MORTAR

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

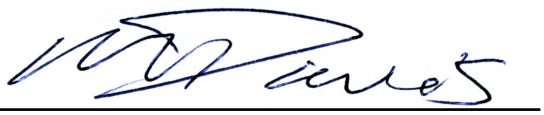
EMSL Canada Order 551801387
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Analyst(s):

Anne Balayboa	PLM (98)
Caroline Allen	PLM (15)
Shorthri Kalikutty	PLM (188) TEM Grav. Reduction (3)

Reviewed and approved by:



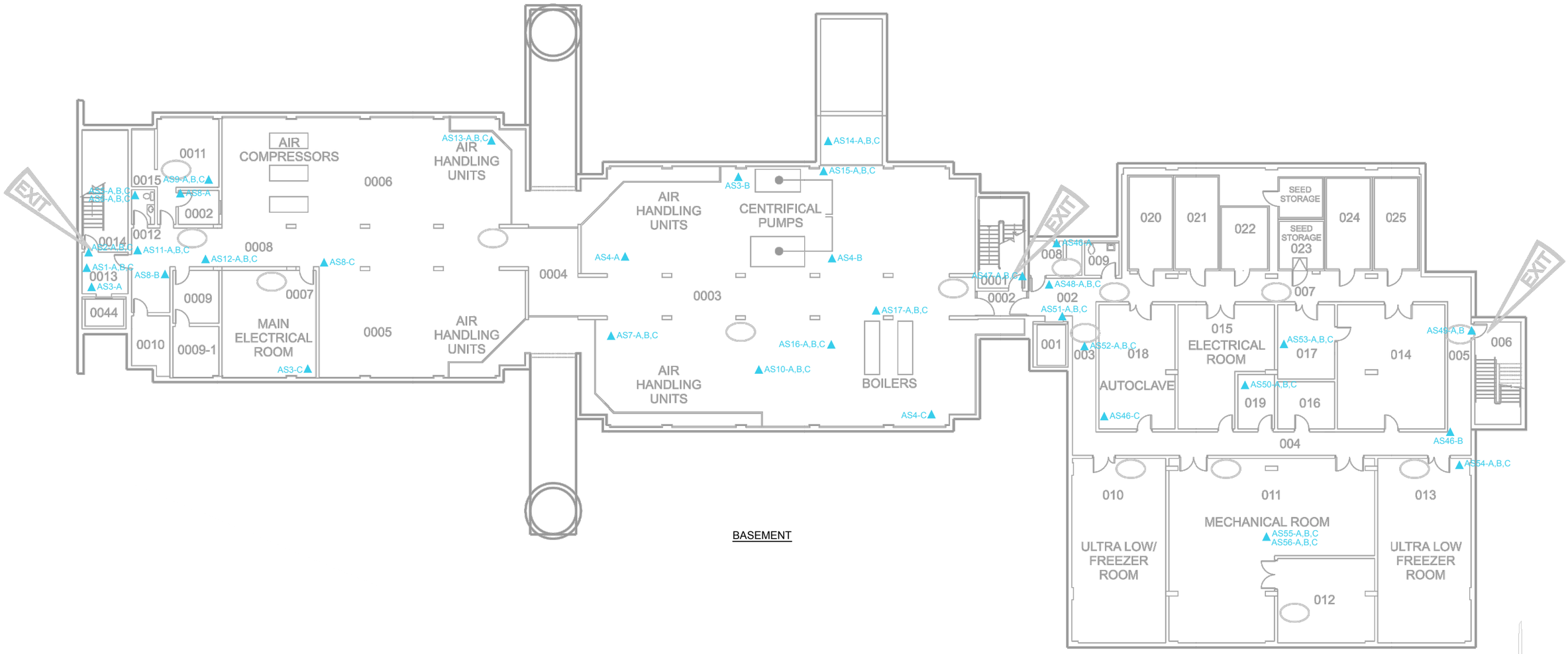
Matthew Davis or other approved signatory
or Other Approved Signatory

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: 02/14/201814:40:05 Replaces initial report from: 02/13/201814:26:00 Reason Code: Client-Additional Analysis

DRAWINGS



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: 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

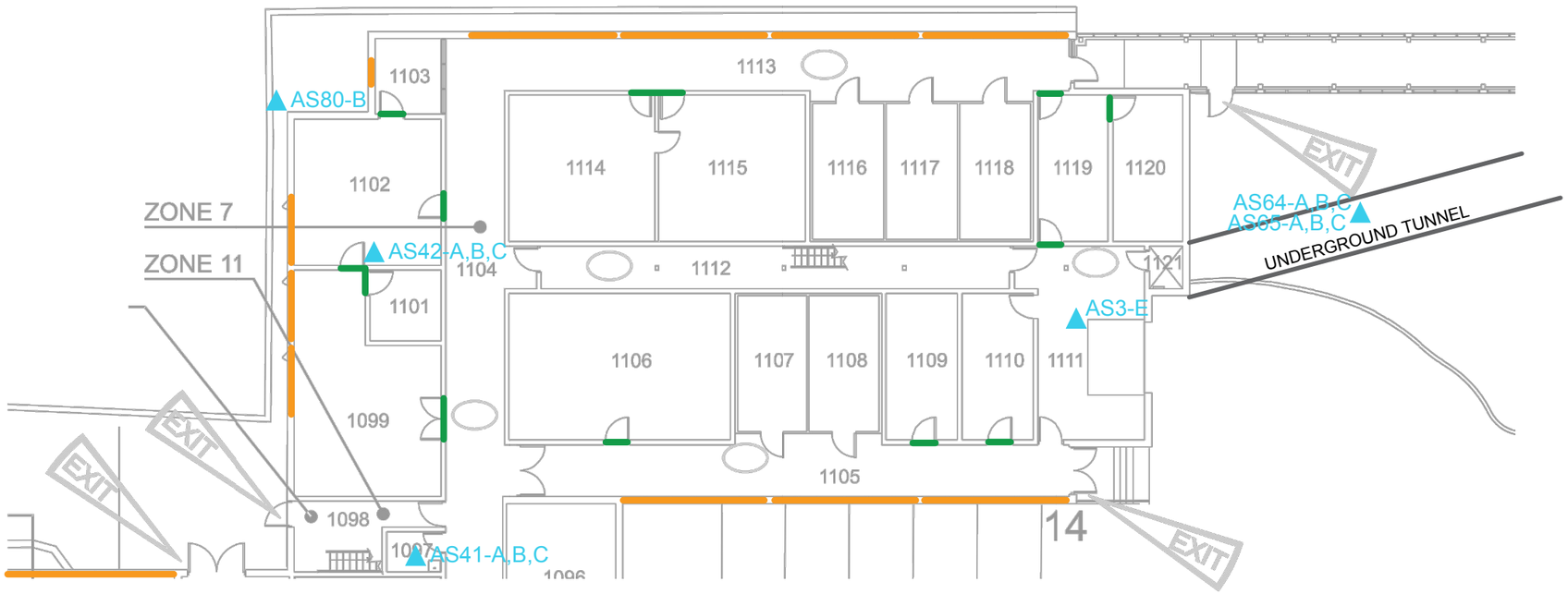
Client: PUBLIC SERVICES AND PROCUREMENT CANADA
on behalf of
AGRICULTURE AND AGRI-FOOD CANADA

Site Location:
1391 SANDFORD STREET,
LONDON, ONTARIO

LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 14 OFFICE/LABORATORY BUILDING

Figure No: **D-1**

wsp



INSECTARY WING
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: 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

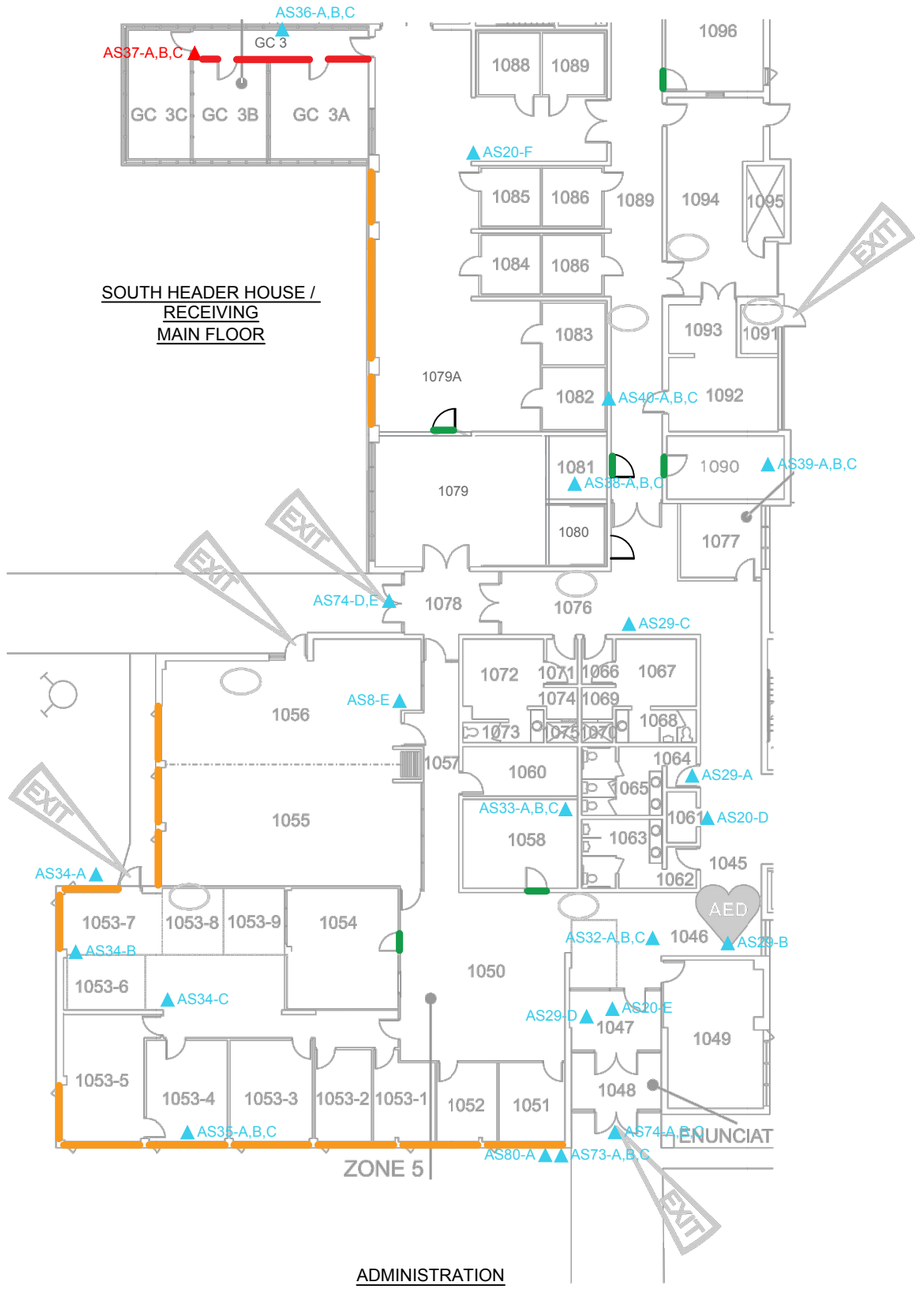
WSP Project No: 181-00742-00
PSPC No: R.095602.001
Date: MARCH 2018
Drawn By: NN
App'd By: SWH

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-2**



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

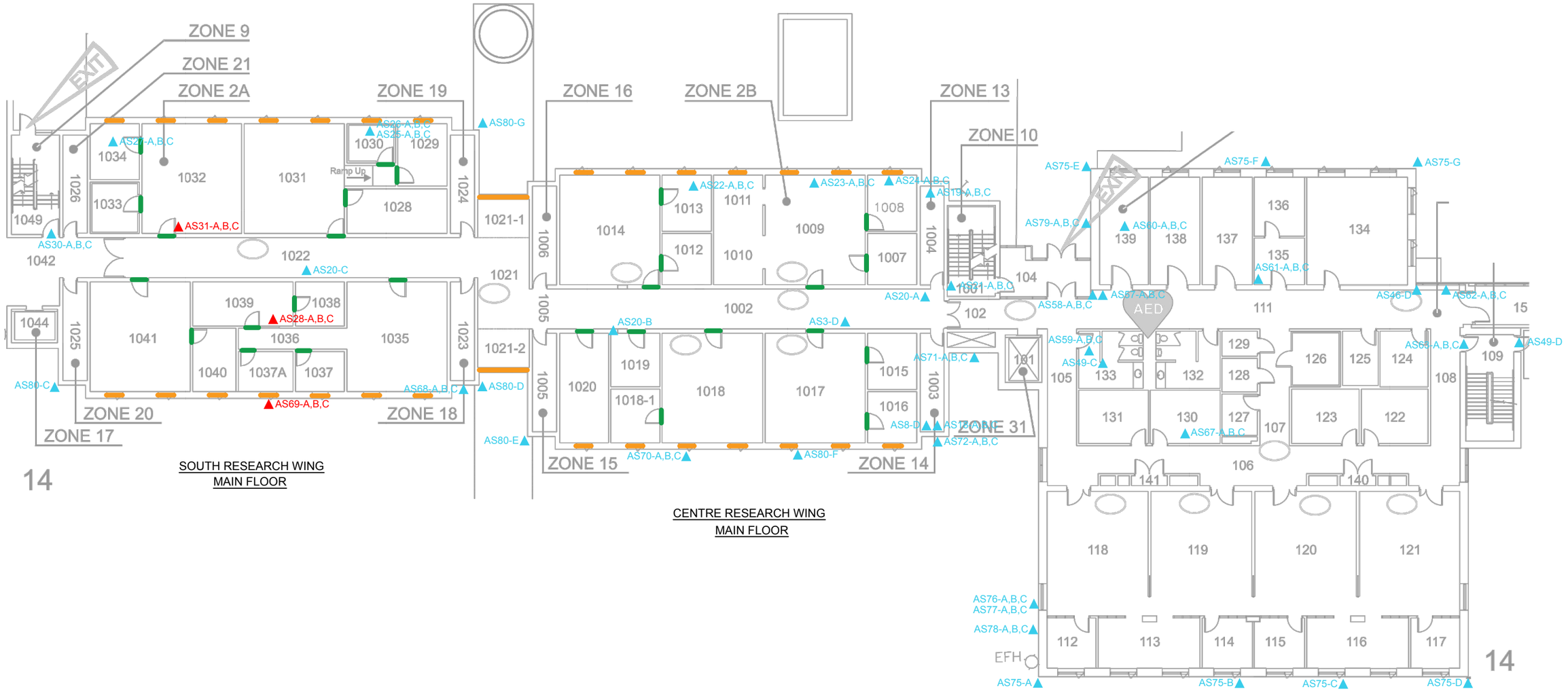
Client: PUBLIC SERVICES AND PROCUREMENT CANADA
on behalf of
AGRICULTURE AND AGRI-FOOD CANADA

Site Location:
1391 SANDFORD STREET,
LONDON, ONTARIO

LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 14 OFFICE/LABORATORY BUILDING

Figure No: **D-3**

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
PSPC No:	R.095602.001
Date:	MARCH 2018
Drawn By:	NN
App'd By:	SWH

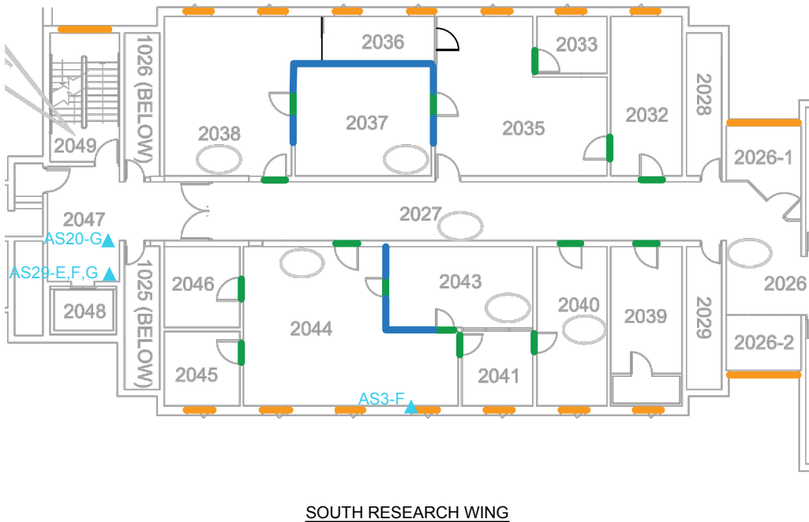
Client: PUBLIC SERVICES AND PROCUREMENT CANADA
on behalf of
AGRICULTURE AND AGRI-FOOD CANADA

Site Location:
1391 SANDFORD STREET,
LONDON, ONTARIO

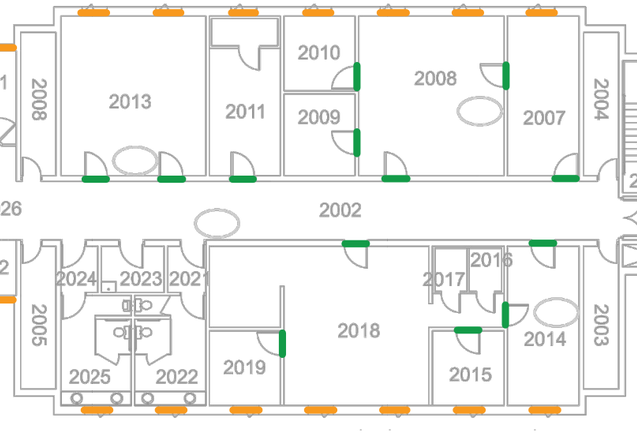
LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 14 OFFICE/LABORATORY BUILDING

Figure No: **D-4**

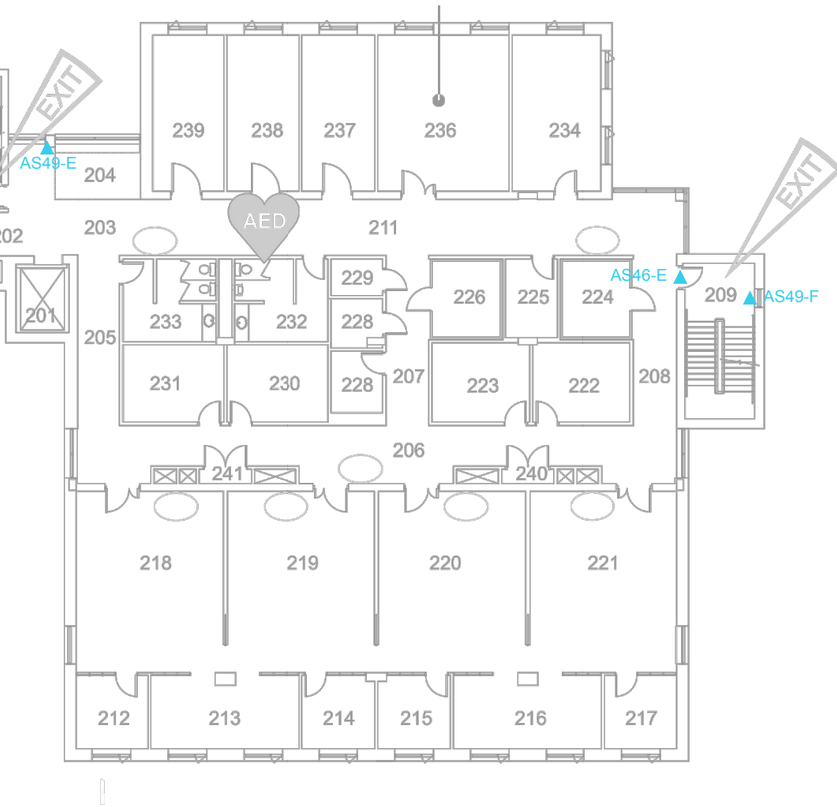
wsp



SOUTH RESEARCH WING
SECOND FLOOR



CENTRE RESEARCH WING
SECOND FLOOR



NORTH RESEARCH WING
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: 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

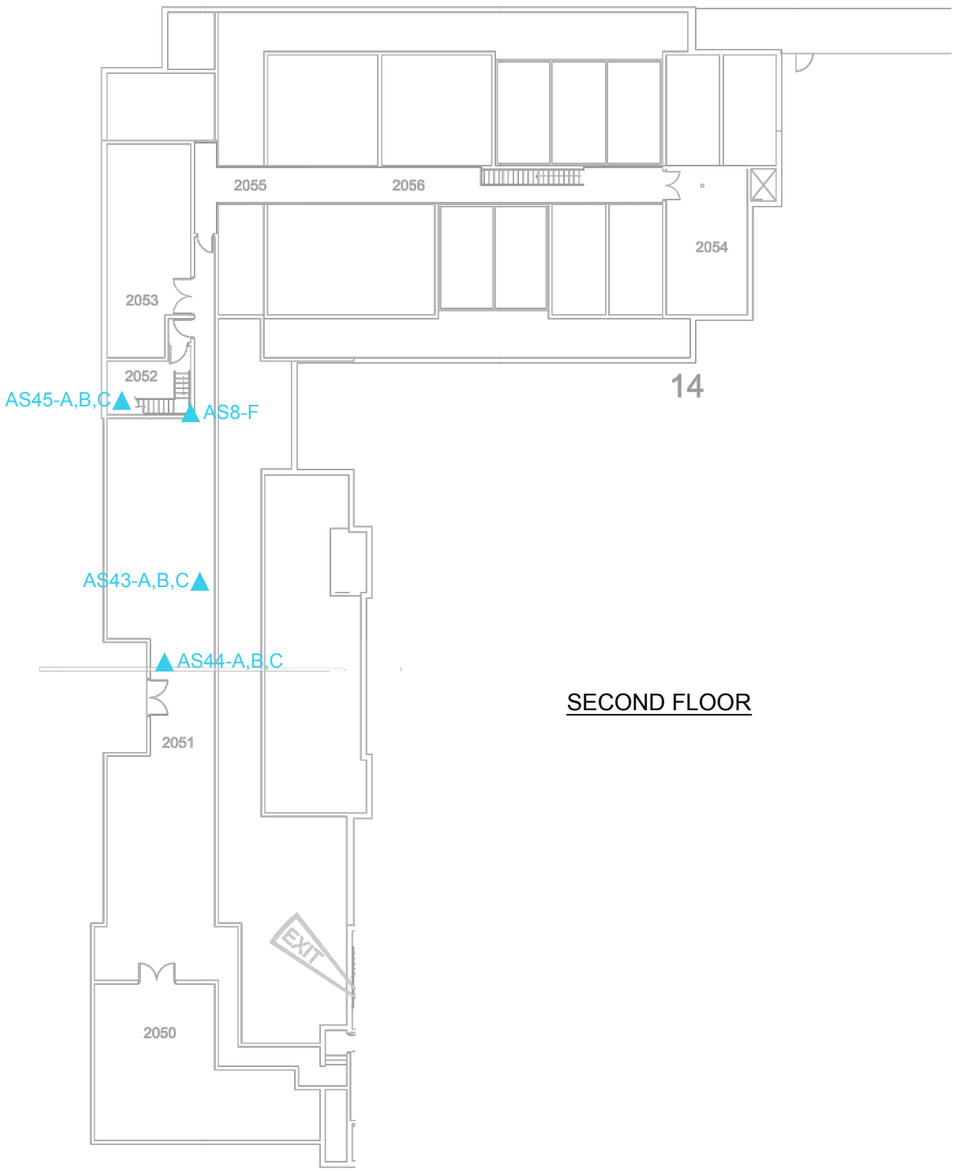
Client: PUBLIC SERVICES AND PROCUREMENT CANADA
on behalf of
AGRICULTURE AND AGRI-FOOD CANADA

Site Location:
1391 SANDFORD STREET,
LONDON, ONTARIO

LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 14 OFFICE/LABORATORY BUILDING

Figure No: **D-5**

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: 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

