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Number R.051251.00B		2015-03-20

Project Title TORONTO, ONTARIO
25/55 ST. CLAIR AVE. EAST
BUILDING WORKS

Project Number R.051251.001B

Project Date 2015-03-20

PWGSC Ontario
Region Project
Building Works
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PROFESSIONAL SEALS PAGE

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Architect



Mechanical Engineer



Electrical Engineer



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Appendices

A	"25-55 St.Clair Ave. Elevator Shaft Evaluation FINAL" dated November 13, 2013, prepared by Read, Jones, Christoffersen Consulting Engineers	20
B	"Designated Substances and Hazardous Materials Assessment Specific to Stairway Fire Separation Project, Stairways # 1-5 25/55 St. Clair Ave East, Toronto Ontario" prepared by Safetech Environmental Ltd.	74
C	"Reassessment of Asbestos Containing Building Materials Survey, 25/55 St.Clair Avenue East" dated February 14, 2011, prepared by Safetech Environmental Ltd.	56
D	"Hazardous Building Materials Reassessment, Floors 2-9 - Mechanical Areas, Pipe Shafts, Elevator Shafts, Elevator Penthouse, 25/55 St. Clair Avenue East, Toronto, Ontario" dated August 21, 2012, and prepared by Safetech Environment Ltd.	57
E	"Application of the National Building and Fire Code of Canada for: 25/55 St. Clair Ave. East, Elevator Modernization & Elevator Shafts Fire-Resistance Remediation Work" dated May 6, 2013, and prepared by LRI Fire Protection & Building Code Consulting Engineers	15

PART 1 - GENERAL

<u>1.1 PRECEDENCE</u>	.1	For Federal Government projects, Division 01 Sections take precedence over technical specification sections in other Divisions of this Project Manual.
<u>1.2 WORK COVERED BY CONTRACT DOCUMENTS</u>	.1	Work of this Contract comprises general renovation of elevator shafts fire rating work, located at 25/55 St. Clair Ave. East, Toronto, Ontario.
	.2	For schedule and quantification of concrete and masonry repair work, and installation of fireproofing, and firestopping sealant refer to "25/55 St. Clair Avenue East, Toronto, ON - Elevator Shaft Evaluation FINAL" report, dated November 13, 2013, prepared by Read Jones Christoffersen Consulting Engineers, and "Additional Scope Stair A" document dated November 7, 2013. Both documents are attached at the end of the specifications.
	.2	Engage the services of a building elevator contractor to gain access to the hoistways and provide a temporary elevator operator.
<u>1.3 CONTRACT METHOD</u>	.1	Construct Work under lump sum contract.
	.2	Relations and responsibilities between Contractor and subcontractors, and suppliers and subcontractors assigned by Departmental Representative are as defined in Conditions of Contract.
<u>1.4 COST BREAKDOWN</u>	.1	Within 5 days of notification of acceptance of bid furnish a cost breakdown by Section aggregating contract amount.
	.2	Within 48 hours of acceptance of bid submit a list of subcontractors.
<u>1.5 WORK SEQUENCE</u>	.1	Construct Work in stages to accommodate Departmental Representative's continued use of premises during construction.

- .2 Coordinate Progress Schedule and coordinate with Departmental Representative occupancy during construction.
- .3 Construct Work in stages to provide for continuous public usage. Do not close off public usage of facilities until use of one stage of Work will provide alternate usage.
- .4 For the sequence of work refer to Section 14 05 00 and Section 01 32 16.
- .5 Maintain fire access/control.

1.6 CONTRACTOR'S USE
OF PREMISES

- .1 Contractor shall limit use of premises for Work, for storage, and for access, to allow;
 - .1 Occupancy.
 - .2 Work by other contractors.
 - .3 Public usage.
- .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.
- .4 Obtain and pay for security services required by the Contractor.

1.7 OCCUPANCY

- .1 Premises will be occupied during entire construction period for execution of normal operations.
- .2 Cooperate with Departmental Representative in scheduling operations to minimize conflict and to facilitate usage.