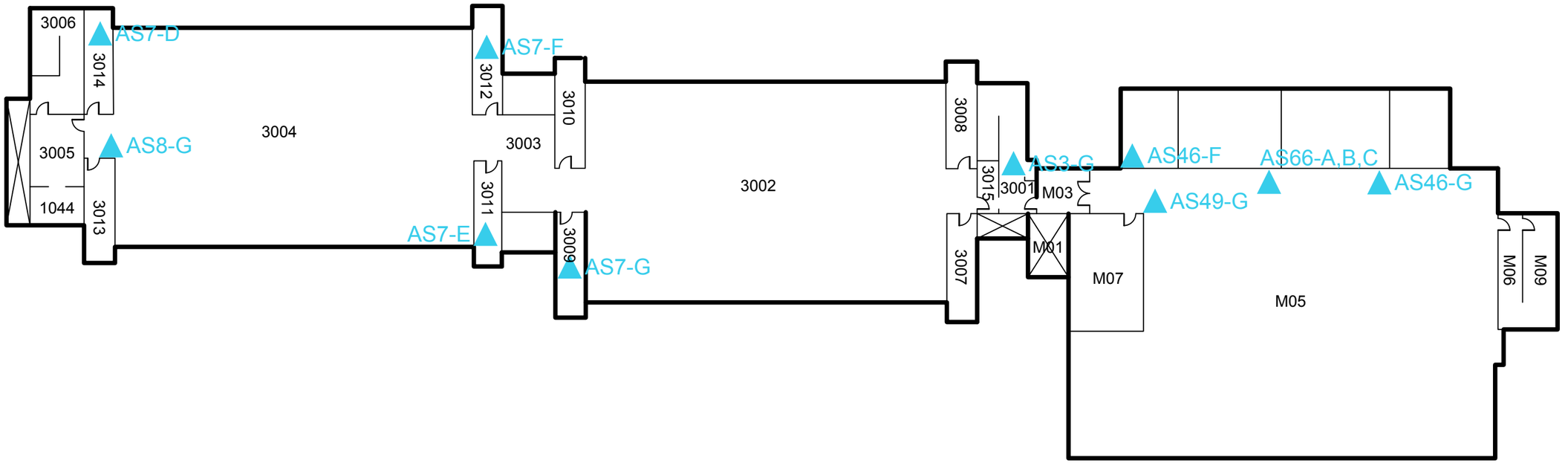
Client: PUBLIC SERVICES AND PROCUREMENT CANADA
on behalf of
AGRICULTURE AND AGRI-FOOD CANADA

Site Location:
1391 SANDFORD STREET,
LONDON, ONTARIO

LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS BUILDING 14 OFFICE/LABORATORY BUILDING

Figure No: **D-6**

wsp



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

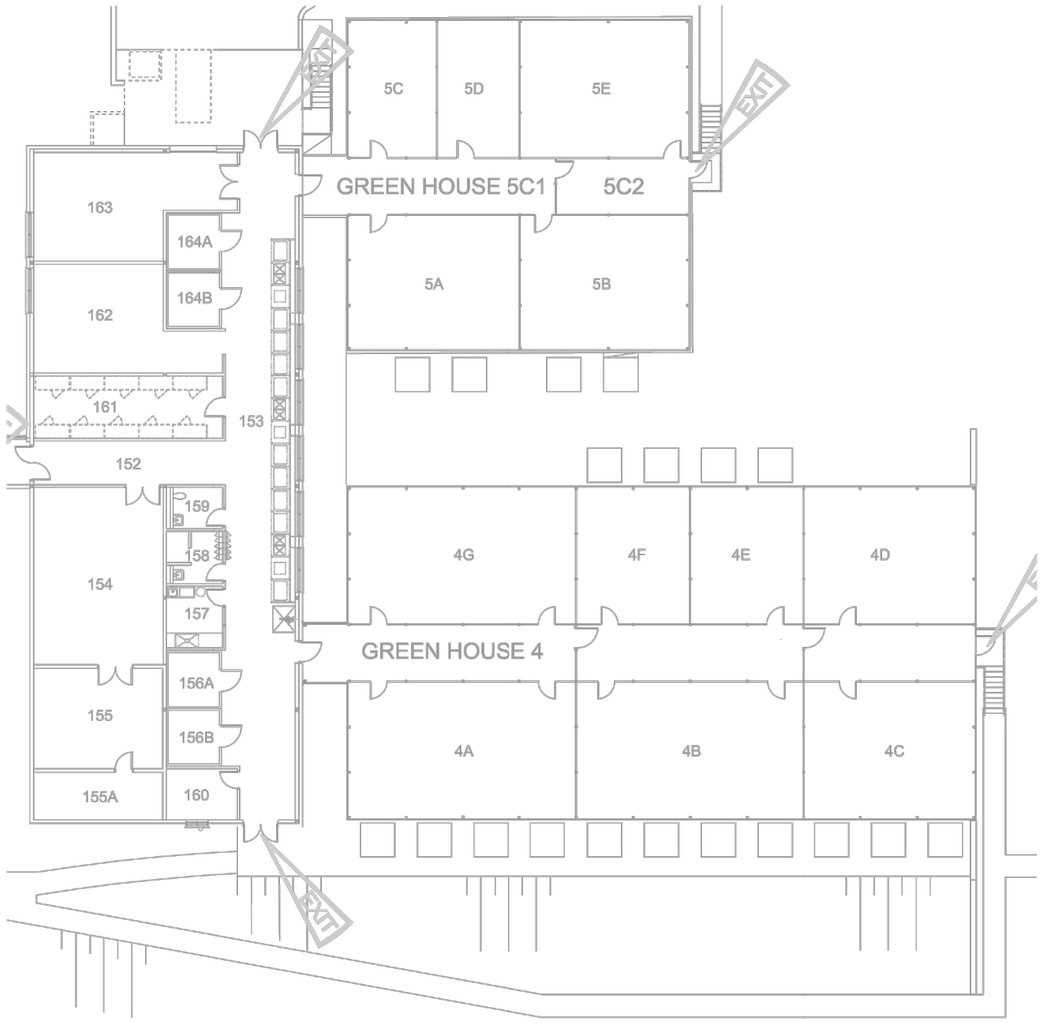
Client: PUBLIC SERVICES AND PROCUREMENT CANADA
on behalf of
AGRICULTURE AND AGRI-FOOD CANADA

Site Location:
1391 SANDFORD STREET,
LONDON, ONTARIO

LOCATIONS OF SAMPLES AND ASBESTOS-CONTAINING MATERIALS
BUILDING 14
OFFICE/LABORATORY BUILDING

Figure No: **D-7**

wsp



GREENHOUSE COMPLEX

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-8**

wsp

APPENDIX

E

BUILDING 15 – MASS PRODUCTION

TABLE OF CONTENTS

1 OBSERVATIONS AND RESULTS....1

1.1 Asbestos-Containing Materials....1

1.2 Summary of Bulk Samples Identified as “Non-Asbestos”2

TABLES

TABLE 1 – ASBESTOS-CONTAINING MATERIALS....1

TABLE 2 – SUMMARY OF BULK SAMPLES IDENTIFIED AS “NON-ASBESTOS” 2

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 m^2 (4,736 ft^2) 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

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Yellow	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	White	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS85-B **Lab Sample ID:** **551801504-0018**
Sample Description: Drywall Joint Compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray/Blue	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Brown	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Red	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS91-A **Lab Sample ID:** **551801504-0039**
Sample Description: Black Interior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	White	0%	100%	None Detected	

Client Sample ID: B15-AS93-A **Lab Sample ID:** **551801504-0045**
Sample Description: Brown Duct Sealent

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B15-AS93-B **Lab Sample ID:** **551801504-0046**
Sample Description: Brown Duct Sealent

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Brown	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS93-C **Lab Sample ID:** **551801504-0047**
Sample Description: Brown Duct Sealent

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Insualtion

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	White	15%	85%	None Detected	

Client Sample ID: B15-AS95-B **Lab Sample ID:** **551801504-0052**
Sample Description: White Block Insualtion

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	White	10%	90%	None Detected	

Client Sample ID: B15-AS95-C **Lab Sample ID:** **551801504-0053**
Sample Description: White Block Insualtion

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Black	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS96-B **Lab Sample ID:** **551801504-0055**
Sample Description: Brown Ext Door/Window Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Brown	0%	100%	None Detected	

Client Sample ID: B15-AS97-A **Lab Sample ID:** **551801504-0057**
Sample Description: Marroon Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Tan	0%	100%	None Detected	

Client Sample ID: B15-AS97-B **Lab Sample ID:** **551801504-0058**
Sample Description: Marroon Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Tan	0%	100%	None Detected	

Client Sample ID: B15-AS97-C **Lab Sample ID:** **551801504-0059**
Sample Description: Marroon Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Black	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS99-A **Lab Sample ID:** **551801504-0063**
Sample Description: Grey Fire Stop Around EXT Conduits

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Red	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS100-F ***Lab Sample ID:*** **551801504-0071**

Sample Description: Exterior Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Red	0%	100%	None Detected	

Client Sample ID: B15-AS100-G ***Lab Sample ID:*** **551801504-0072**

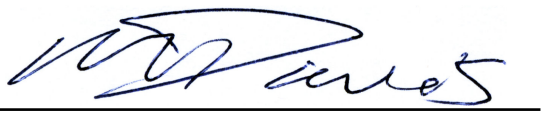
Sample Description: Exterior Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Red	0%	100%	None Detected	

Analyst(s):

Brian Jolly PLM (28)
Christine Stouffer PLM (51)

Reviewed and approved by:



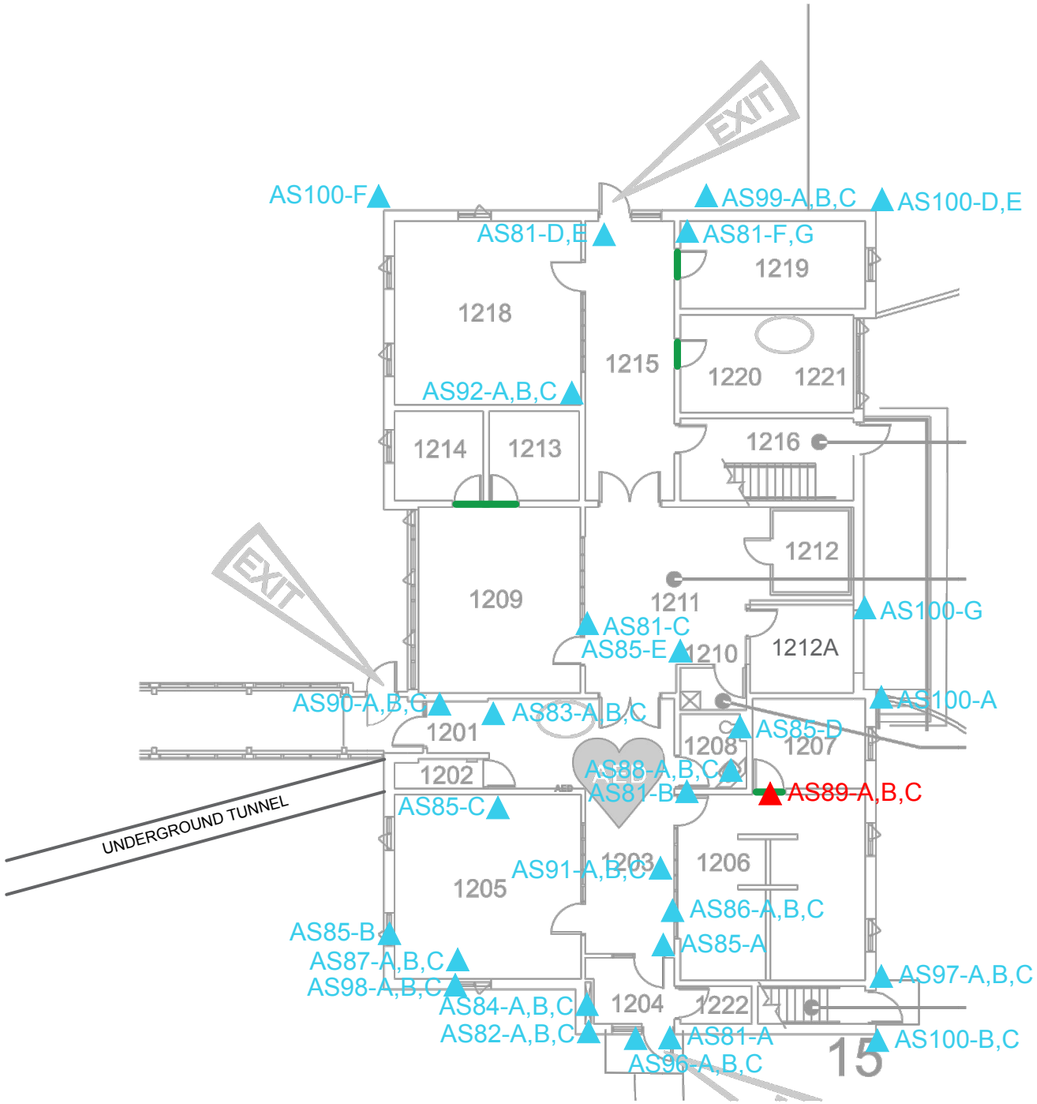
Matthew Davis or other approved signatory
or Other Approved Signatory

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: 02/12/201817:18:20

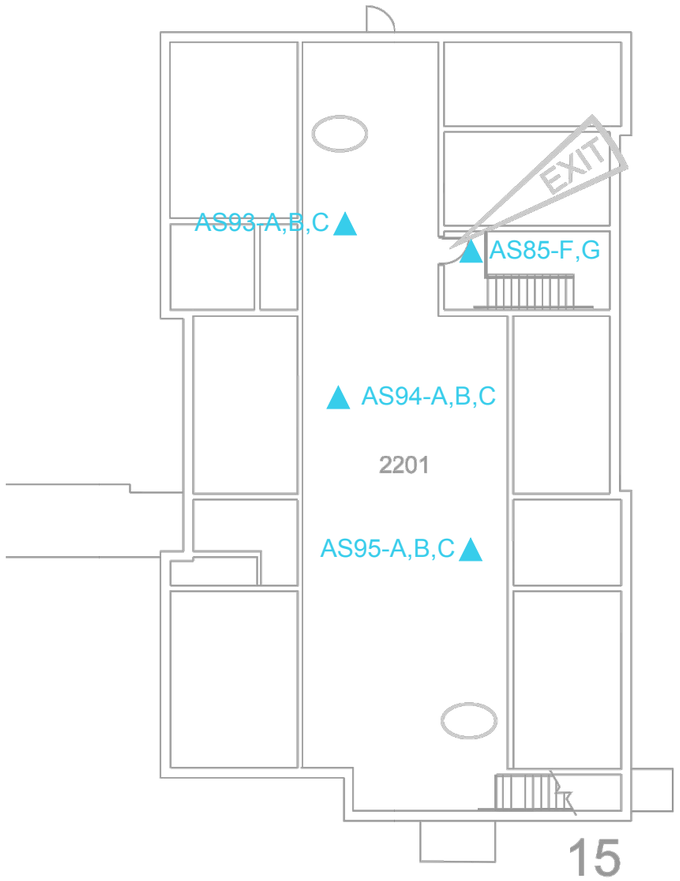
DRAWINGS



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**



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.

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-2**

wsp

APPENDIX

F

BUILDING 17 – PESTICIDE HANDLING BUILDING

TABLE OF CONTENTS

1 OBSERVATIONS AND RESULTS.....1

1.1 Asbestos-Containing Materials.....1

TABLES

TABLE 1 – SUMMARY OF BULK SAMPLES IDENTIFIED AS "NON-ASBESTOS" 1

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 m^2 (215 ft^2) 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 Handing Building (facing northwest).	
SAMPLE NUMBER(S): -	

LABORATORY CERTIFICATES OF ANALYSIS

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 551801417
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/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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Brown	2%	98%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 551801417
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray	2%	98%	None Detected	

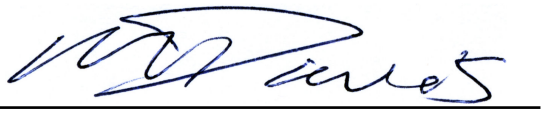
Client Sample ID: B17-AS118-C **Lab Sample ID:** **551801417-0012**
Sample Description: Grey door window glazing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray	0%	100%	None Detected	

Analyst(s):

Colin Slattery PLM (12)

Reviewed and approved by:



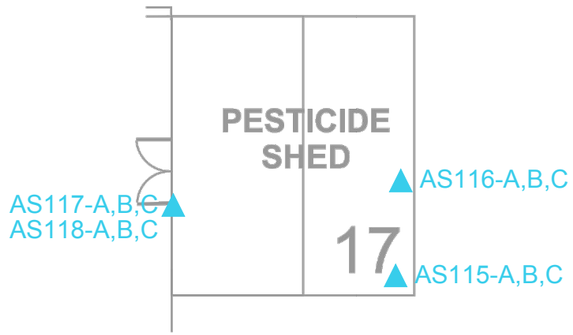
Matthew Davis or other approved signatory
or Other Approved Signatory

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: 02/12/201813:00:43

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.

LEGEND
- ASBESTOS BULK SAMPLE LOCATION
- CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION

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 17 PESTICIDE HANDLING BUILDING

Figure No: **F-1**

wsp

APPENDIX

G

BUILDING 18 – MULTI PURPOSE FACILITY

TABLE OF CONTENTS

1 OBSERVATIONS AND RESULTS.....1

1.1 Asbestos-Containing Materials.....1

TABLES

TABLE 1 – SUMMARY OF BULK SAMPLES IDENTIFIED AS "NON-ASBESTOS" 1

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 m^2 (1,776 ft^2) 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.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 551801454
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: B18-AS124-A **Lab Sample ID:** **551801454-0001**
Sample Description: White Caulking around Concrete Slab

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray/White	0%	100%	None Detected	

Client Sample ID: B18-AS126-A **Lab Sample ID:** **551801454-0007**
Sample Description: Firep-roofing Over Spray Foam

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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: Firep-roofing Over Spray Foam

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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: Firep-roofing Over Spray Foam

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Tan/White	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

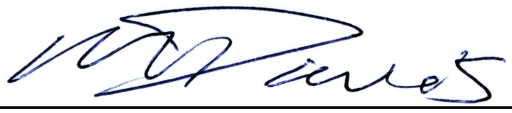
EMSL Canada Order 551801454
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

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:



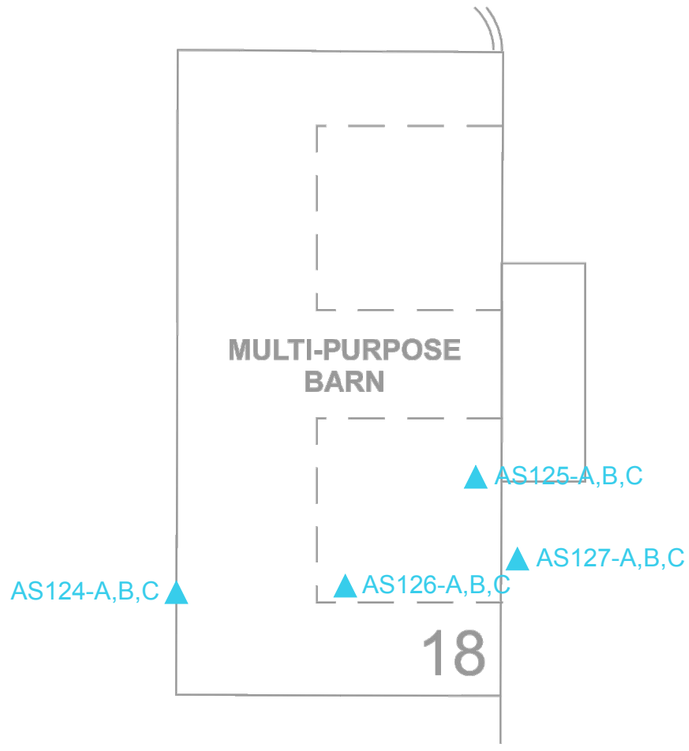
Matthew Davis or other approved signatory
or Other Approved Signatory

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: 02/12/201815:31:28

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.

LEGEND
- ASBESTOS BULK SAMPLE LOCATION
- CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION

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 18
MULTI-PURPOSE FACILITY

Figure No: **G-1**

wsp

APPENDIX

H

BUILDING 19 – POLE BARN

TABLE OF CONTENTS

1 OBSERVATIONS AND RESULTS.....1

1.1 Asbestos-Containing Materials.....1

ATTACHMENTS

SITE PHOTOGRAPHS

LABORATORY CERTIFICATES OF ANALYSIS

DRAWINGS

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 m^2 (2,874 ft^2) 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

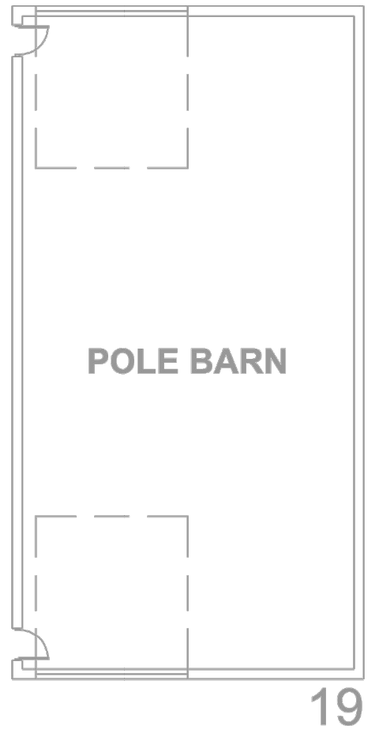
The *Canada Occupational Health & Safety Regulations (SOR/86-304)* and *Ontario Regulation 278/05 (O. Reg. 278/05)* both establish definitions of asbestos-containing material (ACM), however, *O. Reg. 278/05* is more stringent. In accordance with the requirements of *O. Reg. 278/05*, homogenous materials (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.

LEGEND
- ASBESTOS BULK SAMPLE LOCATION
- CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION

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 19
POLE BARN

Figure No: **H-1**

wsp

APPENDIX

I

BUILDING 10 - GARAGE

TABLE OF CONTENTS

1 OBSERVATIONS AND RESULTS.....1

1.1 Asbestos-Containing Materials.....1

TABLES

TABLE 1 – SUMMARY OF BULK SAMPLES IDENTIFIED AS "NON-ASBESTOS" 1

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 m^2 (576 ft^2) 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.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 551801453
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/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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Tan	2%	98%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Tan	4%	96%	None Detected	

Client Sample ID: B10-AS123-C ***Lab Sample ID:*** **551801453-0009**

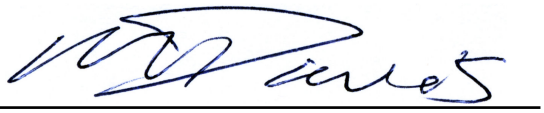
Sample Description: Interior Window Glazing

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Tan	<1%	100%	None Detected	

Analyst(s):

Colin Slattery PLM (9)

Reviewed and approved by:



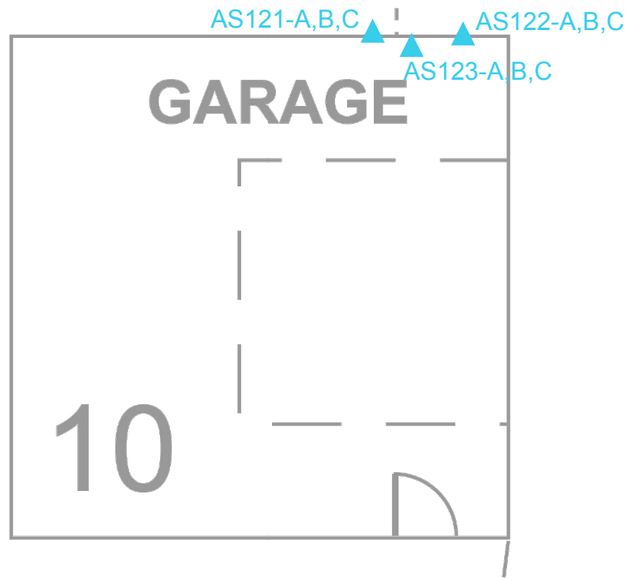
Matthew Davis or other approved signatory
or Other Approved Signatory

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: 02/12/201813:32:42

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.

LEGEND
- ASBESTOS BULK SAMPLE LOCATION
- CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION

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 10 GARAGE

Figure No: I-1

wsp

APPENDIX

J

BUILDING 16 - GARAGE

TABLE OF CONTENTS

1 OBSERVATIONS AND RESULTS.....1

1.1 Asbestos-Containing Materials.....1

1.2 Summary of Bulk Samples Identified as “Non-Asbestos”3

TABLES

TABLE 1 – ASBESTOS-CONTAINING MATERIALS.....2

TABLE 2 – SUMMARY OF BULK SAMPLES IDENTIFIED AS “NON-ASBESTOS” 3

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 m^2 (4,305 ft^2) 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 *(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
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 *(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]
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

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Tan	0%	100%	None Detected	

EMSL Canada Inc.
2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS101-C-Caulk **Lab Sample ID:** **551801418-0003**
Sample Description: Black Window /Door Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray/White	<1%	100%	None Detected	Inseparable paint / coating layer included in analysis

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Red/Black	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Brown/Red	<1%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Gray/Black	0%	96%	**4% Chrysotile**	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Fibrous	Asbestos	Comment
PLM	2/12/2018			Positive Stop (Not Analyzed)		

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

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-AS113-A **Lab Sample ID:** **551801418-0041**
Sample Description: Puddy aournd Electrical Conduits

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
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 Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	2/12/2018	Tan	0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

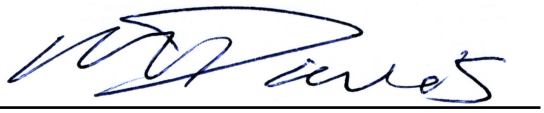
EMSL Canada Order 551801418
Customer ID: 55MMMG25
Customer PO: 181-00742-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Analyst(s):

Eric Budai PLM (16)
Rebecca Newman PLM (33)

Reviewed and approved by:



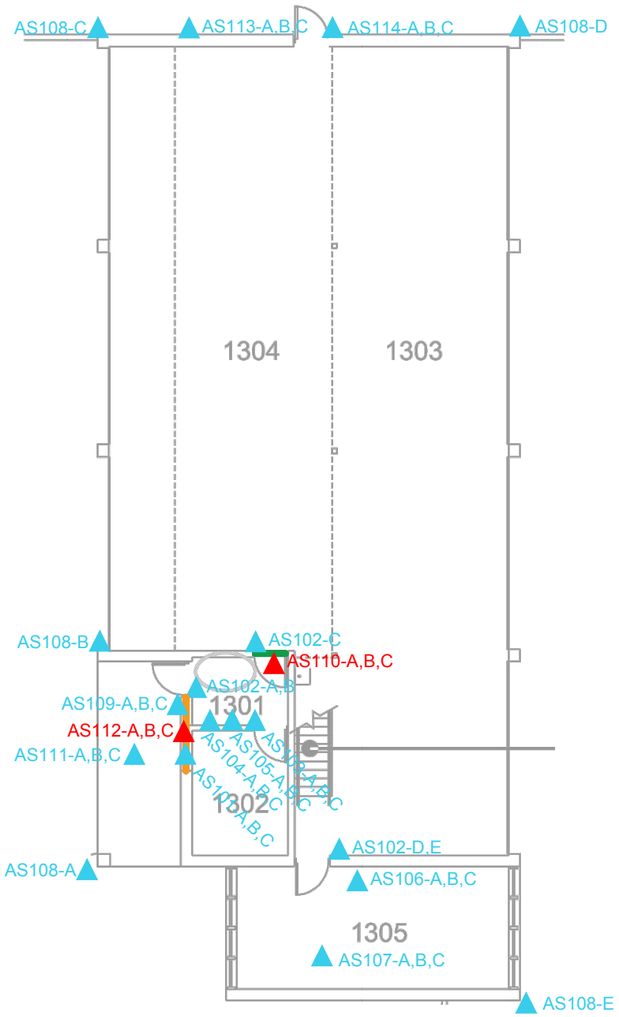
Matthew Davis or other approved signatory
or Other Approved Signatory

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: 02/12/201815:30:09

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.

LEGEND
- ASBESTOS BULK SAMPLE LOCATION
- CONFIRMED ASBESTOS-CONTAINING BULK SAMPLE LOCATION
- EXTERIOR WINDOW GLAZING
- 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 16
GARAGE

Figure No: **J-1**

wsp

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 m^2 surface area, or 3 linear metres of pipe insulation
    - in Quebec: up to 0.03 m^3 of debris
    - all others: up to 1 m^2 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/cm^3. This order is in effect until work processes are corrected and subsequent tests are less than 0.05 fibres/cm^3.

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/cm^3. This order is in effect until work processes are corrected and subsequent tests are less than 0.05 fibres/cm^3.

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/cm^3) 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

Annex A

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.

Annex B

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 (parging 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.

T. HARRIS
ENVIRONMENTAL MANAGEMENT
since 1979

93 Skyway Avenue, Suite 101
Toronto, Ontario M9W 6N6
Tel. (416) 679-8914
Fax. (416) 679-8915
1-888-ASK-THEM

Fume Hood Exhaust Ductwork Sampling

Agriculture and Agri-Food Canada
1381 Sandford Street
London, ON

FINAL REPORT

Assessment performed: February 20th and 21st, 2019
Report issued: March 19, 2019
THEM Project # T19-17346

Performed by:

T. HARRIS ENVIRONMENTAL MANAGEMENT INC.

Richard Quenneville, B.Sc, ROH, CIH
Senior Director Corporate Services

Zainab Mustafa, H.B.Sc., M.P.H.
Junior Occupational Hygienist

Joe D'Angelo, B.A.(Envs), AMRT, EPt
Project Coordinator

Greg Balsden, B.Sc., AMRT
Manager – Southwestern Ontario

Performed for:

Mr. David Yin
Senior Associate, Buildings Engineering
Stantec Consulting Limited
400-1331 Clyde Avenue
Ottawa, ON, K2C 3G4

EXECUTIVE SUMMARY

On February 20th and 21st, 2019, personnel from T. Harris Environmental Management Inc. (THEM) conducted an assessment of the internal ducting for a centralized exhaust fan using surface chemical wipes. The assessment was performed in the Mechanical Room Penthouse of Agriculture and Agri-Food Canada located on 1381 Sandford Street in London, Ontario. The assessment was conducted at the request of Mr. David Yin, Senior Associate, Buildings Engineer for Stantec Consulting Limited. The chemical parameters tested included, pH, formic acid, acetic acid, alkaline metal dust, polycyclic aromatic hydrocarbons (PAHs), toxic meals, and inorganic acids. All exhaust fans except for exhaust fan #7 were tested.

Based on the measurement results and visual inspections, the following conclusions are drawn:

- There was no heavy dust loading at any of the sampling locations that were accessible and visible during the assessment.

- The maximum concentrations of hydrofluoric acid, sulfuric acid, and hydrochloric acid were above the derived acceptable surface limit. All samples assessed for hydrobromic acid were below the limit of detection.

- To protect workers from exposure to hydrofluoric acid (30 - 70%), sulfuric acid, and hydrochloric acid the following gloves materials are recommended as they are resistant from chemical penetration for more than eight-hours of use: Butyl Rubber, Viton®/Butyl Rubber or Barrier – PE/PA/PE. Neoprene and Silver Shield – PE/EVAL/PE will provide greater than 4 hours of protection from hydrofluoric acid (30 - 70%). These recommendations are not valid for very thin gloves 0.3 mm (12 mil) or less.

- Most formic acid and acetic acid concentrations were below the limit of detection. One surface sample for formic acid reported a concentration of 0.2 µg/cm^2, which was not a health concern.

- The concentration of lithium was below the limit of detection for all surfaces sampled. Sodium and potassium surface contamination are not a concern based on concentration the presence of pH values below neutral and acidic.

- All PAHs sampled were below the limit of detection and the WTC screening value of 0.0145 µg/cm^2.

- Out of the ten (10) toxic metals assessed, lead was the only one that exceeded the WTC

screening value. It is possible that hand lead contamination and subsequent ingestion can occur from lead contaminated hands or gloves from normal hand to mouth actions.

- Worker risk of ingestion is low provided that eating, drinking, chewing and smoking is prohibited in the work space, nitrile gloves (> 0.3 mm or 12 mil) are used when handling contaminated ducts or working in the sampled areas and hand washing with D-Lead® Hand Soap and D-Wipes is practiced.

Precautions to be followed during ductwork removal and maintenance include:

- Work should be classed as a Type 2a lead operation as per the Ministry of Labour lead guideline and the EACO lead guideline and should follow the recommended procedures for removal of lead contaminated materials.

- Respiratory protection worn by contractors during ductwork removal and maintenance should include Half Face Respirator with P100 filter.

This executive summary is not to be used alone and the report should be reviewed in its entirety.

TABLE OF CONTENTS

EXECUTIVE SUMMARY i

1.0 BACKGROUND 1

2.0 INTRODUCTION 2

2.1 Mineral Acids 2
2.2 Organic Acids 3
2.3 Alkaline Metal Dust 4
2.4 Polycyclic Aromatic Hydrocarbons (PAHs) 4
2.5 Toxic Metals 5

3.0 METHODOLOGY 5

3.1 Visual Assessment 5
3.2 Surface Sampling 6

4.0 RESULTS 7

4.1 Visual Assessment 7
4.2 Surface Sampling 7

5.0 CONCLUSIONS AND RECOMMENDATIONS 10

6.0 LIMITATIONS 12

APPENDIX I PHOTOGRAPHS

APPENDIX II SAMPLE LOCATIONS AND RESULTS

APPENDIX III LABORATORY CERTIFICATE OF ANALYSIS

March 19, 2019

Stantec Consulting Limited
400-1331 Clyde Avenue
Ottawa, ON
K2C 3G4

Attn.: Mr. David Yin
Senior Associate, Buildings Engineer

Re: Surface Chemical Wipes - T19-17346
Agriculture and Agri-Food Canada
1381 Sandford Street, London, Ontario

1.0 BACKGROUND

On February 20th and 21st, 2019, personnel from T. Harris Environmental Management Inc. (THEM) conducted an assessment of the internal ducting for a centralized exhaust fan using surface chemical wipes. The assessment was performed in the Mechanical Room Penthouse of Agriculture and Agri-Food Canada located on 1381 Sandford Street in London, Ontario. The assessment was conducted at the request of Mr. David Yin, Senior Associate, Buildings Engineer for Stantec Consulting Limited.

Surface wipe samples were collected from an existing exhaust fan system. Based on a review of the chemical inventory, and nature of work conducted in chemical fume hoods, wipe samples were collected for the following chemical parameters.

1) Mineral Acids – Hydrofluoric Acid (HF), Sulfuric Acid (H_2SO_4), Hydrochloric Acid (HCl) and Hydrobromic Acid (HBr),
2) Organic Acids – Formic acid, acetic acid
3) Alkaline Metal Dust – Lithium (Li), Sodium (Na) and Potassium (K) and pH
4) Common Polycyclic Aromatic Hydrocarbons (PAHs) – Phenanthrene, Anthracene, Pyrene, Chrysene and Benzo (α) Pyrene
5) Toxic Metals – Antimony (Sb), Arsenic (As), Barium (Ba), Beryllium (Be), Cadmium (Cd), Lead (Pb), Nickel (Ni), Selenium (Se), Thallium (Tl), Vanadium (V)

Thirty-eight (38) wipe samples and four (4) blanks were collected for each chemical class listed above. Exhaust fan #7 was not tested due to potential contamination with radioisotopes.

2.0 INTRODUCTION

2.1 Mineral Acids

Hydrofluoric Acid

As per CHEMINFO[1], hydrochloric acid (CAS# 7664-39-3) is a clear, colourless, liquid with a strong odour. Hydrofluoric acid is used stainless steel pickling operations, chemical milling, metal coatings, and for etching and frosting glass.

Hydrofluoric acid is corrosive and can cause severe irritation if inhaled, including life threatening accumulation of fluid in the lungs. Absorbed fluoride can cause metabolic imbalances with irregular heartbeat, nausea, dizziness, vomiting and seizures. Long-term exposure may cause skeletal fluorosis. Other symptoms include coughing, shortness of breath and chest pain. Contact with the skin can cause severe burns, blisters and ulcers. Eye contact can lead to burns and potential blindness. Ingestion can cause burns, nausea, vomiting, diarrhea, and in severe cases, death. It is not listed as a carcinogen by the US National Toxicology Program (NTP) and American Conference of Governmental Industrial Hygienists (ACGIH). Hydrogen fluoride does not have a category for human carcinogenicity as per IARC, MAK, NTP, EPA and TLV.

Sulfuric Acid

As per CHEMINFO[2], sulfuric acid (CAS# 7664-93-9) is a clear, colourless, odorless liquid when pure, and has a yellow to dark brown colour when impure. Sulfuric acid is used in the manufacturing of fertilizers, pigments and colours, explosives, alcohols, drugs and rubbers. It is used in the preparation of electrolytic baths for nonferrous-metal purification and plating.

Sulfuric acid is corrosive and can cause severe irritation if inhaled, including life threatening accumulation of fluid in the lungs. Other symptoms include coughing, shortness of breath and chest pain. Contact with the skin can cause severe burns, blisters and ulcers. Eye contact can lead to burns and potential blindness. Ingestion can cause burns, nausea, vomiting, diarrhea, and in severe cases, death. Sulfuric acid in the form of strong inorganic mists is an IARC-1, MAK-4, NTP-K and TLV-A2 category human carcinogen.

[1] Canadian Centre for Occupational Health & Safety, CHEMINFO Chemical Profile #47, Hydrofluoric Acid, 2019
[2] Canadian Centre for Occupational Health & Safety, CHEMINFO Chemical Profile #122, Sulfuric Acid, 2019

Hydrochloric Acid

As per CHEMINFO[3], hydrochloric acid (CAS# 7647-01-0) is a colourless or slightly yellow liquid with a pungent and choking odour. Hydrochloric acid is used primarily in brine acidification, additional uses include metal pickling, cleaning operations, production of chlorides, and the production of synthetic rubber.

Hydrochloric acid is corrosive and can cause severe irritation if inhaled, including life threatening accumulation of fluid in the lungs. Other symptoms include coughing, pain, sore throat, and inflammation if inhaled. Contact with the skin can cause severe burns, blisters and permanent scarring. Eye contact can lead to burns and potential blindness. Ingestion can cause burns, vomiting, and in severe cases, death. Hydrochloric acid is not classifiable as to its carcinogenicity to humans (Group 3) according to IARC, and ACGIH has listed this chemical as not classifiable as a human carcinogen (TLV-A4).

Hydrobromic Acid

As per CHEMINFO[4], hydrobromic acid (CAS# 10035-10-6) is a colourless to pale yellow liquid with an irritating odour. Hydrobromic acid is used in the production of inorganic bromides, alkyl bromides, salts of organic nitrogen compounds, and as an alkylation catalyst.

Hydrobromic acid very readily releases a toxic hydrogen bromide gas that causes irritation to the nose and throat when inhaled, in severe cases it can be fatal. It is corrosive to the eyes and skin, causing severe eye and skin burns and injuries including blindness. Ingestion can cause burns, vomiting, diarrhea and in severe cases, death. Hydrobromic acid is not a known carcinogen; it is not listed as a carcinogen by the US National Toxicology Program (NTP). Hydrogen bromide does not have a category for human carcinogenicity as per IARC, MAK, EPA and TLV.

2.2 Organic Acids

Formic Acid

As per CHEMINFO[5], formic acid (CAS# 64-18-6) is a colourless liquid with a strong and penetrating odour. Formic acid is primarily used as a silage additive. Additional uses include dyeing of fibres, tanning of leather, and coagulating latex in the production of rubber and certain rubber

[3] Canadian Centre for Occupational Health & Safety, CHEMINFO Chemical Profile #13, Hydrochloric Acid, 2019
[4] Canadian Centre for Occupational Health & Safety, CHEMINFO Chemical Profile #477, Hydrobromic Acid, 2019
[5] Canadian Centre for Occupational Health & Safety, CHEMINFO Chemical Profile #466, Formic Acid, 2019

chemicals.

Formic acid is corrosive and can cause severe irritation and corrosive damage to the respiratory tract upon inhalation. It forms high vapour concentrations posing a significant inhalation hazard, especially in poorly ventilated areas. Formic acid can cause serious eye and skin damage, including permanent scars and blindness. Ingestion can cause burns, vomiting, diarrhea and in severe cases, death. Formic acid is not a known carcinogen; it is not listed as a carcinogen by the US National Toxicology Program (NTP). Formic acid does not have a category for human carcinogenicity as per IARC, MAK, EPA and TLV.

Acetic Acid

As per NIOSH Pocket Guide[6], acetic acid (CAS# 64-19-7) is a colourless liquid or a crystal with a sour, vinegar-like odour. Acetic acid is present in vinegar (5-8%).

Acetic acid can result in irritation to eyes, skin, nose, and throat. It can result in burns to the eyes and skin burns, skin sensitization, dental erosion and conjunctivitis. Acetic acid is not a known carcinogen; it is not listed as a carcinogen by the US National Toxicology Program (NTP). Acetic acid does not have a category for human carcinogenicity as per IARC, MAK, EPA and TLV.

2.3 Alkaline Metal Dust

Lithium, sodium, and potassium are alkali metals that are of health concern when present in their aqueous form as they form alkaline/basic solutions with a pH level above neutral (pH of 7). The solutions can cause severe skin burns, eye damage, and release flammable gases[7].

2.4 Polycyclic Aromatic Hydrocarbons (PAHs)

The term polycyclic aromatic hydrocarbons defines not one compound, but a broad class of compounds which generally includes all organic compounds with more than one benzene ring, and which have a boiling point above 212 °F (100 °C). Sixteen polycyclic aromatic hydrocarbons (PAHs), a subset of the class of polycyclic compounds, were designated by the US-EPA as the compounds of interest as Urban Air Toxics. Notable among such compounds are Phenanthrene, Anthracene, Pyrene, Chrysene, and Benzo(α)Pyrene.

[6] Canadian Centre for Occupational Health & Safety, NIOSH Pocket Guide to chemical Hazards RTECS #AF1225000, acetic Acid, 2019
[7] CLEAPSS Student Safety Sheets, Alkali Metals, #80, 2018

The principal formation mechanism for PAHs occurs as part of the fuel combustion process in many different types of source categories. The combustion processes, which are much more significant in terms of air emissions, include stationary external combustion for heat and electricity generation, internal combustion engines and turbines, motor vehicles (cars, trucks, and aircraft), and a variety of industrial fuel combustion sources.

2.5 Toxic Metals

Toxic metals tested included Antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), cadmium (Cd), lead (Pb), nickel (Ni), selenium (Se), thallium (Tl), vanadium (V). These ten (10) toxic metals have variable toxicities and health-related safe levels.

For the purpose of this assessment the health-based screening values derived in The Contaminants of Potential Concern (COPC) Committee of the World Trade Center (WTC) Indoor Air Taskforce Working Group[8] have been used. The established acceptable settled dust screening values are peer reviewed and health-based benchmark for indoor environments to prevent long-term health risks. These guidelines apply to residential exposures for the very old and very young or pregnant women, where exposure times can range up to 24 hours per day for the infirm or for young children who are more likely to spend time on floors playing or crawling. The WTC guidelines for settled dust were derived with input from the EPA, NIOSH, and New York City Public Health. These surface concentrations are considered a 'best management practice' under the general duty clause section 25.(2)(h) of the Occupational Health and Safety Act for employers to '…take every precaution reasonable in the circumstances for the protection of a worker…'.

The WTC Settled Dust Screening Value are used in this report to determine if worker exposure is possible from skin adsorption or ingestion or by secondary transfer of substances from contaminated hands to mouth, tobacco, drink or food.

3.0 METHODOLOGY

3.1 Visual Assessment

Visual observation of the exhaust fan units and ducts was conducted within the Mechanical Room penthouse to observe housekeeping and potential areas for hand contamination and ingestion of substances.

[8] Contaminants of Potential Concern (COPC) Committee of the World Trade Center Indoor Air Task Force Working Group, "World Trade Center Indoor Environment Assessment: Selecting Contaminants of Potential Concern and Setting Health Based Benchmarks", Table A-3, May 2003

3.2 Surface Sampling

Surface wipe samples were collected, as per NIOSH Method 9100, from an existing exhaust fan system. Based on a review of the chemical inventory, and nature of work conducted in chemical fume hoods, wipe samples were collected for chemical parameters listed below. Thirty-eight (38) wipe samples and four (4) blanks were collected for each chemical class listed above.

A surface area of 100 cm^2 was wiped down using a new 10 cm x 10 cm disposable cardboard template and a new pair of nitrile gloves for each sample.

Upon completion, the wipe samples were sent for chemical analysis to an AIHA accredited laboratory, CASSEN Testing Laboratories.

Sample locations can be found in Appendix II, Laboratory Certificate of Analysis are in Appendix III.

Mineral Acids

Hydrofluoric Acid (HF), Sulfuric Acid (H_2SO_4), Hydrochloric Acid (HCl), Hydrobromic Acid (HBr) were analysed using ion chromatography with conductivity detector. The lab used CASSEN method M.706.R0, an in-house method that references NIOSH methods 7909 and 7908. The sampling media used was a glass fiber filter (37mm).

Organic Acids

Formic and acetic acid were analysed using ion chromatography with conductivity detector. The lab used CASSEN method M.8706.R0, an in-house method. The sampling media used was a glass fiber filter (37mm).

Alkaline Metal Dusts

Lithium (Li), Sodium (Na), Potassium (K) were analysed using inductively coupled plasma with optical emission spectrometer. The lab used CASSEN method M.101203.R0, a modification of NIOSH method 7405. The sampling media used was a MCE Filter Wipe.

Polycyclic Aromatic Hydrocarbons

Phenanthrene, Anthracene, Pyrene, Chrysene, Benzo (α) Pyrene were analysed using gas chromatography / mass spectrometry. The lab used CASSEN method M.3019.R0, a modification of NIOSH method 5515. The sampling media used was a synthetic wipe.

Toxic Metals

Antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), cadmium (Cd), lead (Pb), nickel (Ni), selenium (Se), thallium (Tl), vanadium (V) were analysed using inductively coupled plasma with optical emission spectrometer. The lab used CASSEN method M.101203.R0, a modification of NIOSH method 7303. The sampling media used was a MCE Filter Wipe.

4.0 RESULTS

4.1 Visual Assessment

Visual observation of the exhaust fan units and ducts were conducted within the Mechanical Room penthouse. The dust loading on the duct varied. Most sampling locations visibility was limited due to narrow openings. There was no heavy dust loading at any of the sampling locations.

Photographs of select fume hoods are present in Appendix I.

4.2 Surface Sampling

Mineral Acids

To determine acceptable surface limits for mineral acids the Occupational Safety and Health Administration (OSHA)[9] guideline on surface wipe sampling was used for the purposes of this report. The chemical's eight-hour time-weighted average (TWA) airborne exposure limit is multiplied by 10 m^3, the volume of air inhaled by an average worker in an eight-hour workday, to determine the maximum acceptable dose. The maximum acceptable dose is then divided by the area of a worker's hand to determine the acceptable surface limit. As per the *EPA Exposure*

[9] Occupational Safety and Health Administration, Section II: Chapter 2 “Surface Contaminants, Skin Exposure, Biological Monitoring and Other Assays”.

Factors Handbook: 2011 Edition, the total surface area for both hands of a 50th percentile adult male is approximately 1070 cm^2.

For hydrofluoric acid, CalEPA has calculated a chronic inhalation Reference Exposure Level (REL) of 0.014 mg/m^3 for hydrogen fluoride based on effects on the bone (skeletal fluorosis) in humans. Using the REL of 0.014 mg/m^3 x $10m^3$ = 0.14 mg = 140 µg, using 1070 cm^2 as the surface area of hands, 140 µg/ 1070 cm^2 = the 0.131 $µg/cm^2$. Thus the most conservative acceptable surface limit of HF is 0.131 $µg/cm^2$ assuming total transfer on both hands upon touching the surface with unprotected skin.

Additionally the pH values support the presence of acidic conditions on the surfaces sampled. A pH below neutral (pH of 7) demonstrates acidity. The lowest pH level detected was 5.35, and on average the pH level was 6.37. Detailed surface sampling results may be found in Appendix II Table I.

Calculations and summary results for mineral acids are, presented in **Table I.** Detailed surface sampling results may be found in Appendix II Table II.

TABLE I
Summary of observed Mineral Acid Concentrations and Calculated Surface Limits
Agriculture and Agri-Food Canada
Feb 20 – 21, 2019

Substance	Surface Concentration (µg/cm²)		Percent Samples Exceeding Limit (%)	Acceptable Surface Limit (µg/cm²)	Airborne Health Guideline Used (mg/m³)	
	Maximum	Average				
Hydrofluoric Acid	**0.9**	0.074	10.52	0.131	CalEPA REL[10]	0.014
Sulfuric Acid	**28.5**	6.602	15.78	9.346	NIOSH REL[11]	1
Hydrochloric Acid	**8.60**	**2.045**	97.37	0.187	US EPA RfC[12]	0.02
Hydrobromic Acid	<0.02	<0.02	0	93.46	NIOSH REL[13]	10

Values in **red** indicate dermal over exposure to substance is possible for unprotected skin based on health guidelines.

[10] California Environmental Protection Agency (CalEPA). Technical Support Document for the Determination of Non cancer Chronic Reference Exposure Levels. Office of Environmental Health Hazard Assessment, Berkeley, CA. 2000.
[11] The National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limits: Sulfuric Acid
[12] United States Environmental Protection Agency (US EPA) Reference Concentration for Hydrogen Chloride
[13] The National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limits: Hydrogen Bromide

Organic Acids

Formic and acetic acid were all below the limit of detection of 0.1 µg/cm^2, with the exception of one sample (sample 2-FAA), which resulted in 0.2 µg/cm^2 of formic acid. These concentration are not of concern. Detailed surface sampling results may be found in Appendix II Table III.