1.8 ALTERATIONS TO
EXISTING BUILDING

- .1 Remove and recycle, compost, anaerobic digest, for reuse or dispose of demolition materials.

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PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

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END OF SECTION

PART 1 - GENERAL

1.1 ACCESS AND
EGRESS

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

1.2 USE OF SITE AND
FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Departmental Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.
- .5 Use only elevators, 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.
- .6 Closures: protect work temporarily until permanent enclosures are completed.

1.3 PARKING

- .1 Parking is not available on site.
- .2 Should the Contractor require parking after normal working hours (07:00 - 18:00) the Contractor will be required to pay parking fees.

1.4 ALTERATIONS,
ADDITIONS OR

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

REPAIRS TO EXISTING
BUILDING

Representative to facilitate execution of work.

- .2 Execute work so as not more than two elevators are down at the same time.

1.5 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, 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 Provide for personnel pedestrian and vehicular traffic.

- .4 Construct barriers in accordance with Section 01 56 00.

1.6 SPECIAL
REQUIREMENTS

- .1 Regular work hours are Monday to Friday 07:00 hours to 18:00 hours.

- .2 Work will only be permitted during weekends and statutory holidays with the permission of the Departmental Representative. A minimum of 3 days advance notice will be required to obtain the required permission. In case of emergencies or other special circumstances, this advance notice may be waived by the Departmental Representative.

- .3 Carry out painting work in occupied areas Monday to Friday from 18:00 to 07:00 hours only, and on Saturdays, Sundays, and statutory holidays.

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

- .5 Submit schedule in accordance with Section 01 32 16.

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

- .7 Keep within limits of work and avenues of ingress and

egress.

- .8 Deliver materials outside of peak traffic hours 17:00 to 07:00 hours and 13:00 to 15:00 unless otherwise approved by Departmental Representative.
- .9 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 x-ray, ground penetrating radar or other appropriate method. Submit findings to Departmental Representative prior to cutting or drilling.

1.7 SECURITY

- .1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.
- .2 Security clearances:
 - .1 Personnel employed on this project will be subject to security check. Obtain clearance, as instructed, for each individual who will require to enter premises.
 - .2 Obtain requisite clearance, as instructed, for each individual required to enter premises.
 - .3 Personnel will be checked daily at start of work shift and provided with pass which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.
- .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 14 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.

1.8 BUILDING <u>SMOKING ENVIRONMENT</u>	.1	Comply with smoking restrictions. Smoking is not permitted.
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PART 2 - PRODUCTS

<u>2.1 NOT USED</u>	.1	Not Used.
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PART 3 - EXECUTION

<u>3.1 NOT USED</u>	.1	Not Used.
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END OF SECTION

PART 1 - GENERAL

1.1 CASH ALLOWANCES

- .1 Include in Contract Amount, cash allowances as follows:
 - .1 \$120,000.00 for testing, inspections and unforeseen site conditions.
 - .2 \$112,500.00 to engage the services of the building elevator modernization contractor to gain access to the hoistways and provide a temporary elevator operator.
- .2 Cash allowances, unless otherwise specified, cover net cost to Contractor, subcontractor of services, products, construction machinery and equipment, freight, handling, unloading, storage, installation and other authorized expenses incurred in performing Work.
- .3 Contract Amount, and not cash allowance, includes Contractor's overhead and profit in connection with such cash allowance.
- .4 Contract Amount will be adjusted by written order to provide for an excess or deficit to each cash allowance.
- .5 Where costs under a cash allowance exceed amount of allowance, Contractor will be compensated for any excess incurred and substantiated plus an allowance for overhead and profit as set out in Contract Documents.
- .6 Progress payments on accounts of work authorized under cash allowances shall be included in Departmental Representative's monthly certificate for payment.
- .7 Schedule shall be prepared jointly by Departmental Representative and Contractor to show when items called for under cash allowances must be authorized by Departmental Representative for ordering purposes so that progress of Work will not be delayed.
- .8 Materials and work by Building Service Providers.
 - .1 Programming: by Chubb Edwards.
 - .2 Maintenance of fire alarm system: by Vipond.
 - .3 Connections for CCTV: by TYCO.
 - .4 Mechanical modifications.
 - .5 Electrical modifications.
 - .6 Safety and Security modifications.