Alkaline Metal Dusts

The concentration of lithium was below the limit of detection of 0.01 µg/cm^2 for all surfaces sampled. Sodium and potassium on their own are commonly found minerals without health-based screening levels[8]. They are of health concern when present in their aqueous form as they form alkaline solutions with a pH level above neutral. A basic pH of above 7 was only detected for one sample; sample TH-39-AD had a pH of 7.02. The pH for all other samples was below 7, and it is not likely that alkaline metals are of a health concern in this assessment and are not present as hydroxides. The maximum and average concentrations of alkali metals are presented in **Table II**. Detailed surface sampling results may be found in Appendix II Table IV.

TABLE II
Summary of Alkali Metal Dust Acid Concentrations
Agriculture and Agri-Food Canada
Feb 20 – 21, 2019

Substance	Surface Concentration (µg/cm^2)	
	Maximum	Average
Lithium	<0.01	<0.01
Sodium	3.10	0.590
Potassium	0.80	0.209

Polycyclic Aromatic Hydrocarbons

All PAHs sampled were below the limit of detection of 0.0003 µg/cm^2. The health-based screening values derived in The Contaminants of Potential Concern (COPC) Committee of the World Trade Center (WTC) Indoor Air Taskforce Working Group[8] for PAHs is 0.0145 µg/cm^2, thus PAHs are not of concern in this assessment. Detailed surface sampling results may be found in Appendix II Table V.

Toxic Metals

The health-based screening values derived in The Contaminants of Potential Concern (COPC) Committee of the World Trade Center (WTC) Indoor Air Taskforce Working Group[8] for the ten (10) toxic metals were used for the purpose of this assessment. The maximum and average concentrations of toxic metals are presented in **Table III**. Detailed surface sampling results may be found in Appendix II Table VI.

TABLE III
Summary of Toxic Metal Concentrations and their Screening Values
Agriculture and Agri-Food Canada
Feb 20 – 21, 2019

Substance	Surface Concentration (µg/cm²)		Percent of Samples Exceeding Limit (%)	Screening Value for Settled Dust[8] (µg /cm²)
	Maximum	Average		
Antimony	0.03	0.0073	0	0.0627
Arsenic	0.01	0.0051	0	0.0387
Barium	0.03	0.0041	0	11.0
Beryllium	<0.0002	<0.0002	0	0.314
Cadmium	0.005	0.0021	0	0.154
Lead	**0.9**	**0.1036**	52.6	0.027
Nickel	1.8	0.2404	0	3.14
Selenium	0.4	0.0561	0	0.784
Thallium	<0.005	<0.005	0	0.0110
Vanadium	0.02	0.0036	0	1.10

Values in **red** indicate exposure to substance is possible from ingestion based on the WTC Guideline[8]

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the measurement results and visual inspections, the following conclusions are drawn:

- There was no heavy dust loading at any of the sampling locations that were accessible and visible during the assessment.

- The maximum concentrations of hydrofluoric acid, sulfuric acid, and hydrochloric acid were above the derived acceptable surface limit. All samples assessed for hydrobromic acid were below the limit of detection.

- To protect workers from exposure to hydrofluoric acid (30 - 70%), sulfuric acid, and

hydrochloric acid the following gloves materials are recommended as they are resistant from chemical penetration for more than eight-hours of use: Butyl Rubber, Viton®/Butyl Rubber or Barrier – PE/PA/PE. Neoprene and Silver Shield – PE/EVAL/PE will provide greater than 4 hours of protection from hydrofluoric acid (30 - 70%). These recommendations are not valid for very thin gloves 0.3 mm (12 mil) or less.

- Most formic acid and acetic acid concentrations were below the limit of detection. One sample for formic acid reported a concentration of 0.2 µg/cm^2, which was not a health concern.

- The concentration of lithium was below the limit of detection for all surfaces sampled. Sodium and potassium surface contamination are not a concern based on concentration the presence of pH values below neutral and acidic.

- All PAHs sampled were below the limit of detection and the WTC screening value of 0.0145 µg/cm^2.

- Out of the ten (10) toxic metals assessed, lead was the only one that exceeded the WTC screening value. It is possible that hand lead contamination and subsequent ingestion can occur for lead contaminated hands or gloves from normal hand to mouth actions.

- Worker risk of lead ingestion can be controlled provided that eating, drinking, chewing and smoking is prohibited in the work space, nitrile gloves (> 0.3 mm or 12 mil) are used when handling contaminated ducts or working in the sampled areas and hand washing with D-Lead® Hand Soap and D-Wipes is practiced.

Precautions to be followed during ductwork removal and maintenance include:

- Work should be classed as a Type 2a lead operation as per the Ministry of Labour lead guideline[14] and the EACO lead guideline[15] and should follow the recommended procedures for removal of lead contaminated materials.

- Respiratory protection worn by contractors during ductwork removal and maintenance should include Half Face Respirator with P100 filters.

[14] Guideline Lead on Construction Projects, Ministry of Labour - 2011
[15] EACO Lead Guideline for Construction, Renovation, Maintenance or Repair - 2014

6.0 LIMITATIONS

In this statement of limitations, the "Client" refers to the persons or entities to whom this report is addressed. "THEM" refers to T. Harris Environmental Management Inc. The "Contract" refers to any general, or project-specific written agreement, including project-specific scope of work documents, executed between THEM and the Client pertaining to the subject matter of this report.

This report is subject to the limitations set out below and any other limitations set out in the body of this report or in the Contract between THEM and the Client.

The investigation and assessment described in this report were conducted in accordance with the Contract agreed upon by the Client in a manner consistent with a reasonable level of care and skill normally exercised by members of the occupational hygiene consulting profession currently practising under similar conditions in the Province of Ontario and observing the code of ethics of the Canadian Registration Board of Occupational Hygienists (CRBOH) and the American Board of Industrial Hygiene (ABIH).

In preparing this report, THEM has relied on information provided by others, including without limitation, information concerning the history and operation of the site, and test results and analyses of other consultants, independent laboratories, or testing services. Except as expressly stated in this report, THEM have not made any independent verification of such information. Findings cannot be extended to portions of the site, which were unavailable for direct observation.

The assessment in this report has been made in the context of regulations which were in force and effect at the time of the assessment and which are specified in this report. The assessment did not take into account any regulations, which were not in effect at the date of the assessments, or any guideline or standard not specified in this report. Regulatory standards do not exist for all materials of a potentially hazardous nature.

The collection of any samples at the site (including the location of samples and the analytical parameters applied to the samples) was undertaken in accordance with the Contract agreed upon by the Client, based upon the information provided to THEM by the Client concerning existing site conditions. Conditions between sample locations (if any) may differ from those indicated in this report.

This report is intended solely for the use or uses specified in this report and/or the Contract. Use of this report for purposes other than those set out in this report and/or the Contract will be at the sole risk of the Client.

Copying of this report except as may be reasonably required for internal use by the Client and any distribution of this report to persons other than the Client in whole or in part, is not permitted without the express written permission of THEM.

This report is for the sole use of the Client. THEM makes no representation or warranty, either expressed or implied, to any third party with regard to this report and the work referred to in this report and expressly disclaims any, and accepts no duty of care to any third party or any responsibility or liability whatsoever to any third party for any loss, expenses, damages (direct, consequential or contingent), fines, penalties, or other harm that may be suffered or incurred by any third party as a result of any use of, any reliance placed upon, or any decision made or actions taken based upon this report or the work referred to herein.

In no event shall THEM be liable for any indirect, incidental, special or consequential damages, or damages from loss of profits, revenue, or use, whether in an action in tort or contract, even if THEM has been advised of the possibility of such damages. If new information concerning the subject matter of this report arises, THEM should be contacted to re-evaluate the conclusions of this report and to provide amendments as required.

If you have any questions or require further information, please contact our office.

APPENDIX I
PHOTOGRAPHS

Photograph 1: View of exhaust fan #40 fume hood.

Photograph 2: View of exhaust fan #37 fume hood.

Photograph 3: View of exhaust fan #23 fume hood.

Photograph 4: View of exhaust fan #12 fume hood.

APPENDIX II
SAMPLE LOCATIONS AND RESULTS

TABLE I
pH Values of Surface Samples

Exhaust Fan Fume Hood Unit Sampled	Sample Location	Sample ID	pH
1	Access Hatch	TH-1-AD	6.05
2	Access Hatch	TH-2-AD	6.19
4	Duct Work at Fan Unit	TH-4-AD	6.57
5	Access Hatch	TH-5-AD	6.31
6	Access Hatch	TH-6-AD	6.1
8	Access Hatch	TH-8-AD	5.56
9	Access Hatch	TH-9-AD	6.09
11	Access Hatch	TH-11-AD	6.25
12	Duct Work at Fan Unit	TH-12-AD	6.64
14	Access Hatch	TH-14-AD	6.02
15	Access Hatch	TH-15-AD	6.82
16	Access Hatch	TH-16-AD	6.88
17	Access Hatch	TH-17-AD	6.87
18	Access Hatch	TH-18-AD	6.59
19	Access Hatch	TH-19-AD	6.78
20	Access Hatch	TH-20-AD	6.21
21	Access Hatch	TH-21-AD	6.1
22	Access Hatch	TH-22-AD	6.39
23	Duct Work at Fan Unit	TH-23-AD	6.72
24	Access Hatch	TH-24-AD	6.56
25	Duct Work at Fan Unit	TH-25-AD	6.38
27	Access Hatch	TH-27-AD	6.58
28	Access Hatch	TH-28-AD	6.44
29	Access Hatch	TH-29-AD	6.3
33	Access Hatch	TH-33-AD	6.04
34	Access Hatch	TH-34-AD	5.92
35	Access Hatch	TH-35-AD	5.89
36	Access Hatch	TH-36-AD	6.82
37	Duct Work at Fan Unit	TH-37-AD	6.4
38	Duct Work at Fan Unit	TH-38-AD	6.87
39	Duct Work at Fan Unit	TH-39-AD	7.02
40	Duct Work at Fan Unit	TH-40-AD	6.69
41	Access Hatch	TH-41-AD	6.88
42	Access Hatch	TH-42-AD	6.42
43	Access Hatch	TH-43-AD	6.35
44	Access Hatch	TH-44-AD	5.35
45	Access Hatch	TH-45-AD	6.33
64	Duct Work at Fan Unit	TH-64-AD	5.79

TABLE II
Mineral Acid Concentrations

Exhaust Fan Fume Hood Unit Sampled	Sample Location	Sample ID	Surface Concentration (µg/cm²)			
			Hydrofluoric Acid	Hydrochloric Acid	Hydrobromic Acid	Sulfuric Acid
1	Access Hatch	1-IA	0.01	**1**	<0.02	1.2
2	Access Hatch	2-IA	<0.004	**2.3**	<0.02	0.9
4	Duct Work at Fan Unit	4-IA	0.04	**5.1**	<0.02	2.1
5	Access Hatch	5-IA	**0.5**	**4.9**	<0.02	7.4
6	Access Hatch	6-IA	0.04	**0.5**	<0.02	7.3
8	Access Hatch	8-IA	<0.004	**4.8**	<0.02	2
9	Access Hatch	9-IA	0.07	**2.7**	<0.02	8.9
11	Access Hatch	11-IA	0.01	**2.1**	<0.02	6.2
12	Duct Work at Fan Unit	12-IA	0.04	**1**	<0.02	6.8
14	Access Hatch	14-IA	<0.004	**0.7**	<0.02	2.2
15	Access Hatch	15-IA	0.03	**0.7**	<0.02	5.5
16	Access Hatch	16-IA	0.007	**0.4**	<0.02	2.2
17	Access Hatch	17-IA	0.02	**0.7**	<0.02	4.2
18	Access Hatch	18-IA	<0.004	**0.6**	<0.02	4.8
19	Access Hatch	19-IA	0.05	**2.4**	<0.02	8.6
20	Access Hatch	20-IA	0.005	**0.4**	<0.02	4.1
21	Access Hatch	21-IA	0.01	**0.4**	<0.02	6.9
22	Access Hatch	22-IA	0.009	**4.1**	<0.02	5.3
23	Duct Work at Fan Unit	23-IA	0.1	**1.1**	<0.02	5.5
24	Access Hatch	24-IA	0.01	**5.8**	<0.02	2.7
25	Duct Work at Fan Unit	25-IA	0.03	**2.2**	<0.02	1.6
27	Access Hatch	27-IA	0.03	**0.6**	<0.02	**15.4**
28	Access Hatch	28-IA	<0.004	**0.8**	<0.02	2.2
29	Access Hatch	29-IA	<0.004	0.1	<0.02	3
33	Access Hatch	33-IA	<0.004	**1.2**	<0.02	1
34	Access Hatch	34-IA	0.03	**0.6**	<0.02	28.5
35	Access Hatch	35-IA	<0.004	**1.9**	<0.02	6.4
36	Access Hatch	36-IA	**0.9**	**7.2**	<0.02	**20.8**
37	Duct Work at Fan Unit	37-IA	0.08	**8.6**	<0.02	**10.4**
38	Duct Work at Fan Unit	38-IA	**0.2**	**1.3**	<0.02	**11.8**
39	Duct Work at Fan Unit	39-IA	**0.5**	**3.3**	<0.02	**23.4**
40	Duct Work at Fan Unit	40-IA	<0.004	**1.3**	<0.02	**12.5**
41	Access Hatch	41-IA	0.02	**0.8**	<0.02	6.4
42	Access Hatch	42-IA	0.01	**0.4**	<0.02	3
43	Access Hatch	43-IA	0.02	**1**	<0.02	4.4
44	Access Hatch	44-IA	<0.004	**2.9**	<0.02	3.9
45	Access Hatch	45-IA	0.01	**0.3**	<0.02	0.8
64	Duct Work at Fan Unit	64-IA	<0.004	**1.5**	<0.02	0.6

Values in **red** indicate dermal over exposure to substance is possible for unprotected skin based on health guidelines.

TABLE III
Organic Acid Concentrations

Exhaust Fan Fume Hood Unit Sampled	Sample Location	Sample ID	Surface Concentration (µg/cm^2)	
			Acetic Acid	Formic
1	Access Hatch	1-FAA	<0.1	<0.1
2	Access Hatch	2-FAA	0.2	<0.1
4	Duct Work at Fan Unit	4-FAA	<0.1	<0.1
5	Access Hatch	5-FAA	<0.1	<0.1
6	Access Hatch	6-FAA	<0.1	<0.1
8	Access Hatch	8-FAA	<0.1	<0.1
9	Access Hatch	9-FAA	<0.1	<0.1
11	Access Hatch	11-FAA	<0.1	<0.1
12	Duct Work at Fan Unit	12-FAA	<0.1	<0.1
14	Access Hatch	14-FAA	<0.1	<0.1
15	Access Hatch	15-FAA	<0.1	<0.1
16	Access Hatch	16-FAA	<0.1	<0.1
17	Access Hatch	17-FAA	<0.1	<0.1
18	Access Hatch	18-FAA	<0.1	<0.1
19	Access Hatch	19-FAA	<0.1	<0.1
20	Access Hatch	20-FAA	<0.1	<0.1
21	Access Hatch	21-FAA	<0.1	<0.1
22	Access Hatch	22-FAA	<0.1	<0.1
23	Duct Work at Fan Unit	23-FAA	<0.1	<0.1
24	Access Hatch	24-FAA	<0.1	<0.1
25	Duct Work at Fan Unit	25-FAA	<0.1	<0.1
27	Access Hatch	27-FAA	<0.1	<0.1
28	Access Hatch	28-FAA	<0.1	<0.1
29	Access Hatch	29-FAA	<0.1	<0.1
33	Access Hatch	33-FAA	<0.1	<0.1
34	Access Hatch	34-FAA	<0.1	<0.1
35	Access Hatch	35-FAA	<0.1	<0.1
36	Access Hatch	36-FAA	<0.1	<0.1
37	Duct Work at Fan Unit	37-FAA	<0.1	<0.1
38	Duct Work at Fan Unit	38-FAA	<0.1	<0.1
39	Duct Work at Fan Unit	39-FAA	<0.1	<0.1
40	Duct Work at Fan Unit	40-FAA	<0.1	<0.1
41	Access Hatch	41-FAA	<0.1	<0.1
42	Access Hatch	42-FAA	<0.1	<0.1
43	Access Hatch	43-FAA	<0.1	<0.1
44	Access Hatch	44-FAA	<0.1	<0.1
45	Access Hatch	45-FAA	<0.1	<0.1
64	Duct Work at Fan Unit	64-FAA	<0.1	<0.1

TABLE IV
Alkali Metal Dust Concentrations

Exhaust Fan Fume Hood Unit Sampled	Sample Location	Sample ID	Surface Concentration ($\mu g/cm^2$)		
			Lithium	Sodium	Potassium
1	Access Hatch	1-AD	<0.01	<0.05	0.6
2	Access Hatch	2-AD	<0.01	<0.05	<0.05
4	Duct Work at Fan Unit	4-AD	<0.01	0.6	0.3
5	Access Hatch	5-AD	<0.01	0.6	0.2
6	Access Hatch	6-AD	<0.01	0.3	0.1
8	Access Hatch	8-AD	<0.01	0.2	0.08
9	Access Hatch	9-AD	<0.01	2.2	0.8
11	Access Hatch	11-AD	<0.01	0.3	0.2
12	Duct Work at Fan Unit	12-AD	<0.01	0.5	0.3
14	Access Hatch	14-AD	<0.01	0.2	<0.05
15	Access Hatch	15-AD	<0.01	0.5	0.2
16	Access Hatch	16-AD	<0.01	0.1	<0.05
17	Access Hatch	17-AD	<0.01	0.2	0.09
18	Access Hatch	18-AD	<0.01	0.5	0.4
19	Access Hatch	19-AD	<0.01	0.2	0.07
20	Access Hatch	20-AD	<0.01	0.8	0.3
21	Access Hatch	21-AD	<0.01	3.1	0.3
22	Access Hatch	22-AD	<0.01	0.2	0.09
23	Duct Work at Fan Unit	23-AD	<0.01	0.4	0.3
24	Access Hatch	24-AD	<0.01	0.4	0.2
25	Duct Work at Fan Unit	25-AD	<0.01	0.6	0.2
27	Access Hatch	27-AD	<0.01	0.7	0.2
28	Access Hatch	28-AD	<0.01	0.09	<0.05
29	Access Hatch	29-AD	<0.01	<0.05	<0.05
33	Access Hatch	33-AD	<0.01	<0.05	<0.05
34	Access Hatch	34-AD	<0.01	0.6	0.2
35	Access Hatch	35-AD	<0.01	0.1	0.1
36	Access Hatch	36-AD	<0.01	0.3	0.3
37	Duct Work at Fan Unit	37-AD	<0.01	0.6	0.1
38	Duct Work at Fan Unit	38-AD	<0.01	0.5	0.6
39	Duct Work at Fan Unit	39-AD	<0.01	0.4	0.4
40	Duct Work at Fan Unit	40-AD	<0.01	<0.05	<0.05
41	Access Hatch	41-AD	<0.01	1.1	0.2
42	Access Hatch	42-AD	<0.01	0.6	0.2
43	Access Hatch	43-AD	<0.01	0.8	0.2
44	Access Hatch	44-AD	<0.01	0.7	0.2
45	Access Hatch	45-AD	<0.01	<0.05	0.08
64	Duct Work at Fan Unit	64-AD	<0.01	0.5	0.1

TABLE V
Polycyclic Aromatic Hydrocarbon Concentrations

Exhaust Fan Fume Hood Unit Sampled	Sample Location	Sample ID	Surface Concentration ($\mu g/cm^2$)				
			Anthracene	Benzo[a]pyrene	Chrysene	Phenanthrene	Pyrene
1	Access Hatch	1-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
2	Access Hatch	2-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
4	Duct Work at Fan Unit	4-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
5	Access Hatch	5-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
6	Access Hatch	6-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
8	Access Hatch	8-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
9	Access Hatch	9-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
11	Access Hatch	11-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
12	Duct Work at Fan Unit	12-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
14	Access Hatch	14-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
15	Access Hatch	15-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
16	Access Hatch	16-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
17	Access Hatch	17-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
18	Access Hatch	18-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
19	Access Hatch	19-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
20	Access Hatch	20-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
21	Access Hatch	21-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
22	Access Hatch	22-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
23	Duct Work at Fan Unit	23-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
24	Access Hatch	24-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
25	Duct Work at Fan Unit	25-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
27	Access Hatch	27-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
28	Access Hatch	28-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
29	Access Hatch	29-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
33	Access Hatch	33-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
34	Access Hatch	34-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
35	Access Hatch	35-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
36	Access Hatch	36-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
37	Duct Work at Fan Unit	37-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
38	Duct Work at Fan Unit	38-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
39	Duct Work at Fan Unit	39-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
40	Duct Work at Fan Unit	40-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
41	Access Hatch	41-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
42	Access Hatch	42-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
43	Access Hatch	43-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
44	Access Hatch	44-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
45	Access Hatch	45-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
64	Duct Work at Fan Unit	64-PAH	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003

TABLE VI
Toxic Metal Concentrations

Exhaust Fan Fume Hood Unit Sampled	Sample Location	Sample ID	Surface Concentration ($\mu g/cm^2$)									
			Antimony	Arsenic	Barium	Beryllium	Cadmium	Lead	Nickel	Selenium	Thallium	Vanadium
1	Access Hatch	1-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	<0.005	0.04	0.007	<0.005	<0.002
2	Access Hatch	2-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	**0.04**	0.01	<0.005	<0.005	<0.002
4	Duct Work at Fan	4-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	<0.005	0.2	0.03	<0.005	<0.002
5	Access Hatch	5-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	0.02	0.3	0.05	<0.005	0.004
6	Access Hatch	6-TM	0.03	0.01	0.03	<0.0002	<0.002	**0.03**	1.8	0.4	<0.005	0.02
8	Access Hatch	8-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	0.007	0.1	0.02	<0.005	<0.002
9	Access Hatch	9-TM	<0.005	<0.005	0.008	<0.0002	<0.002	**0.1**	0.1	0.02	<0.005	0.002
11	Access Hatch	11-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	**0.06**	0.2	0.04	<0.005	<0.002
12	Duct Work at Fan	12-TM	<0.005	<0.005	0.008	<0.0002	<0.002	**0.03**	0.03	<0.005	<0.005	<0.002
14	Access Hatch	14-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	**0.05**	0.08	0.02	<0.005	<0.002
15	Access Hatch	15-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	**0.05**	0.01	<0.005	<0.005	<0.002
16	Access Hatch	16-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	**0.04**	0.007	<0.005	<0.005	<0.002
17	Access Hatch	17-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	0.02	<0.005	<0.005	<0.005	<0.002
18	Access Hatch	18-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	**0.04**	0.07	0.01	<0.005	0.002
19	Access Hatch	19-TM	<0.005	<0.005	0.004	<0.0002	<0.002	**0.4**	0.2	0.03	<0.005	0.003
20	Access Hatch	20-TM	<0.005	<0.005	0.006	<0.0002	<0.002	**0.3**	0.09	0.02	<0.005	0.004
21	Access Hatch	21-TM	0.009	<0.005	<0.0002	<0.0002	<0.002	0.01	0.05	<0.005	<0.005	<0.002
22	Access Hatch	22-TM	0.007	<0.005	0.03	<0.0002	<0.002	**0.09**	0.2	0.04	<0.005	0.005
23	Duct Work at Fan	23-TM	0.02	<0.005	0.006	<0.0002	<0.002	**0.3**	0.2	0.06	<0.005	0.003
24	Access Hatch	24-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	**0.09**	0.06	0.007	<0.005	<0.002
25	Duct Work at Fan	25-TM	0.02	<0.005	0.001	<0.0002	<0.002	**0.7**	1.1	0.3	<0.005	0.008
27	Access Hatch	27-TM	0.01	<0.005	0.02	<0.0002	<0.002	**0.9**	0.6	0.2	<0.005	0.01
28	Access Hatch	28-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002
29	Access Hatch	29-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	0.008	0.04	<0.005	<0.005	<0.002
33	Access Hatch	33-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	0.02	0.02	0.005	<0.005	<0.002
34	Access Hatch	34-TM	0.007	0.005	0.01	<0.0002	0.005	**0.04**	0.06	0.01	<0.005	0.006
35	Access Hatch	35-TM	0.01	<0.005	<0.0002	<0.0002	<0.002	0.01	0.7	0.2	<0.005	0.004

Exhaust Fan Fume Hood Unit Sampled	Sample Location	Sample ID	Surface Concentration ($\mu g/cm^2$)									
			Antimony	Arsenic	Barium	Beryllium	Cadmium	Lead	Nickel	Selenium	Thallium	Vanadium
36	Access Hatch	36-TM	<0.005	<0.005	0.01	<0.0002	<0.002	**0.04**	0.1	0.01	<0.005	0.004
37	Duct Work at Fan	37-TM	0.02	<0.005	0.005	<0.0002	<0.002	0.2	1.3	0.3	<0.005	0.008
38	Duct Work at Fan	38-TM	<0.005	<0.005	0.005	<0.0002	<0.002	0.2	0.1	0.01	<0.005	0.004
39	Duct Work at Fan	39-TM	<0.005	<0.005	0.006	<0.0002	<0.002	0.008	0.3	0.07	<0.005	0.004
40	Duct Work at Fan	40-TM	0.005	<0.005	<0.0002	<0.0002	<0.002	0.01	0.3	0.07	<0.005	0.003
41	Access Hatch	41-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	<0.005	0.2	0.05	<0.005	<0.002
42	Access Hatch	42-TM	<0.005	<0.005	0.001	<0.0002	<0.002	**0.04**	0.05	0.006	<0.005	0.002
43	Access Hatch	43-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	0.02	0.1	0.02	<0.005	<0.002
44	Access Hatch	44-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	0.008	0.2	0.04	<0.005	<0.002
45	Access Hatch	45-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	<0.005	0.01	<0.005	<0.005	<0.002
64	Duct Work at Fan	64-TM	<0.005	<0.005	<0.0002	<0.0002	<0.002	**0.03**	0.2	0.04	<0.005	<0.002

Values in **red** indicate dermal over exposure to substance is possible for unprotected skin based on health guidelines.