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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 APPOINTMENT AND
PAYMENT

- .1 Departmental Representative will appoint and pay for services of testing laboratory except follows:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for Contractor's convenience.
 - .3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
 - .4 Mill tests and certificates of compliance.
 - .5 Tests specified to be carried out by Contractor under supervision of Departmental Representative.
- .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.

1.2 CONTRACTOR'S
RESPONSIBILITIES

- .1 Provide labour, equipment and facilities to:
 - .1 Provide access to Work for inspection and testing.
 - .2 Facilitate inspections and tests.
 - .3 Make good Work disturbed by inspection and test.
 - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .2 Notify Departmental Representative 48 hours minimum sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 11 00 - Summary of Work.
- .2 Section 01 91 13 - General Commissioning (CX) Requirements.

1.2 DESCRIPTION

- .1 Coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities, and construction Work, with progress of Work of other contractors, under instructions of Departmental Representative.

1.3 PROJECT MEETINGS

- .1 Schedule and administer weekly project meetings throughout progress of Work as determined by Departmental Representative.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting four days in advance of meeting date to Departmental Representative.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Record minutes. Include significant proceedings and decisions. Identify action by parties.
- .7 Reproduce and distribute copies of minutes within three days after each meeting and transmit to meeting participants, affected parties not in attendance, Departmental Representative.

1.4 CONSTRUCTION ORGANIZATION AND START-UP

- .1 Within 10 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
 - .2 Senior representatives of the Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
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- .3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 Agenda to include following:
 - .1 Appointment of official representative of participants in Work.
 - .2 Schedule of Work, progress scheduling in accordance with Section 01 32 16.
 - .3 Schedule of submission of shop drawings, samples, colour chips in accordance with Section 01 33 00.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 51 00.
 - .5 Delivery schedule of specified equipment in accordance with Section 01 32 16.
 - .6 Site security in accordance with Section 01 52 00.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements (GC).
 - .8 Departmental Representative provided Products.
 - .9 Record drawings in accordance with Section 01 78 00.
 - .10 Maintenance in accordance with Section 01 78 00.
 - .11 Commissioning in accordance with Section 01 91 13.
 - .12 Take-over procedures, acceptance, and warranties in accordance with Section 01 77 00 and 01 78 00.
 - .13 Monthly progress claims, administrative procedures, photographs, and holdbacks (GC).
 - .14 Appointment of inspection and testing agencies or firms in accordance with Section 01 45 00.
 - .15 Insurances and transcript of policies (GC).
- .6 Comply with Departmental Representative's allocation of mobilization areas of site; for field offices and sheds, for access, traffic, and parking facilities.
- .7 During construction coordinate use of site and facilities through Departmental Representative's procedures for intra-project communications: Submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.
- .8 Comply with instructions of Departmental Representative for use of temporary utilities and construction facilities.
- .9 Coordinate field engineering and layout work with Departmental Representative.

1.5 ON-SITE
DOCUMENTS

- .1 Maintain at job site, one copy each of the following:
 - .1 Contract drawings.
 - .2 Specifications.
 - .3 Amendments and addenda.
 - .4 Reviewed shop drawings.
 - .5 Change orders.
 - .6 Other modifications to Contract.
 - .7 Field test reports.
 - .8 Copy of approved Work schedule.
 - .9 Manufacturers' installation and application instructions.
 - .10 Labour conditions and wage schedules.
 - .11 Material Safety Data Sheets.
 - .12 Labour and Material Bonds.
 - .13 All applicable Municipal Permits.

1.6 SCHEDULES

- .1 Submit preliminary construction progress schedule in accordance with Section 01 32 16 and Commissioning Schedule in accordance with Section 01 91 13 to Departmental Representative coordinated with Departmental Representative's project schedule.
- .2 After review, revise and resubmit schedule to comply with revised project schedule.
- .3 During progress of Work revise and resubmit as directed by Departmental Representative.

1.7 CONSTRUCTION
PROGRESS MEETINGS

- .1 During course of Work and 2 weeks prior to project completion, schedule progress meetings bi-weekly.
- .2 Schedule separate commissioning meetings in accordance with Section 01 91 13.
- .3 Contractor, major subcontractors involved in Work and Departmental Representative are to be in attendance.
- .4 Notify parties minimum 5 days prior to meetings.
- .5 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.
- .6 Agenda to include following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.

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- .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 effect on construction schedule and on completion date.
- .12 Other business.

1.8 SUBMITTALS

- .1 Make submittal to Departmental Representative for review.
- .2 Submit preliminary shop drawings, product data and samples in accordance with Section 01 33 00 and 01 91 13 for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space, and for relation to Work of other contracts. After review, revise and resubmit for transmittal to Departmental Representative.
- .3 Submit requests for payment for review, and for transmittal to Departmental Representative.
- .4 Submit requests for interpretation of Contract Documents, and obtain instructions through Departmental Representative.
- .5 Process substitutions through Departmental Representative.
- .6 Process change orders through Departmental Representative.
- .7 Deliver closeout submittals for review and preliminary inspections, for transmittal to Departmental Representative.

1.9 COORDINATION DRAWINGS

- .1 Provide information required by Departmental Representative for preparation of coordination drawings.
- .2 Review and approve revised drawings for submittal to Departmental Representative.

1.10 CLOSEOUT
PROCEDURES

- .1 Notify Departmental Representative when Work is considered ready for Substantial Performance.
- .2 Accompany Departmental Representative on preliminary inspection to determine items listed for completion or correction.
- .3 Comply with Departmental Representative's instructions for correction of items of Work listed in executed certificate of Substantial Performance and for access to occupied areas.
- .4 Notify Departmental Representative of instructions for completion of items of Work determined in Departmental Representative's final inspection.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 ADMINISTRATIVE

- .1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting 4 days in advance of meeting date to Departmental Representative.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7 Reproduce and distribute copies of minutes within three days after meetings and transmit to Departmental Representative, meeting participants and affected parties not in attendance.
- .8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRE-CONSTRUCTION MEETING

- .1 Within 10 days after award of Contract, request meeting of parties in contract to discuss and resolve administrative procedures and to discuss 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: in accordance with Section 01 32 16.
 - .3 Schedule of submission of shop drawings, samples, mock-ups, colour chips. Submit submittals in accordance with Section 01 33 00.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00.
 - .6 Site security in accordance with Section 01 56 00.
 - .7 Health and safety in accordance with Section 01 35 29.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .8 Record drawings and specifications in accordance with Section 01 33 00.
 - .9 Maintenance manuals in accordance with Section 01 78 00.
 - .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00.
 - .11 Monthly progress claims, administrative procedures, photographs, hold backs.
 - .12 Appointment of inspection and testing agencies or firms.
 - .13 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

- .1 During course of Work and 2 weeks prior to project completion, schedule progress meetings every two weeks.
- .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 3 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 effect on construction schedule and on completion date.
- .12 Other business.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 DEFINITIONS

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

1.2 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Certificate of Substantial Performance and Certificate of Completion as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Submit to Departmental Representative within 10 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

1.4 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 working days.
- .3 Revise impractical schedule and resubmit within 5 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.5 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.
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- .3 Permits.
- .4 Mobilization.
- .5 Structural Steel.
- .6 Interior Architecture (Walls, Floors and Ceiling).
- .7 Electrical.
- .8 Controls.
- .9 Testing and Commissioning.
- .10 Supplied equipment, long delivery items.

1.6 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.

1.7 PROJECT
MEETINGS

- .1 Discuss Project Schedule at regular site meetings specified in Section 01 31 19, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .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 and AutoCAD files. Forward pdf and AutoCAD files on CD or USB drive.