APPENDIX III
LABORATORY CERTIFICATE OF ANALYSIS

CASSEN Testing Laboratories
51 International Blvd., Toronto, Ontario, M9W 6H3
tel: (416) 679-9663 fax: (416) 679-9668 web: www.cassen.ca

T-Harris Environmental Management Inc.
ATTN: Richard Quenneville
93 Skyway Ave. Suite 101
Toronto, Ontario, M9W 6N6

Analytical Report

CASSEN Work Order #: 2509925/2509925A
Date Received: February 22, 2019
Client Project Name / Number: T19-17346

Reviewed By: Queenie Yip

Queenie Yip, B.Sc., C.Chem, QA Manager

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: February 25, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 23, 2019

Analysis Requested: PAHs
Instrument: Gas Chromatougraphy Mass Spectrometry
CASSEN Method: M.3019.R0
Reference Method: Modified NIOSH 5515
Sampling Media: Wipe

No. of Samples: 38
No. of Blanks: 4

Sample Identification: 1-PAH
Sampling Area (cm2): 100

Lab ID: 67722
Date Sampled: February 21, 2019
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 2-PAH
Sampling Area (cm2): 100

Lab ID: 67723
Date Sampled: February 21, 2019
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 4-PAH
Sampling Area (cm2): 100

Lab ID: 67724
Date Sampled: February 20, 2019
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: February 25, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 23, 2019

Sample Identification: 5-PAH
Lab ID: 67725
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 6-PAH
Lab ID: 67726
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 8-PAH
Lab ID: 67727
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: February 25, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 23, 2019

Sample Identification: 9-PAH
Lab ID: 67728
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 11-PAH
Lab ID: 67729
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 12-PAH
Lab ID: 67730
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: February 25, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 23, 2019

Sample Identification: 14-PAH
Lab ID: 67731
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 15-PAH
Lab ID: 67732
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 16-PAH
Lab ID: 67733
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: February 25, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 23, 2019

Sample Identification: 17-PAH
Lab ID: 67734
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 18-PAH
Lab ID: 67735
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 19-PAH
Lab ID: 67736
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: February 25, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 23, 2019

Sample Identification: 20-PAH
Lab ID: 67737
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 21-PAH
Lab ID: 67738
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 22-PAH
Lab ID: 67739
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: February 25, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 23, 2019

Sample Identification: 23-PAH
Lab ID: 67740
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 24-PAH
Lab ID: 67741
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 25-PAH
Lab ID: 67742
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: February 25, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 23, 2019

Sample Identification: 27-PAH
Lab ID: 67743
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 28-PAH
Lab ID: 67744
Date Sampled: February 21, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 29-PAH
Lab ID: 67745
Date Sampled: February 21, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: February 25, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 23, 2019

Sample Identification: 33-PAH
Lab ID: 67746
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 34-PAH
Lab ID: 67747
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 35-PAH
Lab ID: 67748
Date Sampled: February 21, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: February 25, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 23, 2019

Sample Identification: 36-PAH
Lab ID: 67749
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 37-PAH
Lab ID: 67750
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 38-PAH
Lab ID: 67751
Date Sampled: February 21, 2019
Sampling Area (cm2): 100
Date Analyzed: February 23, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: February 25, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 23, 2019

Sample Identification: 39-PAH
Sampling Area (cm2): 100

Lab ID: 67752
Date Sampled: February 20, 2019
Date Analyzed: February 24, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 40-PAH
Sampling Area (cm2): 100

Lab ID: 67753
Date Sampled: February 20, 2019
Date Analyzed: February 24, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 41-PAH
Sampling Area (cm2): 100

Lab ID: 67754
Date Sampled: February 20, 2019
Date Analyzed: February 24, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: February 25, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 23, 2019

Sample Identification: 42-PAH
Sampling Area (cm2): 100

Lab ID: 67755
Date Sampled: February 21, 2019
Date Analyzed: February 24, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 43-PAH
Sampling Area (cm2): 100

Lab ID: 67756
Date Sampled: February 21, 2019
Date Analyzed: February 24, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 44-PAH
Sampling Area (cm2): 100

Lab ID: 67757
Date Sampled: February 20, 2019
Date Analyzed: February 24, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: February 25, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 23, 2019

Sample Identification: 45-PAH
Lab ID: 67758
Date Sampled: February 21, 2019
Sampling Area (cm2): 100
Date Analyzed: February 24, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: 64-PAH
Lab ID: 67759
Date Sampled: February 20, 2019
Sampling Area (cm2): 100
Date Analyzed: February 24, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	< 0.0003
2	Benzo[a]pyrene	000050-32-8	< 0.03	< 0.0003
3	Chrysene	000218-01-9	< 0.03	< 0.0003
4	Phenanthrene	000085-01-8	< 0.03	< 0.0003
5	Pyrene	000129-00-0	< 0.03	< 0.0003

See Final Page for Notes

Sample Identification: PAH-Blank 1
Lab ID: 67760
Date Sampled: February 20, 2019
Sampling Area (cm2): N.A.
Date Analyzed: February 24, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	N.A.
2	Benzo[a]pyrene	000050-32-8	< 0.03	N.A.
3	Chrysene	000218-01-9	< 0.03	N.A.
4	Phenanthrene	000085-01-8	< 0.03	N.A.
5	Pyrene	000129-00-0	< 0.03	N.A.

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: February 25, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 23, 2019

Sample Identification: PAH-Blank 2
Sampling Area (cm2): N.A.

Lab ID: 67761
Date Sampled: February 20, 2019
Date Analyzed: February 24, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	N.A.
2	Benzo[a]pyrene	000050-32-8	< 0.03	N.A.
3	Chrysene	000218-01-9	< 0.03	N.A.
4	Phenanthrene	000085-01-8	< 0.03	N.A.
5	Pyrene	000129-00-0	< 0.03	N.A.

See Final Page for Notes

Sample Identification: PAH-Blank 3
Sampling Area (cm2): N.A.

Lab ID: 67762
Date Sampled: February 20, 2019
Date Analyzed: February 24, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	N.A.
2	Benzo[a]pyrene	000050-32-8	< 0.03	N.A.
3	Chrysene	000218-01-9	< 0.03	N.A.
4	Phenanthrene	000085-01-8	< 0.03	N.A.
5	Pyrene	000129-00-0	< 0.03	N.A.

See Final Page for Notes

Sample Identification: PAH-Blank 4
Sampling Area (cm2): N.A.

Lab ID: 67763
Date Sampled: February 20, 2019
Date Analyzed: February 24, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Anthracene	000120-12-7	< 0.03	N.A.
2	Benzo[a]pyrene	000050-32-8	< 0.03	N.A.
3	Chrysene	000218-01-9	< 0.03	N.A.
4	Phenanthrene	000085-01-8	< 0.03	N.A.
5	Pyrene	000129-00-0	< 0.03	N.A.

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: February 25, 2019

Organization:	T-Harris Environmental Management Inc.		
Address:	93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6		
Contact:	Richard Quenneville	**Work Order No.:**	2509925
Project:	T19-17346	**Date Received:**	February 22, 2019
		Date Analyzed:	February 23, 2019

Quality Control Data

#	Analyte	CAS	Desorption Efficiency %	Uncertainty %	MRL (µg)
1	Anthracene	000120-12-7	97.91	6.53	0.03
2	Benzo[a]pyrene	000050-32-8	107.09	7.52	0.03
3	Chrysene	000218-01-9	92.98	7.06	0.03
4	Phenanthrene	000085-01-8	100.19	7.25	0.03
5	Pyrene	000129-00-0	94.70	6.03	0.03

Notes:
1) N.A.: Information not available or not applicable.
2) < is defined as less than the indicated minimum reporting limit (MRL). The analyte is either not detected or less than the minimum reporting limit (MRL).
3) MRL (Minimum Reporting Limit): it is the lowest mass/concentration of analyte in a sample that can be reported with a defined reproducible level of certainty.
4) Uncertainty is expressed as a percentage at a total mass per sample. It is a result of the evaluation aimed at characterizing the range within which the true value of a test result is estimated to lie at the 95% confidence interval.
5) CAS Number is the Chemical Abstracts Service registry number corresponding to the target analyte.
6) The results obtained for the target analyte have been lab blank subtracted.
7) Amount is the mass of target analyte in micrograms (ug) detected in the sampling media.
8) Concentration is the total amount of target analyte expressed in micrograms per square centimeter (ug/cm2). The sampling area used are those supplied to CASSEN Testing Laboratories.
9) CTL has established an ISO17025 reporting policy that a maximum of 3 significant figures will be reported for test results.
10) The sample(s) were received in acceptable condition unless otherwise noted.

Analyst:

Mark Reid, B.Sc., Analytical Chemist

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
tel: (416) 679-9663 fax: (416) 679-9668 web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: March 05, 2019

Analysis Requested: Formic and Acetic Acid
Instrument: Ion Chromatography with Conductivity Detector
CASSEN Method: M.8706.R0
Reference Method: CASSEN In-House Method
Sampling Media: Glass Fiber Filter - 37mm, 1 um (225-7)

No. of Samples: 38
No. of Blanks: 4

Acetic acid

#	Lab ID	Sample Identification	Date Sampled (dd/mm/yy)	Sampling Area (cm^2)	Amount	Concentration
					Total (µg)	(µg/cm^2)
1	67764	1-FAA	21/02/19	100	< 10	< 0.1
2	67765	2-FAA	21/02/19	100	15.4	0.2
3	67766	4-FAA	20/02/19	100	< 10	< 0.1
4	67767	5-FAA	20/02/19	100	< 10	< 0.1
5	67768	6-FAA	20/02/19	100	< 10	< 0.1
6	67769	8-FAA	20/02/19	100	< 10	< 0.1
7	67770	9-FAA	20/02/19	100	< 10	< 0.1
8	67771	11-FAA	20/02/19	100	< 10	< 0.1
9	67772	12-FAA	20/02/19	100	< 10	< 0.1
10	67773	14-FAA	20/02/19	100	< 10	< 0.1
11	67774	15-FAA	20/02/19	100	< 10	< 0.1
12	67775	16-FAA	20/02/19	100	< 10	< 0.1
13	67776	17-FAA	20/02/19	100	< 10	< 0.1
14	67777	18-FAA	20/02/19	100	< 10	< 0.1
15	67778	19-FAA	20/02/19	100	< 10	< 0.1
16	67779	20-FAA	20/02/19	100	< 10	< 0.1
17	67780	21-FAA	20/02/19	100	< 10	< 0.1
18	67781	22-FAA	20/02/19	100	< 10	< 0.1
19	67782	23-FAA	20/02/19	100	< 10	< 0.1
20	67783	24-FAA	20/02/19	100	< 10	< 0.1
21	67784	25-FAA	20/02/19	100	< 10	< 0.1
22	67785	27-FAA	20/02/19	100	< 10	< 0.1
23	67786	28-FAA	21/02/19	100	< 10	< 0.1
24	67787	29-FAA	21/02/19	100	< 10	< 0.1
25	67788	33-FAA	20/02/19	100	< 10	< 0.1
26	67789	34-FAA	20/02/19	100	< 10	< 0.1
27	67790	35-FAA	21/02/19	100	< 10	< 0.1
28	67791	36-FAA	20/02/19	100	< 10	< 0.1
29	67792	37-FAA	20/02/19	100	< 10	< 0.1
30	67793	38-FAA	21/02/19	100	< 10	< 0.1

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
tel: (416) 679-9663 fax: (416) 679-9668 web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: March 05, 2019

Acetic acid

#	Lab ID	Sample Identification	Date Sampled (dd/mm/yy)	Sampling Area (cm^2)	Amount	Concentration
					Total (µg)	(µg/cm^2)
31	67794	39-FAA	20/02/19	100	< 10	< 0.1
32	67795	40-FAA	20/02/19	100	< 10	< 0.1
33	67796	41-FAA	20/02/19	100	< 10	< 0.1
34	67797	42-FAA	21/02/19	100	< 10	< 0.1
35	67798	43-FAA	21/02/19	100	< 10	< 0.1
36	67799	44-FAA	20/02/19	100	< 10	< 0.1
37	67800	45-FAA	21/02/19	100	< 10	< 0.1
38	67801	64-FAA	20/02/19	100	< 10	< 0.1
39	67802	FAA-Blank 1	20/02/19	N.A.	< 10	N.A.
40	67803	FAA-Blank 2	20/02/19	N.A.	< 10	N.A.
41	67804	FAA-Blank 3	20/02/19	N.A.	< 10	N.A.
42	67805	FAA-Blank 4	20/02/19	N.A.	< 10	N.A.

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
tel: (416) 679-9663 fax: (416) 679-9668 web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: March 05, 2019

Formic acid

#	Lab ID	Sample Identification	Date Sampled (dd/mm/yy)	Sampling Area (cm^2)	Amount	Concentration
					Total (µg)	(µg/cm^2)
1	67764	1-FAA	21/02/19	100	< 10	< 0.1
2	67765	2-FAA	21/02/19	100	< 10	< 0.1
3	67766	4-FAA	20/02/19	100	< 10	< 0.1
4	67767	5-FAA	20/02/19	100	< 10	< 0.1
5	67768	6-FAA	20/02/19	100	< 10	< 0.1
6	67769	8-FAA	20/02/19	100	< 10	< 0.1
7	67770	9-FAA	20/02/19	100	< 10	< 0.1
8	67771	11-FAA	20/02/19	100	< 10	< 0.1
9	67772	12-FAA	20/02/19	100	< 10	< 0.1
10	67773	14-FAA	20/02/19	100	< 10	< 0.1
11	67774	15-FAA	20/02/19	100	< 10	< 0.1
12	67775	16-FAA	20/02/19	100	< 10	< 0.1
13	67776	17-FAA	20/02/19	100	< 10	< 0.1
14	67777	18-FAA	20/02/19	100	< 10	< 0.1
15	67778	19-FAA	20/02/19	100	< 10	< 0.1
16	67779	20-FAA	20/02/19	100	< 10	< 0.1
17	67780	21-FAA	20/02/19	100	< 10	< 0.1
18	67781	22-FAA	20/02/19	100	< 10	< 0.1
19	67782	23-FAA	20/02/19	100	< 10	< 0.1
20	67783	24-FAA	20/02/19	100	< 10	< 0.1
21	67784	25-FAA	20/02/19	100	< 10	< 0.1
22	67785	27-FAA	20/02/19	100	< 10	< 0.1
23	67786	28-FAA	21/02/19	100	< 10	< 0.1
24	67787	29-FAA	21/02/19	100	< 10	< 0.1
25	67788	33-FAA	20/02/19	100	< 10	< 0.1
26	67789	34-FAA	20/02/19	100	< 10	< 0.1
27	67790	35-FAA	21/02/19	100	< 10	< 0.1
28	67791	36-FAA	20/02/19	100	< 10	< 0.1
29	67792	37-FAA	20/02/19	100	< 10	< 0.1
30	67793	38-FAA	21/02/19	100	< 10	< 0.1
31	67794	39-FAA	20/02/19	100	< 10	< 0.1
32	67795	40-FAA	20/02/19	100	< 10	< 0.1
33	67796	41-FAA	20/02/19	100	< 10	< 0.1
34	67797	42-FAA	21/02/19	100	< 10	< 0.1
35	67798	43-FAA	21/02/19	100	< 10	< 0.1

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
tel: (416) 679-9663 fax: (416) 679-9668 web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: March 05, 2019

Formic acid

#	Lab ID	Sample Identification	Date Sampled (dd/mm/yy)	Sampling Area (cm^2)	Amount	Concentration
					Total (µg)	(µg/cm^2)
36	67799	44-FAA	20/02/19	100	< 10	< 0.1
37	67800	45-FAA	21/02/19	100	< 10	< 0.1
38	67801	64-FAA	20/02/19	100	< 10	< 0.1
39	67802	FAA-Blank 1	20/02/19	N.A.	< 10	N.A.
40	67803	FAA-Blank 2	20/02/19	N.A.	< 10	N.A.
41	67804	FAA-Blank 3	20/02/19	N.A.	< 10	N.A.
42	67805	FAA-Blank 4	20/02/19	N.A.	< 10	N.A.

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
tel: (416) 679-9663 fax: (416) 679-9668 web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: March 05, 2019

Quality Control Batch #: 1866-86

#	Analyte	CAS	Desorption Efficiency %	Uncertainty %	MRL (µg)
1	Acetic acid	000064-19-7	95.10	9.08	10
2	Formic acid	000064-18-6	90.72	11.22	10

Notes:
1) N.A.: Information not available or not applicable
2) < is defined as less than the indicated minimum reporting limit (MRL). The analyte is either not detected or less than the minimum reporting limit (MRL).
3) MRL (Minimum Reporting Limit): it is the lowest mass/concentration of analyte in a sample that can be reported with a defined reproducible level of certainty.
4) Uncertainty is expressed as a percentage at a total mass per sample. It is a result of the evaluation aimed at characterizing the range within which the true value of a test result is estimated to lie at the 95% confidence interval.
5) CAS Number is the Chemical Abstracts Service registry number corresponding to the target analyte.
6) Desorption Efficiency is defined as the percent (%) spike recovery of a target analyte from the sampling media using the described procedure.
7) The results obtained for the target analyte have been lab blank subtracted.
8) Amount is the mass of target analyte in micrograms (µg) detected in the sampling media. The results have been corrected for desorption efficiency.
9) Concentration is the total amount of target analyte expressed in micrograms per square centimeter (µg/cm²). The sampling area used are those supplied to CASSEN Testing Laboratories.
10) CTL has established an ISO17025 reporting policy that a maximum of 3 significant figures will be reported for test results.
11) The sample(s) were received in acceptable condition unless otherwise noted.

Analyst:

Timothy Hutama, M.Sc., C.Chem, Analytical Chemist

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Analysis Requested: Inorganic acid
Instrument: Ion Chromatography with Conductivity Detector
CASSEN Method: M.8706.R0
Reference Method: Mod. NIOSH 7907/NIOSH 7908
Sampling Media: Glass Fiber Filter - 37mm, 1 um (225-7)

No. of Samples: 38
No. of Blanks: 4

Sample Identification: 1-IA
Sampling Area (cm²): 100

Lab ID: 67806
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	1	0.01
2	Hydrochloric Acid	007647-01-0	13.9	0.1
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	122	1.2

See Final Page for Notes

Sample Identification: 2-IA
Sampling Area (cm²): 100

Lab ID: 67807
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	< 0.4	< 0.004
2	Hydrochloric Acid	007647-01-0	234	2.3
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	85.9	0.9

See Final Page for Notes

Sample Identification: 4-IA
Sampling Area (cm²): 100

Lab ID: 67808
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	3.8	0.04
2	Hydrochloric Acid	007647-01-0	508	5.1
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	208	2.1

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 5-IA
Sampling Area (cm²): 100

Lab ID: 67809
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	4.8	0.05
2	Hydrochloric Acid	007647-01-0	489	4.9
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	737	7.4

See Final Page for Notes

Sample Identification: 6-IA
Sampling Area (cm²): 100

Lab ID: 67810
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	4.2	0.04
2	Hydrochloric Acid	007647-01-0	48.4	0.5
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	732	7.3

See Final Page for Notes

Sample Identification: 8-IA
Sampling Area (cm²): 100

Lab ID: 67811
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	< 0.4	< 0.004
2	Hydrochloric Acid	007647-01-0	476	4.8
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	202	2

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 9-IA
Sampling Area (cm²): 100

Lab ID: 67812
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	7.4	0.07
2	Hydrochloric Acid	007647-01-0	274	2.7
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	891	8.9

See Final Page for Notes

Sample Identification: 11-IA
Sampling Area (cm²): 100

Lab ID: 67813
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	1.3	0.01
2	Hydrochloric Acid	007647-01-0	210	2.1
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	615	6.2

See Final Page for Notes

Sample Identification: 12-IA
Sampling Area (cm²): 100

Lab ID: 67814
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	3.9	0.04
2	Hydrochloric Acid	007647-01-0	97.1	1
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	684	6.8

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 14-IA
Sampling Area (cm²): 100

Lab ID: 67815
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	< 0.4	< 0.004
2	Hydrochloric Acid	007647-01-0	72.1	0.7
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	221	2.2

See Final Page for Notes

Sample Identification: 15-IA
Sampling Area (cm²): 100

Lab ID: 67816
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	2.8	0.03
2	Hydrochloric Acid	007647-01-0	67.5	0.7
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	554	5.5

See Final Page for Notes

Sample Identification: 16-IA
Sampling Area (cm²): 100

Lab ID: 67817
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	0.7	0.007
2	Hydrochloric Acid	007647-01-0	37.7	0.4
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	221	2.2

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 17-IA
Sampling Area (cm²): 100

Lab ID: 67818
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	1.6	0.02
2	Hydrochloric Acid	007647-01-0	68.1	0.7
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	417	4.2

See Final Page for Notes

Sample Identification: 18-IA
Sampling Area (cm²): 100

Lab ID: 67819
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	< 0.4	< 0.004
2	Hydrochloric Acid	007647-01-0	58.2	0.6
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	481	4.8

See Final Page for Notes

Sample Identification: 19-IA
Sampling Area (cm²): 100

Lab ID: 67820
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	5.2	0.05
2	Hydrochloric Acid	007647-01-0	238	2.4
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	859	8.6

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 20-IA
Sampling Area (cm²): 100

Lab ID: 67821
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	0.5	0.005
2	Hydrochloric Acid	007647-01-0	38.1	0.4
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	412	4.1

See Final Page for Notes

Sample Identification: 21-IA
Sampling Area (cm²): 100

Lab ID: 67822
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	1.4	0.01
2	Hydrochloric Acid	007647-01-0	41.5	0.4
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	691	6.9

See Final Page for Notes

Sample Identification: 22-IA
Sampling Area (cm²): 100

Lab ID: 67823
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	0.9	0.009
2	Hydrochloric Acid	007647-01-0	413	4.1
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	526	5.3

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 23-IA
Sampling Area (cm²): 100

Lab ID: 67824
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	13.2	0.1
2	Hydrochloric Acid	007647-01-0	107	1.1
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	551	5.5

See Final Page for Notes

Sample Identification: 24-IA
Sampling Area (cm²): 100

Lab ID: 67825
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	1.2	0.01
2	Hydrochloric Acid	007647-01-0	581	5.8
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	274	2.7

See Final Page for Notes

Sample Identification: 25-IA
Sampling Area (cm²): 100

Lab ID: 67826
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	2.8	0.03
2	Hydrochloric Acid	007647-01-0	220	2.2
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	160	1.6

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 27-IA
Sampling Area (cm²): 100

Lab ID: 67827
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	3.4	0.03
2	Hydrochloric Acid	007647-01-0	62.1	0.6
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	1540	15.4

See Final Page for Notes

Sample Identification: 28-IA
Sampling Area (cm²): 100

Lab ID: 67828
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	< 0.4	< 0.004
2	Hydrochloric Acid	007647-01-0	80.2	0.8
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	215	2.2

See Final Page for Notes

Sample Identification: 29-IA
Sampling Area (cm²): 100

Lab ID: 67829
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	< 0.4	< 0.004
2	Hydrochloric Acid	007647-01-0	11.9	0.1
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	298	3

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 33-IA
Sampling Area (cm²): 100

Lab ID: 67830
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	< 0.4	< 0.004
2	Hydrochloric Acid	007647-01-0	116	1.2
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	102	1

See Final Page for Notes

Sample Identification: 34-IA
Sampling Area (cm²): 100

Lab ID: 67831
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	2.9	0.03
2	Hydrochloric Acid	007647-01-0	61.6	0.6
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	2850	28.5

See Final Page for Notes

Sample Identification: 35-IA
Sampling Area (cm²): 100

Lab ID: 67832
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	< 0.4	< 0.004
2	Hydrochloric Acid	007647-01-0	193	1.9
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	639	6.4

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 36-IA
Sampling Area (cm²): 100

Lab ID: 67833
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	91.7	0.9
2	Hydrochloric Acid	007647-01-0	720	7.2
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	2080	20.8

See Final Page for Notes

Sample Identification: 37-IA
Sampling Area (cm²): 100

Lab ID: 67834
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	7.8	0.08
2	Hydrochloric Acid	007647-01-0	860	8.6
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	1040	10.4

See Final Page for Notes

Sample Identification: 38-IA
Sampling Area (cm²): 100

Lab ID: 67835
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	18.3	0.2
2	Hydrochloric Acid	007647-01-0	129	1.3
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	1180	11.8

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 39-IA
Sampling Area (cm²): 100

Lab ID: 67836
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	50.3	0.5
2	Hydrochloric Acid	007647-01-0	326	3.3
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	2340	23.4

See Final Page for Notes

Sample Identification: 40-IA
Sampling Area (cm²): 100

Lab ID: 67837
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	< 0.4	< 0.004
2	Hydrochloric Acid	007647-01-0	126	1.3
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	1250	12.5

See Final Page for Notes

Sample Identification: 41-IA
Sampling Area (cm²): 100

Lab ID: 67838
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	1.9	0.02
2	Hydrochloric Acid	007647-01-0	82.3	0.8
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	643	6.4

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 42-IA
Sampling Area (cm²): 100

Lab ID: 67839
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	1.4	0.01
2	Hydrochloric Acid	007647-01-0	42.5	0.4
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	303	3

See Final Page for Notes

Sample Identification: 43-IA
Sampling Area (cm²): 100

Lab ID: 67840
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	2.1	0.02
2	Hydrochloric Acid	007647-01-0	99.1	1
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	439	4.4

See Final Page for Notes

Sample Identification: 44-IA
Sampling Area (cm²): 100

Lab ID: 67841
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	< 0.4	< 0.004
2	Hydrochloric Acid	007647-01-0	287	2.9
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	392	3.9

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 45-IA
Sampling Area (cm²): 100

Lab ID: 67842
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	1.1	0.01
2	Hydrochloric Acid	007647-01-0	25.9	0.3
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	75.5	0.8

See Final Page for Notes

Sample Identification: 64-IA
Sampling Area (cm²): 100

Lab ID: 67843
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	< 0.4	< 0.004
2	Hydrochloric Acid	007647-01-0	153	1.5
3	Hydrobromic Acid	010035-10-6	< 2	< 0.02
4	Sulfuric Acid	007664-93-9	64.8	0.6

See Final Page for Notes

Sample Identification: IA-Blank 1
Sampling Area (cm²): N.A.