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 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario of Canada.
- .3 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 co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow 10 working days for Departmental Representative's review of each submission.
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Amount. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 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.
- .7 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.
- .8 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.
- .9 After Departmental Representative's review, distribute copies.
- .10 Submit three hard copies and one electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .11 Submit three hard copies and 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.
- .12 Submit three hard copies and 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.
- .13 Submit three hard copies and 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.

- .14 Submit three hard copies and 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.

- .15 Submit three hard copies and one electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

- .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

- .17 Submit three hard copies and one electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

- .18 Delete information not applicable to project.

- .19 Supplement standard information to provide details applicable to project.

- .20 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.

- .21 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that PWGSC 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 business address.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Amount. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 MOCK-UPS

- .1 Erect mock-ups in accordance with Section 01 45 00.

1.5 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic and hard copy of colour digital photography in jpg format, standard resolution monthly with progress statement and as directed by Departmental Representative.
- .2 Project identification: name and number of project and date of exposure indicated.

- .3 Number of viewpoints:
 - .1 Viewpoints and their location as determined by Departmental Representative.
- .4 Frequency of photographic documentation: weekly and as directed by Departmental Representative.

1.6 CERTIFICATES
AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Safety and Insurance Board Experience Report.

1.7 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.
- .4 Submit acceptable certificate stating that suspended ceiling systems provide adequate support for electrical fixtures, as required by current bulletin of Electrical Inspection Department of Ontario Hydro.

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 REFERENCES

- .1 Canadian Standards Association (CSA): Canada
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .2 National Building Code 2010 (NBC):
 - .1 NBC 2010, Division B, Part 8 Safety Measures at Construction and Demolition Sites.
- .3 National Fire Code 2010 (NFC):
 - .1 NFC 2010, Division B, Part 5 Hazardous Processes and Operations, subsection 5.6.1.3 Fire Safety Plan.
- .4 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.

1.2 SUBMITTALS

- .1 Make submittals 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 operations.
 - .3 Measures and controls to be implemented to address identified safety hazards and risks.
 - .4 Provide a Fire Safety Plan, specific to the work location, in accordance with NBC, Division B, Article 8.1.1.3 prior to commencement of work. The plan shall be coordinated with, and integrated into, the existing Building Emergency Procedures and Evacuation Plan in place at the site. Departmental Representative will provide Building 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.
 - .5 Contractor's and Sub-contractors' Safety Communication Plan.

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.6 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with existing Facility Emergency Response requirements and procedures provided by Departmental Representative.

.3 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 3 days after receipt of comments from Departmental Representative.

.4 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.

.5 Submit names of personnel and alternates responsible for site safety and health.

.6 Submit records of Contractor's Health and Safety meetings when requested.

.7 Submit 3 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.

.8 Submit copies of orders, directions or reports issued by health and safety inspectors of the authorities having jurisdiction.

.9 Submit copies of incident and accident reports.

.10 Submit Material Safety Data Sheets (MSDS).

.11 Submit Workplace Safety and Insurance Board (WSIB)-Experience Rating Report.

1.3 FILING OF NOTICE

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

1.4 WORK PERMIT

.1 Obtain building permits related to project prior to commencement of Work.

.2 Obtain Hot Work Permit from Building Manager.

1.5 SAFETY
ASSESSMENT

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

1.6 MEETINGS

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

1.7 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.

1.8 PROJECT/SITE
CONDITIONS

- .1 Work at site will involve contact with:
 - .1 Silica in concrete, concrete block concrete brick, stucco.
 - .2 Mercury in switches, fluorescent light tubes, thermostats.
 - .3 Asbestos in pipe covering, vinyl composition tiles.
 - .4 Lead in paint.
 - .5 PCBs in ballasts.
- .2 Confined spaces in elevator shafts.

1.9 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.

<u>1.10 COMPLIANCE REQUIREMENTS</u>	.1	Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990 Chapter 0.1, as amended.
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<u>1.11 RESPONSIBILITY</u>	.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, or as directed by the Departmental Representative, the Contractor shall be designated "Constructor", as defined by Occupational Health and Safety Act for the Province of Ontario.

<u>1.12 UNFORSEEN HAZARDS</u>	.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.

<u>1.13 HEALTH AND SAFETY CO-ORDINATOR</u>	.1	Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must: <ul style="list-style-type: none"> .1 Have site-related working experience specific to activities associated with abatement of lead and asbestos containing materials. .2 Have working knowledge of occupational safety and health regulations. .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work. .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan. .5 Be on site during execution of Work and report directly to and be under direction of site supervisor.
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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 Emergency Response Plan.
 - .10 Site Specific Safety Plan.
 - .11 Valid certificate of first aider on duty.
 - .12 WSIB "In Case of Injury At Work" poster.
 - .13 Location of toilet and cleanup facilities.

1.15 CORRECTION OF
NON-COMPLIANCE

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

1.16 BLASTING

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

1.17 POWDER
ACTUATED DEVICES

- .1 Use of powder actuated devices is not permitted.

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 Health and Safety Coordinator and Competent Supervisor to stop or start Work when, at Health and Safety Coordinator's or 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

- | | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

- | | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .1 | Not used. |
|---------------------|----|-----------|

END OF SECTION

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 01 35 29 - Health and Safety Requirements; Fire safety plan.

1.2 GENERAL

- .1 This section specifies general requirements and procedures for fire safety. Additional requirements may be specified in individual sections elsewhere in specifications.

1.3 REPORTING FIRES

- .1 The Departmental Representative will co-ordinate arrangements for the Contractor to be briefed at the pre-construction meeting concerning Building's fire safety protocol.
- .2 Building Manager will supply a copy of "Fire Safety Emergency Evacuation Plan" in effect for this building. Contractor shall comply with outlined fire safety requirements.
- .3 Know location of nearest fire alarm box and telephone, including emergency phone number.
- .4 Report immediately all fire incidents to Fire Department as follows:
 - .1 activate nearest fire alarm box; or
 - .2 telephone.
- .5 Person activating fire alarm box will remain at box to direct Fire Department to scene of fire.
- .6 When reporting fire by telephone, give location of fire, name or number of building and be prepared to verify the location.

1.4 FIRE WATCH

- .1 Appoint a Fire Watch at locations where welding and soldering, torching or roofing is to take place.
- .2 A dedicated Fire Watch is not required. A competent person from the workforce on site may be assigned as Fire Watch for duration of work.

- .3 Assign a person who is knowledgeable in the correct use of fire extinguishers on the project.
- .4 Have work inspected by the Fire Watch up to 1.0 hours after work stoppage for each work period.

1.5 INTERIOR AND
EXTERIOR FIRE
PROTECTION AND
ALARM SYSTEMS

- .1 Fire protection and alarm system will not be:
 - .1 obstructed
 - .2 shut-off
 - .3 left inactive at end of working day or shift.
- .2 Fire hydrants, standpipes and hose systems will not be used for other than fire-fighting purposes unless authorized by Departmental Representative.
- .3 Provide and maintain free access to fire extinguishing equipment. Maintain exit facilities. Keep means of egress free from materials, equipment and obstructing.

1.6 FIRE
EXTINGUISHERS

- .1 Supply fire extinguishers, as necessary to protect work in progress and contractor's physical plant on site.

1.7 BLOCKAGE OF
ROADWAYS

- .1 Advise Departmental Representative of any work that would impede fire apparatus response. This includes violation of minimum required overhead clearance.

1.8 SMOKING
PRECAUTIONS

- .1 Smoking is not permitted within areas of work or site storage.

1.9 RUBBISH AND
WASTE MATERIALS

- .1 Rubbish and waste materials are to be kept to minimum.
- .2 Burning of rubbish is prohibited.
- .3 Remove all rubbish from work site at end of work day or shift or as directed.
- .4 Storage:
 - .1 Store oily waste in approved receptacles to ensure maximum cleanliness and safety.
 - .2 Deposit greasy or oily rags and materials subject to spontaneous combustion in approved receptacles and remove from site daily or at the end of each shift.