Lab ID: 67844
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	< 0.4	N.A.
2	Hydrochloric Acid	007647-01-0	< 0.6	N.A.
3	Hydrobromic Acid	010035-10-6	< 2	N.A.
4	Sulfuric Acid	007664-93-9	< 3	N.A.

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: IA-Blank 2
Sampling Area (cm²): N.A.

Lab ID: 67845
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	< 0.4	N.A.
2	Hydrochloric Acid	007647-01-0	< 0.6	N.A.
3	Hydrobromic Acid	010035-10-6	< 2	N.A.
4	Sulfuric Acid	007664-93-9	< 3	N.A.

See Final Page for Notes

Sample Identification: IA-Blank 3
Sampling Area (cm²): N.A.

Lab ID: 67846
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	< 0.4	N.A.
2	Hydrochloric Acid	007647-01-0	< 0.6	N.A.
3	Hydrobromic Acid	010035-10-6	< 2	N.A.
4	Sulfuric Acid	007664-93-9	< 3	N.A.

See Final Page for Notes

Sample Identification: IA-Blank 4
Sampling Area (cm²): N.A.

Lab ID: 67847
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Hydrofluoric Acid	007664-39-3	< 0.4	N.A.
2	Hydrochloric Acid	007647-01-0	< 0.6	N.A.
3	Hydrobromic Acid	010035-10-6	< 2	N.A.
4	Sulfuric Acid	007664-93-9	< 3	N.A.

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Quality Control Batch #: 1164-86

#	Analyte	CAS	Desorption Efficiency %	Uncertainty %	MRL (µg)
1	Hydrofluoric Acid	007664-39-3	89.35	5.48	0.4
2	Hydrochloric Acid	007647-01-0	89.49	9.44	0.6
3	Hydrobromic Acid	010035-10-6	94.12	4.76	2
4	Sulfuric Acid	007664-93-9	85.77	23.40	3

Notes:
1) N.A.: Information not available or not applicable
2) < is defined as less than the indicated minimum reporting limit (MRL). The analyte is either not detected or less than the minimum reporting limit (MRL).
3) MRL (Minimum Reporting Limit): it is the lowest mass/concentration of analyte in a sample that can be reported with a defined reproducible level of certainty.
4) Uncertainty is expressed as a percentage at a total mass per sample. It is a result of the evaluation aimed at characterizing the range within which the true value of a test result is estimated to lie at the 95% confidence interval.
5) CAS Number is the Chemical Abstracts Service registry number corresponding to the target analyte.
6) Desorption Efficiency is defined as the percent (%) spike recovery of a target analyte from the sampling media using the described procedure.
7) The results obtained for the target analyte have been lab blank subtracted.
8) Amount is the mass of target analyte in micrograms (µg) detected in the sampling media. The results have been corrected for desorption efficiency.
9) Concentration is the total amount of target analyte expressed in micrograms per square centimeter (µg/cm²). The sampling area used are those supplied to CASSEN Testing Laboratories.
10) CTL has established an ISO17025 reporting policy that a maximum of 3 significant figures will be reported for test results.
11) The sample(s) were received in acceptable condition unless otherwise noted.

Analyst: _____
Timothy Hutama, M.Sc., C.Chem, Analytical Chemist

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Analysis Requested: Toxic Metals
Instrument: Inductively Coupled Plasma with Optical Emission Spectrometer
CASSEN Method: M.101203.R0
Reference Method: Modified NIOSH 7303
Sampling Media: MCE Filter Wipe

No. of Samples: 38
No. of Blanks: 4

Sample Identification: 1-TM
Sampling Area (cm²): 100

Lab ID: 67890
Date Sampled: February 21, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	< 0.5	< 0.005
7	Nickel	007440-02-0	3.8	0.04
8	Selenium	007782-49-2	0.7	0.007
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

Sample Identification: 2-TM
Sampling Area (cm²): 100

Lab ID: 67891
Date Sampled: February 21, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	3.8	0.04
7	Nickel	007440-02-0	1.5	0.01
8	Selenium	007782-49-2	< 0.5	< 0.005
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 4-TM
Sampling Area (cm²): 100

Lab ID: 67892
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	< 0.5	< 0.005
7	Nickel	007440-02-0	18.1	0.2
8	Selenium	007782-49-2	2.9	0.03
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

Sample Identification: 5-TM
Sampling Area (cm²): 100

Lab ID: 67893
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	1.7	0.02
7	Nickel	007440-02-0	27.8	0.3
8	Selenium	007782-49-2	4.8	0.05
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	0.4	0.004

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 6-TM
Sampling Area (cm²): 100

Lab ID: 67894
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	2.6	0.03
2	Arsenic	007440-38-2	1	0.01
3	Barium	007440-39-3	2.5	0.03
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	3.2	0.03
7	Nickel	007440-02-0	184	1.8
8	Selenium	007782-49-2	44.8	0.4
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	1.5	0.02

See Final Page for Notes

Sample Identification: 8-TM
Sampling Area (cm²): 100

Lab ID: 67895
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	0.7	0.007
7	Nickel	007440-02-0	10.8	0.1
8	Selenium	007782-49-2	2.3	0.02
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 9-TM
Sampling Area (cm²): 100

Lab ID: 67896
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	0.8	0.008
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	11.5	0.1
7	Nickel	007440-02-0	11.2	0.1
8	Selenium	007782-49-2	1.7	0.02
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	0.2	0.002

See Final Page for Notes

Sample Identification: 11-TM
Sampling Area (cm²): 100

Lab ID: 67897
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	5.7	0.06
7	Nickel	007440-02-0	22.2	0.2
8	Selenium	007782-49-2	4.1	0.04
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 12-TM
Sampling Area (cm²): 100

Lab ID: 67898
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	0.8	0.008
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	2.9	0.03
7	Nickel	007440-02-0	2.7	0.03
8	Selenium	007782-49-2	< 0.5	< 0.005
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

Sample Identification: 14-TM
Sampling Area (cm²): 100

Lab ID: 67899
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	5.1	0.05
7	Nickel	007440-02-0	7.7	0.08
8	Selenium	007782-49-2	1.8	0.02
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 15-TM
Sampling Area (cm²): 100

Lab ID: 67900
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	5.4	0.05
7	Nickel	007440-02-0	1.3	0.01
8	Selenium	007782-49-2	< 0.5	< 0.005
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

Sample Identification: 16-TM
Sampling Area (cm²): 100

Lab ID: 67901
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	3.6	0.04
7	Nickel	007440-02-0	0.7	0.007
8	Selenium	007782-49-2	< 0.5	< 0.005
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 17-TM
Sampling Area (cm²): 100

Lab ID: 67902
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	1.6	0.02
7	Nickel	007440-02-0	< 0.5	< 0.005
8	Selenium	007782-49-2	< 0.5	< 0.005
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

Sample Identification: 18-TM
Sampling Area (cm²): 100

Lab ID: 67903
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	35.5	0.4
7	Nickel	007440-02-0	7.1	0.07
8	Selenium	007782-49-2	1.4	0.01
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	0.2	0.002

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 19-TM
Sampling Area (cm²): 100

Lab ID: 67904
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	0.4	0.004
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	38.2	0.4
7	Nickel	007440-02-0	21	0.2
8	Selenium	007782-49-2	2.6	0.03
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	0.3	0.003

See Final Page for Notes

Sample Identification: 20-TM
Sampling Area (cm²): 100

Lab ID: 67905
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	0.6	0.006
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	27.4	0.3
7	Nickel	007440-02-0	9.2	0.09
8	Selenium	007782-49-2	1.6	0.02
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	0.4	0.004

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 21-TM
Sampling Area (cm²): 100

Lab ID: 67906
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	0.9	0.009
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	1.4	0.01
7	Nickel	007440-02-0	5.3	0.05
8	Selenium	007782-49-2	< 0.5	< 0.005
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

Sample Identification: 22-TM
Sampling Area (cm²): 100

Lab ID: 67907
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	0.7	0.007
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	3.1	0.03
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	8.8	0.09
7	Nickel	007440-02-0	22.8	0.2
8	Selenium	007782-49-2	3.9	0.04
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	0.5	0.005

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 23-TM
Sampling Area (cm²): 100

Lab ID: 67908
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	2.1	0.02
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	0.6	0.006
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	26.3	0.3
7	Nickel	007440-02-0	24.6	0.2
8	Selenium	007782-49-2	6.4	0.06
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	0.3	0.003

See Final Page for Notes

Sample Identification: 24-TM
Sampling Area (cm²): 100

Lab ID: 67909
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	8.8	0.09
7	Nickel	007440-02-0	5.8	0.06
8	Selenium	007782-49-2	0.7	0.007
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 25-TM
Sampling Area (cm²): 100

Lab ID: 67910
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	2	0.02
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	0.1	0.001
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	74.6	0.7
7	Nickel	007440-02-0	114	1.1
8	Selenium	007782-49-2	34.8	0.3
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	0.8	0.008

See Final Page for Notes

Sample Identification: 27-TM
Sampling Area (cm²): 100

Lab ID: 67911
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	1.2	0.01
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	1.8	0.02
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	94.6	0.9
7	Nickel	007440-02-0	57.8	0.6
8	Selenium	007782-49-2	20.9	0.2
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	1.2	0.01

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 28-TM
Sampling Area (cm²): 100

Lab ID: 67912
Date Sampled: February 21, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	< 0.5	< 0.005
7	Nickel	007440-02-0	< 0.5	< 0.005
8	Selenium	007782-49-2	< 0.5	< 0.005
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

Sample Identification: 29-TM
Sampling Area (cm²): 100

Lab ID: 67913
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	0.8	0.008
7	Nickel	007440-02-0	4.1	0.04
8	Selenium	007782-49-2	< 0.5	< 0.005
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 33-TM
Sampling Area (cm²): 100

Lab ID: 67914
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	1.5	0.02
7	Nickel	007440-02-0	2.3	0.02
8	Selenium	007782-49-2	0.5	0.005
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

Sample Identification: 34-TM
Sampling Area (cm²): 100

Lab ID: 67915
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	0.7	0.007
2	Arsenic	007440-38-2	0.5	0.005
3	Barium	007440-39-3	1.1	0.01
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	0.5	0.005
6	Lead	007439-92-1	3.6	0.04
7	Nickel	007440-02-0	5.7	0.06
8	Selenium	007782-49-2	1.3	0.01
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	0.6	0.006

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 35-TM
Sampling Area (cm²): 100

Lab ID: 67916
Date Sampled: February 21, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	1.1	0.01
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	1.2	0.01
7	Nickel	007440-02-0	66.9	0.7
8	Selenium	007782-49-2	16.2	0.2
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	0.4	0.004

See Final Page for Notes

Sample Identification: 36-TM
Sampling Area (cm²): 100

Lab ID: 67917
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	1	0.01
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	4.4	0.04
7	Nickel	007440-02-0	10.2	0.1
8	Selenium	007782-49-2	1	0.01
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	0.4	0.004

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 37-TM
Sampling Area (cm²): 100

Lab ID: 67918
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	1.7	0.02
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	0.5	0.005
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	17.5	0.2
7	Nickel	007440-02-0	135	1.3
8	Selenium	007782-49-2	27.9	0.3
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	0.8	0.008

See Final Page for Notes

Sample Identification: 38-TM
Sampling Area (cm²): 100

Lab ID: 67919
Date Sampled: February 21, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	0.5	0.005
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	21.3	0.2
7	Nickel	007440-02-0	11.7	0.1
8	Selenium	007782-49-2	1.5	0.01
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	0.4	0.004

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 39-TM
Sampling Area (cm²): 100

Lab ID: 67920
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	0.6	0.006
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	0.8	0.008
7	Nickel	007440-02-0	29.5	0.3
8	Selenium	007782-49-2	6.5	0.07
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	0.4	0.004

See Final Page for Notes

Sample Identification: 40-TM
Sampling Area (cm²): 100

Lab ID: 67921
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	0.5	0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	1.2	0.01
7	Nickel	007440-02-0	29	0.3
8	Selenium	007782-49-2	7.1	0.07
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	0.3	0.003

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 41-TM
Sampling Area (cm²): 100

Lab ID: 67922
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	0.7	0.007
7	Nickel	007440-02-0	19.2	0.2
8	Selenium	007782-49-2	5.3	0.05
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

Sample Identification: 42-TM
Sampling Area (cm²): 100

Lab ID: 67923
Date Sampled: February 21, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	0.1	0.001
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	3.5	0.04
7	Nickel	007440-02-0	5.4	0.05
8	Selenium	007782-49-2	0.6	0.006
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	0.2	0.002

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 43-TM
Sampling Area (cm²): 100

Lab ID: 67924
Date Sampled: February 21, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	2.5	0.02
7	Nickel	007440-02-0	9.8	0.1
8	Selenium	007782-49-2	1.7	0.02
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

Sample Identification: 44-TM
Sampling Area (cm²): 100

Lab ID: 67925
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	0.8	0.008
7	Nickel	007440-02-0	23.8	0.2
8	Selenium	007782-49-2	4.1	0.04
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: 45-TM
Sampling Area (cm²): 100

Lab ID: 67926
Date Sampled: February 21, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	< 0.5	< 0.005
7	Nickel	007440-02-0	1.1	0.01
8	Selenium	007782-49-2	< 0.5	< 0.005
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

Sample Identification: 64-TM
Sampling Area (cm²): 100

Lab ID: 67927
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	< 0.005
2	Arsenic	007440-38-2	< 0.5	< 0.005
3	Barium	007440-39-3	< 0.02	< 0.0002
4	Beryllium	007440-41-7	< 0.02	< 0.0002
5	Cadmium	007440-43-9	< 0.2	< 0.002
6	Lead	007439-92-1	2.6	0.03
7	Nickel	007440-02-0	19.1	0.2
8	Selenium	007782-49-2	3.6	0.04
9	Thallium	007440-28-0	< 0.5	< 0.005
10	Vanadium	007440-62-2	< 0.2	< 0.002

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: TM-Blank 1
Sampling Area (cm²): N.A.

Lab ID: 67928
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	N.A.
2	Arsenic	007440-38-2	< 0.5	N.A.
3	Barium	007440-39-3	< 0.02	N.A.
4	Beryllium	007440-41-7	< 0.02	N.A.
5	Cadmium	007440-43-9	< 0.2	N.A.
6	Lead	007439-92-1	< 0.5	N.A.
7	Nickel	007440-02-0	< 0.5	N.A.
8	Selenium	007782-49-2	< 0.5	N.A.
9	Thallium	007440-28-0	< 0.5	N.A.
10	Vanadium	007440-62-2	< 0.2	N.A.

See Final Page for Notes

Sample Identification: TM-Blank 2
Sampling Area (cm²): N.A.

Lab ID: 67929
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	N.A.
2	Arsenic	007440-38-2	< 0.5	N.A.
3	Barium	007440-39-3	< 0.02	N.A.
4	Beryllium	007440-41-7	< 0.02	N.A.
5	Cadmium	007440-43-9	< 0.2	N.A.
6	Lead	007439-92-1	< 0.5	N.A.
7	Nickel	007440-02-0	< 0.5	N.A.
8	Selenium	007782-49-2	< 0.5	N.A.
9	Thallium	007440-28-0	< 0.5	N.A.
10	Vanadium	007440-62-2	< 0.2	N.A.

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Sample Identification: TM-Blank 3
Sampling Area (cm²): N.A.

Lab ID: 67930
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	N.A.
2	Arsenic	007440-38-2	< 0.5	N.A.
3	Barium	007440-39-3	< 0.02	N.A.
4	Beryllium	007440-41-7	< 0.02	N.A.
5	Cadmium	007440-43-9	< 0.2	N.A.
6	Lead	007439-92-1	< 0.5	N.A.
7	Nickel	007440-02-0	< 0.5	N.A.
8	Selenium	007782-49-2	< 0.5	N.A.
9	Thallium	007440-28-0	< 0.5	N.A.
10	Vanadium	007440-62-2	< 0.2	N.A.

See Final Page for Notes

Sample Identification: TM-Blank 4
Sampling Area (cm²): N.A.

Lab ID: 67931
Date Sampled: February 20, 2019
Date Analyzed: March 06, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Antimony	007440-36-0	< 0.5	N.A.
2	Arsenic	007440-38-2	< 0.5	N.A.
3	Barium	007440-39-3	< 0.02	N.A.
4	Beryllium	007440-41-7	< 0.02	N.A.
5	Cadmium	007440-43-9	< 0.2	N.A.
6	Lead	007439-92-1	< 0.5	N.A.
7	Nickel	007440-02-0	< 0.5	N.A.
8	Selenium	007782-49-2	< 0.5	N.A.
9	Thallium	007440-28-0	< 0.5	N.A.
10	Vanadium	007440-62-2	< 0.2	N.A.

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925A
Date Received: February 22, 2019
Date Analyzed: March 06, 2019

Quality Control Batch #: 1865-136

#	Analyte	CAS	Desorption Efficiency %	Uncertainty %	MRL (µg)
1	Antimony	007440-36-0	101.46	5.56	0.5
2	Arsenic	007440-38-2	100.00	6.47	0.5
3	Barium	007440-39-3	105.66	7.22	0.02
4	Beryllium	007440-41-7	98.50	5.44	0.02
5	Cadmium	007440-43-9	103.35	4.69	0.2
6	Lead	007439-92-1	103.50	4.34	0.5
7	Nickel	007440-02-0	104.00	4.75	0.5
8	Selenium	007782-49-2	100.90	6.82	0.5
9	Thallium	007440-28-0	101.61	7.65	0.5
10	Vanadium	007440-62-2	102.27	5.31	0.2

Notes:
1) N.A.: Information not available or not applicable.
2) < is defined as less than the indicated minimum reporting limit (MRL). The analyte is either not detected or less than the minimum reporting limit (MRL).
3) MRL (Minimum Reporting Limit): it is the lowest mass/concentration of the target analyte in a sample that can be reported with a defined reproducible level of certainty.
4) Uncertainty is expressed as a percentage at a total mass per sample. It is a result of the evaluation aimed at characterizing the range within which the true value of a test result is estimated to lie at the 95% confidence interval.
5) CAS Number is the Chemical Abstracts Service registry number corresponding to the target analyte.
6) Desorption Efficiency is defined as the percent (%) spike recovery of a target analyte from the sampling media using the described procedure.
7) The results obtained for the target analyte have been lab blank subtracted.
8) Amount is the mass of target analyte in micrograms (µg) detected in the sampling media. The results have been corrected for desorption efficiency.
9) Concentration is the total amount of target analyte expressed in micrograms per square centimeter (ug/cm2). The sampling area used are those supplied to CASSEN Testing Laboratories.
10) CTL has established an ISO17025 reporting policy that a maximum of 3 significant figures will be reported for test results.
11) The sample(s) were received in acceptable condition unless otherwise noted.