1.10 FLAMMABLE AND
COMBUSTIBLE LIQUIDS

- .1 Handling, storage and use of flammable and combustible liquids are to be governed by the current National Fire Code of Canada.
- .2 Flammable and combustible liquids such as gasoline, kerosene and naphtha will be kept for ready use in quantities not exceeding 45 litres provided they are stored in approved safety cans bearing Underwriters' Laboratory of Canada or Factory Mutual seal of approval. Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires permission of local Building Manager.
- .3 Transfer of flammable and combustible liquids is prohibited within buildings or jetties.
- .4 Transfer of flammable and combustible liquids will not be carried out in vicinity of open flames or any type of heat-producing devices.
- .5 Flammable liquids having a flash point below 38 C such as naphtha or gasoline will not be used as solvents or cleaning agents.
- .6 Flammable and combustible waste liquids, for disposal, will be stored in approved containers located in a safe ventilated area. Quantities are to be kept to a minimum and Fire Department is to be notified when disposal is required.

1.11 HAZARDOUS
SUBSTANCES

- .1 Work entailing use of toxic or hazardous materials, chemicals and/or explosives, or otherwise creating hazard to life, safety or health, will be in accordance with National Fire Code of Canada.
- .2 Obtain from Building Manager a "Hot Work" permit for work involving welding, burning or use of blow torches and salamanders, in building or facility.
- .3 When Work is carried out in dangerous or hazardous areas involving use of heat, provide fire watchers equipped with sufficient fire extinguishers. Determination of dangerous or hazardous areas along with level of protection necessary for Fire Watch is at discretion of the Building Manager. Contractors are responsible for providing fire watch service for work on a scale established and in conjunction with Building Manager at pre-construction meeting.

1.12 WELDING,
BURNING AND
CUTTING

- .4 Where flammable liquids, such as lacquers or urethanes are to be used, proper ventilation will be assured and all sources of ignition are to be eliminated. Building Manager is to be informed prior to and at cessation of such work.
- .1 Contractor performing work of this section must notify Departmental Representative in advance of commencing work.
- .2 Use non-combustible shields for electric and gas welding or cutting executed within 3 m of combustible material or in occupied spaces.
- .3 Place cylinders supplying gases as close to work as possible. Secure cylinders in upright position, free from exposure to sun or high temperature.
- .4 Locate fire extinguishing equipment near all welding, cutting and soldering operations.
- .5 Contractor's mechanics shall be properly equipped with required protective clothing, including goggles or welding hood or face mask, gloves, etc.
- .6 Contractor is responsible for the protection of his work and the Departmental Representative's property.
- .7 Provide Fire Watch on standby with approved fire extinguisher while burning or welding is in progress.

1.13 QUESTIONS
AND/OR
CLARIFICATIONS

- .1 Direct any questions or clarification on Fire Safety in addition to above requirements to Building Manager.

1.14 FIRE
INSPECTION

- .1 Site inspections by Building Manager will be coordinated through Departmental Representative.
- .2 Allow Building Manager unrestricted access to work site.
- .3 Co-operate with Building Manager during routine fire safety inspection of work site.
- .4 Immediately remedy all unsafe fire situations observed by Building Manager.

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 REFERENCES AND
CODES

- .1 Perform Work in accordance with National Building Code of Canada (NBC) 2010, National Fire Code of Canada (NFC) 2010 and Ontario Building Code (OBC) 2006, including all amendments up to bid closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS
MATERIAL DISCOVERY

- .1 Stop work immediately and notify Departmental Representative if materials which may contain designated substances or PCB's, other than those identified in Section 01 35 29 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-Z204-94(R1999), Guideline for Managing Indoor Air Quality in Office Buildings.

1.5 ACCESSIBLE
DESIGN

- .1 Comply with CSA B651-12, Accessible Design for the Built Environment, unless specified otherwise. In any case of conflict or discrepancy between the building codes and CSA B651, the requirements of CSA B651 shall apply.

1.6 TAXES

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

- | | | |
|------------------------|----|--|
| <u>1.7 EXAMINATION</u> | .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

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|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

- | | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

END OF SECTION

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 01 21 00 - Allowances.
- .2 Section 01 91 13 - General Commissioning (CX)-
Requirements.