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 12, 2019

Organization:	T-Harris Environmental Management Inc.		
Address:	93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6		
Contact:	Richard Quenneville	**Work Order No.:**	2509925A
Project:	T19-17346	**Date Received:**	February 22, 2019
		Date Analyzed:	March 06, 2019

Analyst:

Drew Roberts, B.Sc., Laboratory Analyst

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Analysis Requested: Alkaline Dust (Alkali Metal Cations Na, K, Li)
Instrument: Inductively Coupled Plasma with Optical Emission Spectrometer
CASSEN Method: M.101203.R0
Reference Method: Modified NIOSH 7405
Sampling Media: MCE Filter Wipe

No. of Samples: 38
No. of Blanks: 4

Sample Identification: 1-AD
Sampling Area (cm²): 100

Lab ID: 67848
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	< 5	< 0.05
3	Potassium	007440-09-7	59.5	0.6

See Final Page for Notes

Sample Identification: 2-AD
Sampling Area (cm²): 100

Lab ID: 67849
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	< 5	< 0.05
3	Potassium	007440-09-7	< 5	< 0.05

See Final Page for Notes

Sample Identification: 4-AD
Sampling Area (cm²): 100

Lab ID: 67850
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	57.8	0.6
3	Potassium	007440-09-7	27.7	0.3

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 5-AD
Sampling Area (cm²): 100

Lab ID: 67851
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	57.7	0.6
3	Potassium	007440-09-7	16.6	0.2

See Final Page for Notes

Sample Identification: 6-AD
Sampling Area (cm²): 100

Lab ID: 67852
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	28.8	0.3
3	Potassium	007440-09-7	13	0.1

See Final Page for Notes

Sample Identification: 8-AD
Sampling Area (cm²): 100

Lab ID: 67853
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	17.8	0.2
3	Potassium	007440-09-7	7.9	0.08

See Final Page for Notes

Sample Identification: 9-AD
Sampling Area (cm²): 100

Lab ID: 67854
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	215	2.2
3	Potassium	007440-09-7	75.2	0.8

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 11-AD
Sampling Area (cm²): 100

Lab ID: 67855
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	28.3	0.3
3	Potassium	007440-09-7	18.1	0.2

See Final Page for Notes

Sample Identification: 12-AD
Sampling Area (cm²): 100

Lab ID: 67856
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	53.7	0.5
3	Potassium	007440-09-7	28	0.3

See Final Page for Notes

Sample Identification: 14-AD
Sampling Area (cm²): 100

Lab ID: 67857
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	16.3	0.2
3	Potassium	007440-09-7	< 5	< 0.05

See Final Page for Notes

Sample Identification: 15-AD
Sampling Area (cm²): 100

Lab ID: 67858
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	54.2	0.5
3	Potassium	007440-09-7	24.1	0.2

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 16-AD
Sampling Area (cm²): 100

Lab ID: 67859
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	11	0.1
3	Potassium	007440-09-7	< 5	< 0.05

See Final Page for Notes

Sample Identification: 17-AD
Sampling Area (cm²): 100

Lab ID: 67860
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	20.1	0.2
3	Potassium	007440-09-7	9	0.09

See Final Page for Notes

Sample Identification: 18-AD
Sampling Area (cm²): 100

Lab ID: 67861
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	50.5	0.5
3	Potassium	007440-09-7	40.5	0.4

See Final Page for Notes

Sample Identification: 19-AD
Sampling Area (cm²): 100

Lab ID: 67862
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	17.6	0.2
3	Potassium	007440-09-7	7	0.07

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 20-AD
Sampling Area (cm²): 100

Lab ID: 67863
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	81.2	0.8
3	Potassium	007440-09-7	26.8	0.3

See Final Page for Notes

Sample Identification: 21-AD
Sampling Area (cm²): 100

Lab ID: 67864
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	308	3.1
3	Potassium	007440-09-7	34.5	0.3

See Final Page for Notes

Sample Identification: 22-AD
Sampling Area (cm²): 100

Lab ID: 67865
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	21	0.2
3	Potassium	007440-09-7	9.1	0.09

See Final Page for Notes

Sample Identification: 23-AD
Sampling Area (cm²): 100

Lab ID: 67866
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	43.7	0.4
3	Potassium	007440-09-7	32.4	0.3

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 24-AD
Sampling Area (cm²): 100

Lab ID: 67867
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	35.8	0.4
3	Potassium	007440-09-7	18.7	0.2

See Final Page for Notes

Sample Identification: 25-AD
Sampling Area (cm²): 100

Lab ID: 67868
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	61.9	0.6
3	Potassium	007440-09-7	17.3	0.2

See Final Page for Notes

Sample Identification: 27-AD
Sampling Area (cm²): 100

Lab ID: 67869
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	68.6	0.7
3	Potassium	007440-09-7	24.4	0.2

See Final Page for Notes

Sample Identification: 28-AD
Sampling Area (cm²): 100

Lab ID: 67870
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	9.4	0.09
3	Potassium	007440-09-7	< 5	< 0.05

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 29-AD
Sampling Area (cm²): 100

Lab ID: 67871
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	< 5	< 0.05
3	Potassium	007440-09-7	< 5	< 0.05

See Final Page for Notes

Sample Identification: 33-AD
Sampling Area (cm²): 100

Lab ID: 67872
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	< 5	< 0.05
3	Potassium	007440-09-7	< 5	< 0.05

See Final Page for Notes

Sample Identification: 34-AD
Sampling Area (cm²): 100

Lab ID: 67873
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	56.2	0.6
3	Potassium	007440-09-7	17.4	0.2

See Final Page for Notes

Sample Identification: 35-AD
Sampling Area (cm²): 100

Lab ID: 67874
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	14.7	0.1
3	Potassium	007440-09-7	10.1	0.1

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 36-AD
Sampling Area (cm²): 100

Lab ID: 67875
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	27.6	0.3
3	Potassium	007440-09-7	29.8	0.3

See Final Page for Notes

Sample Identification: 37-AD
Sampling Area (cm²): 100

Lab ID: 67876
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	56.5	0.6
3	Potassium	007440-09-7	14.3	0.1

See Final Page for Notes

Sample Identification: 38-AD
Sampling Area (cm²): 100

Lab ID: 67877
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	48.5	0.5
3	Potassium	007440-09-7	56.7	0.6

See Final Page for Notes

Sample Identification: 39-AD
Sampling Area (cm²): 100

Lab ID: 67878
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	44.3	0.4
3	Potassium	007440-09-7	35	0.4

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 40-AD
Sampling Area (cm²): 100

Lab ID: 67879
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	< 5	< 0.05
3	Potassium	007440-09-7	< 5	< 0.05

See Final Page for Notes

Sample Identification: 41-AD
Sampling Area (cm²): 100

Lab ID: 67880
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	114	1.1
3	Potassium	007440-09-7	22.8	0.2

See Final Page for Notes

Sample Identification: 42-AD
Sampling Area (cm²): 100

Lab ID: 67881
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	63.6	0.6
3	Potassium	007440-09-7	23.8	0.2

See Final Page for Notes

Sample Identification: 43-AD
Sampling Area (cm²): 100

Lab ID: 67882
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	75.4	0.8
3	Potassium	007440-09-7	25	0.2

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: 44-AD
Sampling Area (cm²): 100

Lab ID: 67883
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	73.7	0.7
3	Potassium	007440-09-7	21.3	0.2

See Final Page for Notes

Sample Identification: 45-AD
Sampling Area (cm²): 100

Lab ID: 67884
Date Sampled: February 21, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	< 5	< 0.05
3	Potassium	007440-09-7	8.3	0.08

See Final Page for Notes

Sample Identification: 64-AD
Sampling Area (cm²): 100

Lab ID: 67885
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	< 0.01
2	Sodium	007440-23-5	46	0.5
3	Potassium	007440-09-7	14.4	0.1

See Final Page for Notes

Sample Identification: AD-Blank 1
Sampling Area (cm²): N.A.

Lab ID: 67886
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	N.A.
2	Sodium	007440-23-5	< 5	N.A.
3	Potassium	007440-09-7	< 5	N.A.

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Sample Identification: AD-Blank 2
Sampling Area (cm²): N.A.

Lab ID: 67887
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	N.A.
2	Sodium	007440-23-5	< 5	N.A.
3	Potassium	007440-09-7	< 5	N.A.

See Final Page for Notes

Sample Identification: AD-Blank 3
Sampling Area (cm²): N.A.

Lab ID: 67888
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	N.A.
2	Sodium	007440-23-5	< 5	N.A.
3	Potassium	007440-09-7	< 5	N.A.

See Final Page for Notes

Sample Identification: AD-Blank 4
Sampling Area (cm²): N.A.

Lab ID: 67889
Date Sampled: February 20, 2019
Date Analyzed: February 27, 2019

#	Analyte	CAS	Amount	Concentration
			Total (µg)	(µg/cm²)
1	Lithium	007439-93-2	< 1	N.A.
2	Sodium	007440-23-5	15.5	N.A.
3	Potassium	007440-09-7	< 5	N.A.

See Final Page for Notes

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
Tel: (416) 679-9663 Fax: (416) 679-9668 Web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave. Suite 101, Toronto, Ontario, M9W 6N6
Contact: Richard Quenneville
Project: T19-17346

Work Order No.: 2509925
Date Received: February 22, 2019
Date Analyzed: February 27, 2019

Quality Control Batch #: 1859-136

#	Analyte	CAS	Desorption Efficiency %	Uncertainty %	MRL (µg)
1	Lithium	007439-93-2	104.43	6.15	1
2	Sodium	007440-23-5	100.76	13.11	5
3	Potassium	007440-09-7	101.80	10.29	5

Notes:
1) N.A.: Information not available or not applicable.
2) < is defined as less than the indicated minimum reporting limit (MRL). The analyte is either not detected or less than the minimum reporting limit (MRL).
3) MRL (Minimum Reporting Limit): it is the lowest mass/concentration of the target analyte in a sample that can be reported with a defined reproducible level of certainty.
4) Uncertainty is expressed as a percentage at a total mass per sample. It is a result of the evaluation aimed at characterizing the range within which the true value of a test result is estimated to lie at the 95% confidence interval.
5) CAS Number is the Chemical Abstracts Service registry number corresponding to the target analyte.
6) Desorption Efficiency is defined as the percent (%) spike recovery of a target analyte from the sampling media using the described procedure.
7) Amount is the mass of target analyte in micrograms (µg) detected in the sampling media. The results have been corrected for desorption efficiency.
8) Concentration is the total amount of target analyte expressed in micrograms per square centimeter (µg/cm²). The sample area used are those supplied to CASSEN Testing Laboratories.
15) CTL has established an ISO17025 reporting policy that a maximum of 3 significant figures will be reported for test results.
16) The sample(s) were received in acceptable condition unless otherwise noted.
17) The method is meant for the measurement of alkaline dusts. It is specific for Na+, K+, and Li+ but does not differentiate between the hydroxides and their corresponding salts if both are present in the sample. If the cations are present only in the form of hydroxides, the method is specific for these basic compounds. In other circumstances, the results obtained represent the highest concentration of the hydroxides that could be extant.

Analyst:

Drew Roberts, B.Sc., Laboratory Analyst

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
tel: (416) 679-9663 fax: (416) 679-9668 web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization:	T-Harris Environmental Management Inc.		
Address:	93 Skyway Ave, Suite 101, Toronto Ontario, M9W 6N6		
Contact:	Richard Quenneville	**Work Order No.:**	2509925
Project:	T19-17346	**Date Received:**	February 22, 2019

Analysis Requested:	pH Analysis	**Date Analyzed:**	March 04, 2019
CASSEN Method:	M.7003.R0	**Number of Samples:**	38
Reference Method:	CASSEN in-house method	**Number of Blanks**	4
Equipment:	pH meter		

pH Analysis

Sample	Lab ID	Sample Name	Date Sampled (dd/mm/yy)	pH
1	67848	TH-1-AD	21/02/19	6.05
2	67849	TH-2-AD	21/02/19	6.19
3	67850	TH-4-AD	20/02/19	6.57
4	67851	TH-5-AD	20/02/19	6.31
5	67852	TH-6-AD	20/02/19	6.1
6	67853	TH-8-AD	20/02/19	5.56
7	67854	TH-9-AD	20/02/19	6.09
8	67855	TH-11-AD	20/02/19	6.25
9	67856	TH-12-AD	20/02/19	6.64
10	67857	TH-14-AD	20/02/19	6.02
11	67858	TH-15-AD	20/02/19	6.82
12	67859	TH-16-AD	20/02/19	6.88
13	67860	TH-17-AD	20/02/19	6.87
14	67861	TH-18-AD	20/02/19	6.59
15	67862	TH-19-AD	20/02/19	6.78
16	67863	TH-20-AD	20/02/19	6.21

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
tel: (416) 679-9663 fax: (416) 679-9668 web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave, Suite 101, Toronto Ontario, M9W 6N6
Contact: Richard Quenneville
Work Order No.: 2509925
Project: T19-17346
Date Received: February 22, 2019

pH Analysis

Sample	Lab ID	Sample Name	Date Sampled (dd/mm/yy)	pH
17	67864	TH-21-AD	20/02/19	6.1
18	67865	TH-22-AD	20/02/19	6.39
19	67866	TH-23-AD	20/02/19	6.72
20	67867	TH-24-AD	20/02/19	6.56
21	67868	TH-25-AD	20/02/19	6.38
22	67869	TH-27-AD	20/02/19	6.58
23	67870	TH-28-AD	21/02/19	6.44
24	67871	TH-29-AD	21/02/19	6.3
25	67872	TH-33-AD	20/02/19	6.04
26	67873	TH-34-AD	20/02/19	5.92
27	67874	TH-35-AD	20/02/19	5.89
28	67875	TH-36-AD	20/02/19	6.82
29	67876	TH-37-AD	20/02/19	6.4
30	67877	TH-38-AD	21/02/19	6.87
31	67878	TH-39-AD	20/02/19	7.02
32	67879	TH-40-AD	20/02/19	6.69
33	67880	TH-41-AD	20/02/19	6.88
34	67881	TH-42-AD	21/02/19	6.42
35	67882	TH-43-AD	21/02/19	6.35
36	67883	TH-44-AD	20/02/19	5.35

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

CASSEN Testing Laboratories

51 International Blvd., Toronto, Ontario, M9W 6H3
tel: (416) 679-9663 fax: (416) 679-9668 web: www.cassen.ca

Analytical Results

Date: March 11, 2019

Organization: T-Harris Environmental Management Inc.
Address: 93 Skyway Ave, Suite 101, Toronto Ontario, M9W 6N6
Contact: Richard Quenneville
Work Order No.: 2509925
Project: T19-17346
Date Received: February 22, 2019

pH Analysis

Sample	Lab ID	Sample Name	Date Sampled (dd/mm/yy)	pH
37	67884	TH-45-AD	21/02/19	6.33
38	67885	TH-64-AD	20/02/19	5.79
39	67886	TH-AD-Blank1	20/02/19	6.27
40	67887	TH-AD-Blank2	20/02/19	6.44
41	67888	TH-AD-Blank3	20/02/19	6.29
42	67889	TH-Ad-Blank4	20/02/19	6.05

Notes:

1. **N.A.:** Information not available or not applicable
2. The sample(s) were received in acceptable condition unless otherwise noted.

Analyst:

Drew Roberts, B.Sc., Laboratory Analyst

This ***Certificate of Analysis*** shall not be reproduced except in full, without written approval of the laboratory. These analytical results pertain only to the samples as received in the laboratory. No responsibility or liability is assumed for the manner in which the results are used.

Trow

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
London, Ontario
N5V 4T3

Attention: Mr. Demetre Bomis

This report was prepared by Trow Associates Inc. for the exclusive use of Agriculture and Agri-Food Canada and may not be reproduced in whole or in part, or used or relied upon in whole or in part by any party other than Agriculture and Agri-Food Canada for any purpose whatsoever without the express permission of Agriculture and Agri-Food Canada in writing.

Trow Associates Inc.

15 Cuddy Boulevard
London, Ontario
N5V 3Y3
Telephone: (519) 453-1480
Facsimile: (519) 453-1551

LNEN00008223A
December 2005

Table of Contents

1. Introduction 3

2. Approach to Work 4

2.1 Asbestos Survey 4
2.2 Lead Paint 5
2.3 Mercury 5
2.4 Other Designated Substances 6
2.5 PCB Survey 6

3. Results and Findings 7

3.1 Asbestos Survey 7
Friable Asbestos 7
Pipe Fittings and Pipe Insulation 7
Ceiling Tile 7
Sprayed Fireproofing/Insulation 7
Non-Friable Asbestos 7
Floor Tile 7
Plaster 7
3.2 Lead 8
3.2.1 Wipe/Drain Trap Samples 8
3.2.2 Paint Samples 8
3.3 Mercury 8
3.3.1 Wipe/Drain Trap Samples 8
3.3.2 Fluorescent Lights 9
3.4 Arsenic 9
3.5 Other Designated Substances 9
3.6 PCB Survey 9
Ballasts 10

4. Conclusions and Recommendations 11

5. General Limitations 13

Figures

Figures: Asbestos and Lead Paint Sampling Location Plans

Appendices

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 μg/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 Minimata 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/ft^2. 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/ft^2. 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/ft^2). 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/ft^2. 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/ft^2. 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 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.

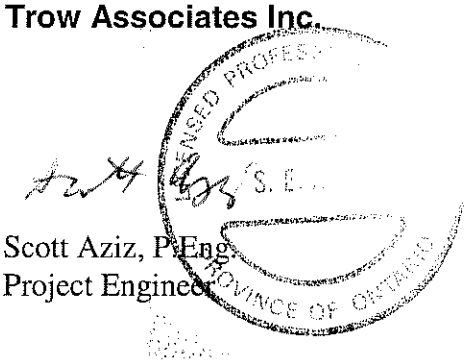
The objective of this report was to audit the environmental conditions at the Site within the context of our contract with respect to existing regulations within the applicable jurisdiction. Compliance of past and current owners with applicable local, provincial and federal government laws and regulations 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.

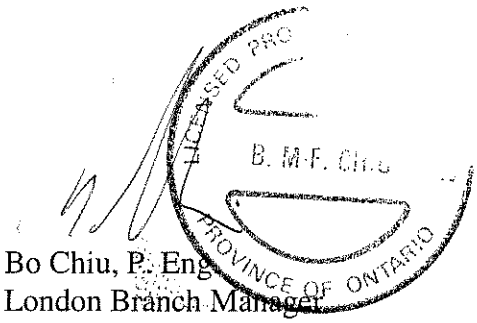
This report has been prepared in accordance with generally accepted environmental study and/or engineering practices. No other warranties, either expressed or implied, are made as to the professional services provided under the terms of our contract and included in this report.

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

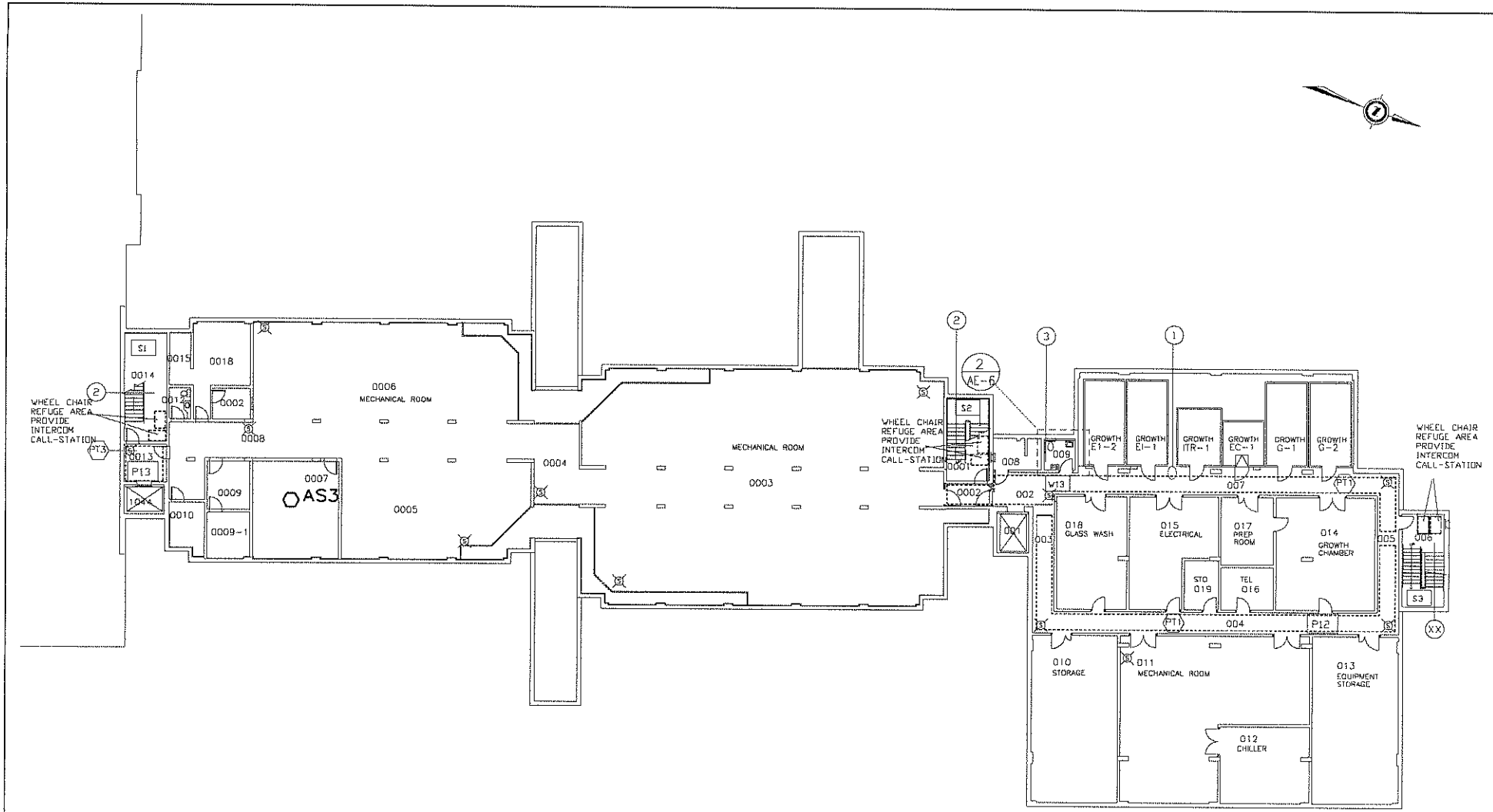


Bo Chiu, P. Eng.
London Branch Manager

Distribution:

SA/BC/LNEN00008223Arep

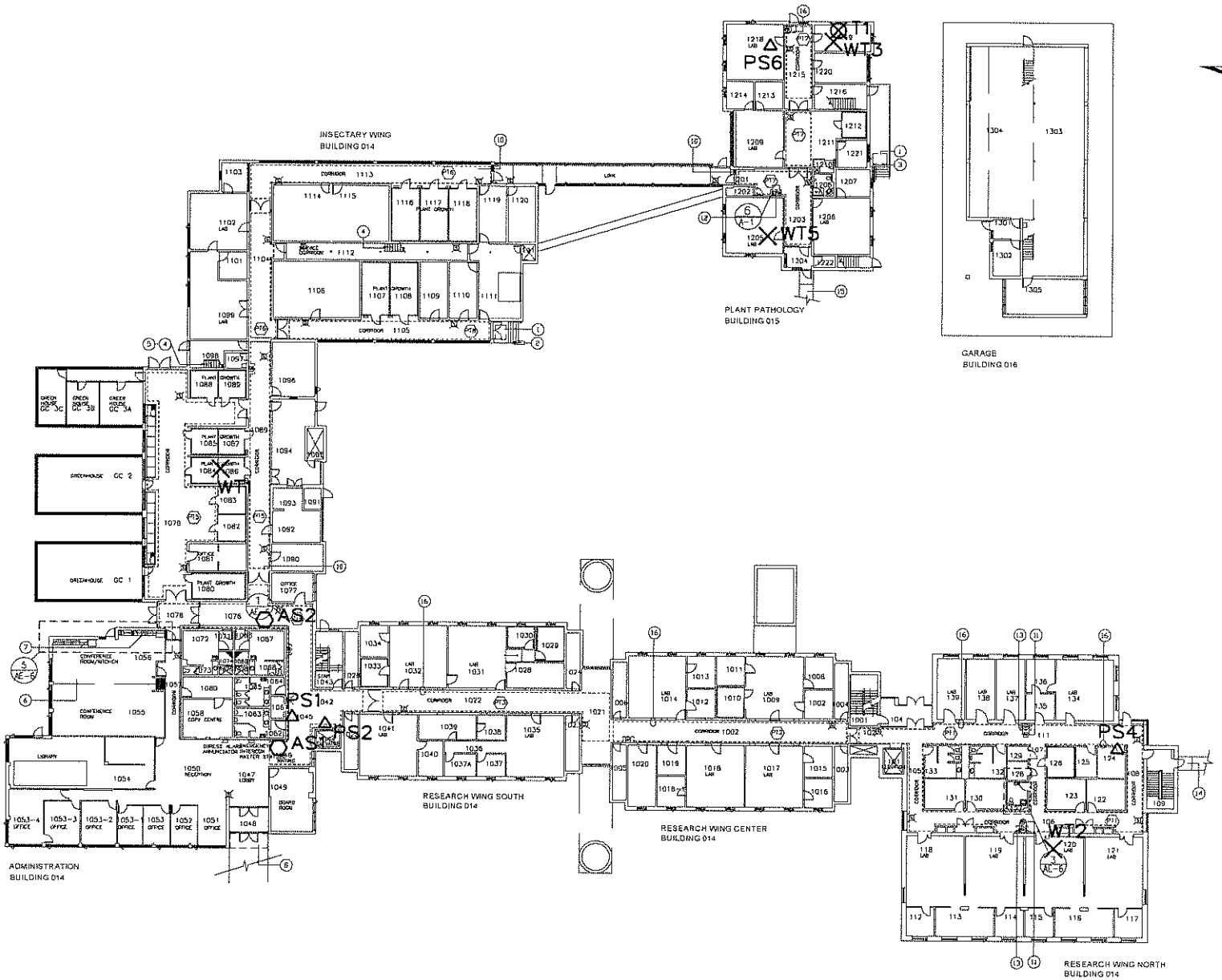
Figures 1-4: Asbestos, Lead Paint and Mercury Sampling Location Plans



LEGEND

- ⊠ WT1 Wipe Sample Location
- ⊠ T1 Drain/Trap Sample Location
- ⬡ AS1 Asbestos Sample Location (Non-Asbestos)
- △ PS1 Lead Paint Sample Location (<5000PPM Total Lead)

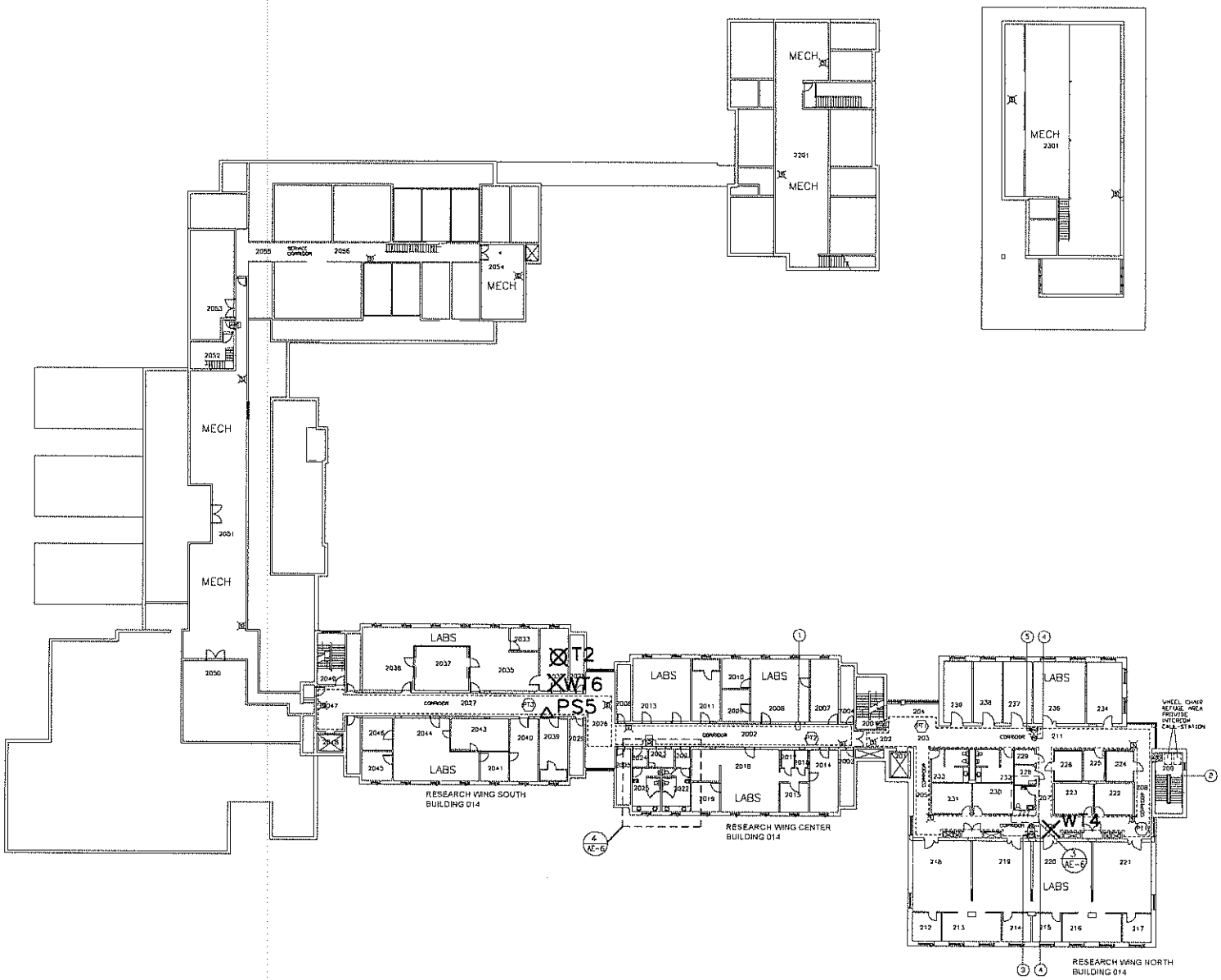
PROJECT	AAFC Harrow Facility
CLIENT	Agriculture & Agri-Food Canada
TITLE	BLDG 14 – BASEMENT – SAMPLE LOCATIONS
Trow	Trow Associates Inc. 15 Cuddy Boulevard, London, Ontario N5V 3Y3
DATE: JANUARY 2006	SCALE: NOT TO SCALE
PROJECT NO.: LNEN00008223A	DWG. 1



LEGEND

- ✕ WT1 Wipe Sample Location
- ⊠ T1 Drain/Trap Sample Location
- ○ AS1 Asbestos Sample Location (Non-Asbestos)
- △ PS1 Lead Paint Sample Location (<5000PPM Total Lead)

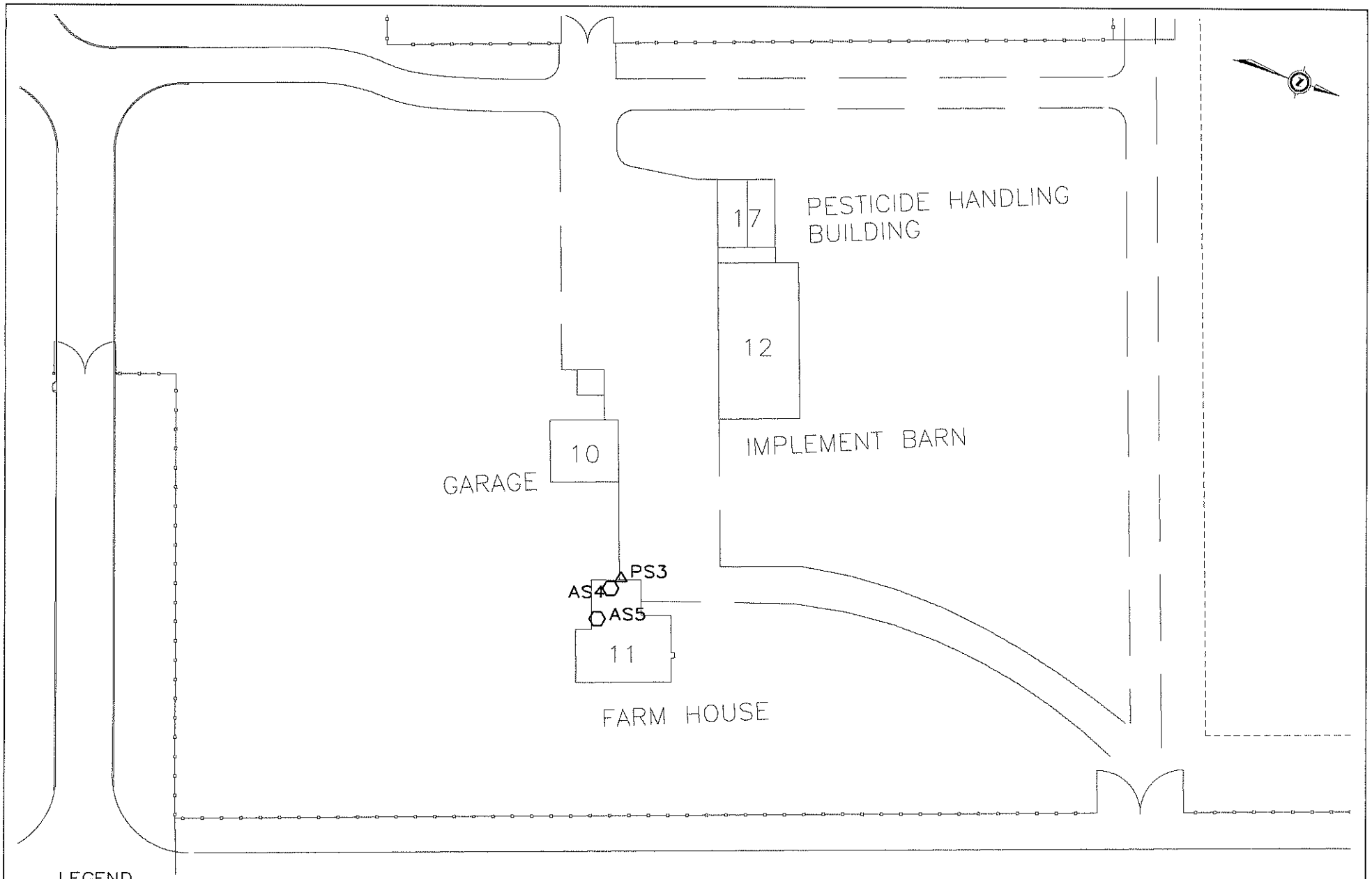
PROJECT	AAFC Harrow Facility		
CLIENT	Agriculture & Agri-Food Canada		
TITLE	BLDG 14 – 2nd FLOOR – SAMPLE LOCATIONS		
Trow	Trow Associates Inc. 15 Cuddy Boulevard, London, Ontario N5V 3Y3		
DATE: JANUARY 2006	SCALE: NOT TO SCALE	PROJECT NO.: LNEN00008223A	DWG: 2



LEGEND

- ⊠ 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	BLDG 14 – 1st FLOOR – SAMPLE LOCATIONS
Trow	Trow Associates Inc. 15 Cuddy Boulevard, London, Ontario N5V 3Y3
DATE: JANUARY 2006	SCALE: NOT TO SCALE
PROJECT NO.: LNEN00008223A	DWG: 3



LEGEND

- 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
Trow	Trow Associates Inc. 15 Cuddy Boulevard, London, Ontario N5V 3Y3
DATE: JANUARY 2006	SCALE: NOT TO SCALE | PROJECT NO.: LNEN00008223A | DWG.: 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 – 2nd Floor	Sheet Vinyl Flooring	No asbestos detected	N/A	N/A	N/A	N/A
AC-LN-AS4-2	Bldg 11 – 2nd Floor	Sheet Vinyl Flooring	No asbestos detected	N/A	N/A	N/A	N/A
AC-LN-AS4-3	Bldg 11 – 2nd 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 LNEN00008223A 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 – 2nd 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. ($\mu g/ft^2$)**	**Mercury Conc. ($\mu g/ft^2$)**	**Arsenic Conc. ($\mu g/ft^2$)**
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

T. HARRIS
ENVIRONMENTAL MANAGEMENT
since 1979

93 Skyway Avenue, Suite 101
Toronto, Ontario M9W 6N6
Tel. (416) 679-8914
Fax. (416) 679-8915
1-888-ASK-THEM

Fume Hood Exhaust Ductwork # 7 Tritium and C14 Wipes

Agriculture and Agri-Food Canada
1381 Sandford Street
London, ON

FINAL REPORT

Assessment performed: May 13, 2019
Report issued: June 6, 2019
THEM Project # T19-17346-00

Performed by:

T. HARRIS ENVIRONMENTAL MANAGEMENT INC.

Richard Quenneville, B.Sc, ROH, CIH
Senior Director Corporate Services

Zainab Mustafa, H.B.Sc., M.P.H.
Junior Occupational Hygienist

Joe D'Angelo, B.A.(Envs), AMRT, EPt
Project Coordinator

Performed for:

Mr. David Yin
Senior Associate, Buildings Engineering
Stantec Consulting Limited
400-1331 Clyde Avenue
Ottawa, ON, K2C 3G4

EXECUTIVE SUMMARY

On May 13, 2019, personnel from T. Harris Environmental Management Inc. (THEM) assessed the internal ducting of fume hood exhaust ductwork # 7 for radioisotopes using surface wipes. The assessment was performed in the Mechanical Room Penthouse of Agriculture and Agri-Food Canada located on 1381 Sandford Street in London, Ontario. The assessment was conducted at the request of Mr. David Yin, Senior Associate, Buildings Engineer for Stantec Consulting Limited. The parameters tested included radioisotope activity of tritium (H-3) and carbon-14 (C-14). Surface samples were collected inside the ductwork of exhaust fan #7, which was a location of concern for the presence of radioisotopes.

Based on the measurement results and visual inspections, the following conclusions are drawn:

- Moderate amount of visible dust was observed inside the duct for exhaust fan #7; the sampling location.

- Surface samples of radioisotopes of tritium and carbon-14 were well below the health-based surface contamination free-release criterion derived in Canadian Nuclear Safety Commission's Radionuclide Information Booklet.

- Workers are not at risk of dermal exposure to radiation from tritium and carbon-14 present in the duct of exhaust fan #7.

This executive summary is not to be used alone and the report should be reviewed in its entirety.

TABLE OF CONTENTS

EXECUTIVE SUMMARY I

1.0 BACKGROUND 1

2.0 INTRODUCTION 1

2.1 RADIOISOTOPES 1
2.1 GUIDELINE FOR RADIOISOTOPES ON SURFACES 2

3.0 METHODOLOGY 3

3.1 VISUAL ASSESSMENT 3
3.2 SURFACE SAMPLING 3

4.0 RESULTS 3

4.1 VISUAL ASSESSMENT 3
4.2 SURFACE SAMPLING 3

5.0 CONCLUSIONS AND RECOMMENDATIONS 4

6.0 LIMITATIONS 5

APPENDIX I PHOTOGRAPHS

APPENDIX II LABORATORY CERTIFICATE OF ANALYSIS

June 06, 2019

Stantec Consulting Limited
400-1331 Clyde Avenue
Ottawa, ON
K2C 3G4

Attn.: Mr. David Yin
Senior Associate, Buildings Engineer

Re: Surface Wipes for Tritium and C14 - T19-17346-00
Agriculture and Agri-Food Canada
1381 Sandford Street, London, Ontario

1.0 BACKGROUND

On May 13, 2019, personnel from T. Harris Environmental Management Inc. (THEM) conducted an assessment of the internal ducting for a centralized exhaust fan using surface wipes. The assessment was performed in the Mechanical Room Penthouse of Agriculture and Agri-Food Canada located on 1381 Sandford Street in London, Ontario. The assessment was conducted at the request of Mr. David Yin, Senior Associate, Buildings Engineer for Stantec Consulting Limited.

Surface wipe samples were collected from an existing exhaust fan system; inside the ductwork of exhaust fan #7. Based on a review of the inventory and nature of work conducted in the fume hood, wipe samples were collected for the following radioisotopes: tritium (H-3) and carbon-14 (C-14). Two (2) wipe samples and one (1) blank was collected for each radioisotope.

2.0 INTRODUCTION

2.1 Radioisotopes

Elements that have the same number of protons, however not the same number of neutrons are called isotopes of that element. When there is an imbalance between protons and neutrons of atoms, the isotope will want to transform itself into a more stable form and a different atom. To achieve stability, the atom ejects excess amounts of protons and/or neutrons to decrease its mass. This is called radioactive decay; the isotope that changes and emits radiation is called a radioisotope[1].

[1] Canadian Nuclear Safety Commission, Radioisotopes, accessed from

When an isotope disintegrates, the excess energy that is emitted is a form of ionizing radiation. In other words, the disintegration gives off radiation and this is called activity. Each disintegration is expressed or measured in a unit called the Becquerel (Bq). One Bq means there is one disintegration per second[1].

Tritium (H-3)

As per Canadian Nuclear Safety Commission's Radionuclide Information Booklet[2], tritium (H-3) is not an external radiation hazard; it carries a radiation hazard if it enters the body through dermal contact, inhalation, and ingestion. This is because once it enters the body the tritiated water (a radioactive form of water) is easily distributed uniformly across the body and can then lead to tissue exposure. Additionally, if tritiated water is absorbed through the surface of the skin, it can also lead to internal exposure. This dermal exposure is of concern for tritium.

Carbon-14 (C-14)

As per Canadian Nuclear Safety Commission's Radionuclide Information Booklet[3], carbon 14 (C-14) is not an external radiation hazard; it carries a radiation hazard if it enters the body through dermal contact, inhalation, and ingestion.

Both H-3 and C-14 isotopes undergo beta decay which means that their neutron is converted to a proton, additionally an electron is emitted from the nucleus. Thereby the atomic number increases by one unit; however, the mass only decreases slightly and is negligible[1]. Emitted energy from beta emitters can ionize atoms in the human body and damage cells.

2.1 Guideline for Radioisotopes on Surfaces

For the purpose of this assessment the health-based surface contamination free-release criterion derived in Canadian Nuclear Safety Commission's Radionuclide Information Booklet[2, 3] have been used. The criterion values take into account the type of emission, and their routes of exposure (dermal contact, inhalation, and ingestion).

http://www.nuclearsafety.gc.ca/eng/resources/radiation/introduction-to-radiation/radioisotopes.cfm, June 2019.
[2] Canadian Nuclear Safety Commission, Radionuclide Information Booklet, page 5, 2017
[3] Canadian Nuclear Safety Commission, Radionuclide Information Booklet, page 6, 2017

3.0 METHODOLOGY

3.1 Visual Assessment

Visual observation of the exhaust fan units and ducts was conducted within the Mechanical Room penthouse to observe housekeeping and potential areas for hand contamination and ingestion of substances.

3.2 Surface Sampling

Surface wipe samples were collected, as per wipe instructions from Bubble Technology Industries Inc. (BTI). The wipes are moistened with the alcohol solution provided. Surface wipe samples were collected from an existing exhaust fan system; inside the ductwork of exhaust fan #7. Based on a review of the inventory and nature of work conducted in the fume hood, wipe samples were collected for two radioisotopes; tritium (H-3) and carbon-14 (C-14).

Two (2) wipe samples and one (1) blank was collected for each radioisotope. A surface area of 100 cm^2 was wiped down using a new 10 cm x 10 cm disposable cardboard template and a new pair of nitrile gloves for each sample. Upon completion, the wipe samples were sent for radiation analysis to an ISO 9001 certified lab Bubble Technology Industries Inc. Analysis is performed in accordance with the Canadian Nuclear Safety Commission's Licence Application Guide: Nuclear Substances and Radiation Devices, REGDOC-1.6.1, version 2, April 2017, Appendix AA: Regulatory Expectations for Leak Testing of Sealed Sources.

Laboratory Certificate of Analysis are in Appendix II.

4.0 RESULTS

4.1 Visual Assessment

Visual observation of the inside the duct of exhaust fan #7 within the Mechanical Room penthouse indicated that moderate amount of visible dust was present at the sampling location. Photographs of select fume hood is present in Appendix I.

4.2 Surface Sampling

Results for radioisotopes surface samples are presented in **Table I.** The results are compared to the health-based surface contamination free-release criterion derived in Canadian Nuclear Safety Commission's Radionuclide Information Booklet[2, 3].

TABLE I
Radioisotopes Surface Sample
Agriculture and Agri-Food Canada
March 13, 2019

Sample Number	Radioisotope	Surface Activity (Bq/cm^2)	Surface Criterion / Guideline (Bq/cm^2)	Percent of Surface Guideline detected (%)
1	Tritium	0.0044	100	0.0044
	Carbon-14	0.0034	1	0.3400
2	Tritium	0.0140	100	0.0140
	Carbon-14	0.0077	1	0.7700

Values in **red** indicate dermal over exposure to substance is possible for unprotected skin based on health guidelines.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the measurement results and visual inspections, the following conclusions are drawn:

- Moderate amount of visible dust was observed inside the duct for exhaust fan #7; the sampling location.

- Surface samples of radioisotopes of tritium and carbon-14 were well below the health-based surface contamination free-release criterion derived in Canadian Nuclear Safety Commission's Radionuclide Information Booklet.

- Workers are not likely to be at risk of dermal exposure to radiation from tritium and carbon-14 present in the duct of exhaust fan #7.

6.0 LIMITATIONS

In this statement of limitations, the "Client" refers to the persons or entities to whom this report is addressed. "THEM" refers to T. Harris Environmental Management Inc. The "Contract" refers to any general, or project-specific written agreement, including project-specific scope of work documents, executed between THEM and the Client pertaining to the subject matter of this report.

This report is subject to the limitations set out below and any other limitations set out in the body of this report or in the Contract between THEM and the Client.

The investigation and assessment described in this report were conducted in accordance with the Contract agreed upon by the Client in a manner consistent with a reasonable level of care and skill normally exercised by members of the occupational hygiene consulting profession currently practising under similar conditions in the Province of Ontario and observing the code of ethics of the Canadian Registration Board of Occupational Hygienists (CRBOH) and the American Board of Industrial Hygiene (ABIH).

In preparing this report, THEM has relied on information provided by others, including without limitation, information concerning the history and operation of the site, and test results and analyses of other consultants, independent laboratories, or testing services. Except as expressly stated in this report, THEM have not made any independent verification of such information. Findings cannot be extended to portions of the site, which were unavailable for direct observation.

The assessment in this report has been made in the context of regulations which were in force and effect at the time of the assessment and which are specified in this report. The assessment did not take into account any regulations, which were not in effect at the date of the assessments, or any guideline or standard not specified in this report. Regulatory standards do not exist for all materials of a potentially hazardous nature.

The collection of any samples at the site (including the location of samples and the analytical parameters applied to the samples) was undertaken in accordance with the Contract agreed upon by the Client, based upon the information provided to THEM by the Client concerning existing site conditions. Conditions between sample locations (if any) may differ from those indicated in this report.

This report is intended solely for the use or uses specified in this report and/or the Contract. Use of this report for purposes other than those set out in this report and/or the Contract will be at the sole risk of the Client.

Copying of this report except as may be reasonably required for internal use by the Client and any distribution of this report to persons other than the Client in whole or in part, is not permitted without the express written permission of THEM.

This report is for the sole use of the Client. THEM makes no representation or warranty, either expressed or implied, to any third party with regard to this report and the work referred to in this report and expressly disclaims any, and accepts no duty of care to any third party or any responsibility or liability whatsoever to any third party for any loss, expenses, damages (direct, consequential or contingent), fines, penalties, or other harm that may be suffered or incurred by any third party as a result of any use of, any reliance placed upon, or any decision made or actions taken based upon this report or the work referred to herein.

In no event shall THEM be liable for any indirect, incidental, special or consequential damages, or damages from loss of profits, revenue, or use, whether in an action in tort or contract, even if THEM has been advised of the possibility of such damages. If new information concerning the subject matter of this report arises, THEM should be contacted to re-evaluate the conclusions of this report and to provide amendments as required.

If you have any questions or require further information, please contact our office.

APPENDIX I
PHOTOGRAPHS

Photograph 1: View of the interior of the duct for exhaust fan #7.

APPENDIX II
LABORATORY CERTIFICATE OF ANALYSIS

BUBBLE Technology Industries

SWIPE ANALYSIS REPORT (H-3/C-14)

Measurer:

Bubble Technology Industries Inc.
P.O. Box 100, 31278 Highway 17
Chalk River, Ontario
K0J 1J0

Phone No.: (613) 589-2456
Fax No.: (613) 589-2763
E-Mail: labservices@bubbletech.ca
Website: www.bubbletech.ca

Sampler:

Company/Institution: T. Harris Environmental Management Inc.
Phone No.: (416) 679-8914 x.245 / (519) 495-1084
Fax No.: Not Provided
Certificate No.: 2019-0001

Address: 931 Commissioners Rd. East
Suite 100
London, ON N5Z 3H9
Contact: Richard Quenneville / Joe D'Angelo
E-Mail: rquenneville@tharris.ca / jdangelo@tharris.ca
Sampling Date: 2019-May-13

		H-3		C-14	
Sample Number	**Sample Identification**	**Activity (Bq/cm^2)***	**Uncertainty (Bq/cm^2)**	**Activity (Bq/cm^2)****	**Uncertainty (Bq/cm^2)**
1	Project No. T19-17346 - Fume Hood #7 Exhaust Duct @ Access Hatch in the Penthouse Mechanical Room (FH7-01)	4.4E-03	8.8E-04	3.4E-03	5.5E-04
2	Project No. T19-17346 - Fume Hood #7 Exhaust Duct @ Access Hatch in the Penthouse Mechanical Room (FH7-02)	1.4E-02	1.6E-03	7.7E-03	7.5E-04
3	Project No. T19-17346 - Blank (FH7-Blank)	< MDA*	-	< MDA**	-

The instrument used to count for Beta Activity is a Wallac 1409/11 LSC S/N 4110007
Analysis performed on samples as received by Bubble Technology Industries using procedures BTI-RS-E-3-0032, BTI-RS-E-5-0014 and BTI-RS-E-5-0027.
The activity of H-3 was calculated under the assumption that all net counts are due to H-3.
The activity of C-14 was calculated under the assumption that all net counts are due to C-14.
The reported uncertainties represent the numerical value of the expanded uncertainties. The uncertainty is based on a rectangular distribution using a coverage factor of k = 2, which defines an interval estimated to have a level of confidence of 95%.
*Resultant activity assumes that the samples analyzed correspond to 100 cm^2 sample area.

*H-3 MDA (Bq/cm^2) = 8.1E-04
**C-14 MDA (Bq/cm^2) = 7.3E-04

Measured and reported by: S. Dayment-Reed
Radiation Services Head — *Signature*

Measurement Date: 2019-May-22 (yyyy-mmm-dd)

Reviewed by: R. Noulty
Manager, Radiation Services — *Signature*

BTI's quality management system is ISO 9001 certified by BSI under certificate number FM 502976.

Analysis report shall not be reproduced except in full, without written approval of Bubble Technology Industries.