1.2 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.

1.3 INDEPENDENT
INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work, above and beyond those required of the Contractor. Cost of such services will be borne by Departmental Representative.
- .2 Allocated costs: to Section 01 21 00.
- .3 Provide equipment required for executing inspection and testing by appointed agencies.

- .4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .5 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and re-inspection.

1.4 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.5 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.

1.6 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.

1.7 REPORTS

- .1 Submit 4 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.

1.8 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 and may be authorized as recoverable.

1.9 MOCK-UPS

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.
- .2 Construct in all locations acceptable to Departmental Representative.
- .3 Prepare mock-ups for Departmental Representative's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 If requested, Departmental Representative will assist in preparing a schedule fixing dates for preparation.
- .6 Accepted mock-ups may remain as part of Work.
- .7 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.10 MILL TESTS

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

- | | | |
|---------------------------------------|----|--|
| <u>1.11 EQUIPMENT AND
SYSTEMS</u> | .1 | Submit testing, adjusting and balancing reports for mechanical, electrical and building equipment systems. |
| | .2 | Submit Commissioning Documentation in accordance with Section 01 91 13. |

PART 2 - PRODUCTS

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|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

- | | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

END OF SECTION

PART 1 - GENERAL

<u>1.1 RELATED SECTIONS</u>	.1	Section 01 52 00 - Construction Facilities.
	.2	Section 01 56 00 - Temporary Barriers and Enclosures.
<u>1.2 REFERENCES</u>	.1	U.S. Environmental Protection Agency (EPA)/ Office of Water .1 EPA 833-R-06-004, May 2007, Developing Your Stormwater Pollution Prevention Plan - A Guide for Construction Sites.
<u>1.3 SUBMITTALS</u>	.1	Provide submittals in accordance with Section 01 33 00.
<u>1.4 INSTALLATION AND REMOVAL</u>	.1	Provide temporary utilities controls in order to execute work expeditiously.
	.2	Remove from site all such work after use.
<u>1.5 DEWATERING</u>	.1	Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.
<u>1.6 WATER SUPPLY</u>	.1	Departmental Representative will provide continuous supply of potable water for construction use.
	.2	Departmental Representative will pay for utility charges at prevailing rates.
<u>1.7 TEMPORARY HEATING AND VENTILATION</u>	.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 non-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.
- .6 Permanent heating system of building, may be used. Be responsible for damage to heating system if use is permitted.
- .7 Ensure Date of Substantial Performance and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Departmental Representative.
- .8 Departmental Representative will pay utility charges when temporary heat source is existing building equipment.
- .9 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .10 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.8 TEMPORARY POWER
AND LIGHT

- .1 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.
- .2 Maximum power supply of 347/600 volts, 3 phase, 60 Hz is available and will be provided for construction use at no cost. Connect to existing power supply in accordance with Canadian Electrical Code.
- .3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.
- .4 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.

1.9 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

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.189-2000, Exterior Alkyd Primer for Wood.
 - .2 CAN/CGSB-1.59-97, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-O121-08, Douglas Fir Plywood.
 - .3 CSA Z797-09, Code of practice for Access Scaffold.
 - .4 CAN/CSA-Z321-96(R2006), Signs and Symbols for the Occupational Environment, withdrawn but still available from CSA, CCOHS and Techstreet.
- .3 U.S. Environmental Protection Agency (EPA)/ Office of Water
 - .1 EPA 833-R-06-004, May 2007, Developing Your Stormwater Pollution Prevention Plan - A Guide for Construction Sites.

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 CSA Z797.
- .2 Provide and maintain scaffolding, ramps, ladders, swing staging, platform, temporary stairs.

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 may be used by construction personnel and transporting of materials. Co-ordinate use with Departmental Representative.
- .2 Provide protective coverings for finish surfaces of cars and entrances.

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.
- .3 Pay for additional security hours.

1.8 CONSTRUCTION
PARKING

- .1 Parking will be permitted on site provided it does not disrupt performance of Work.
- .2 Provide and maintain adequate access to project site.
- .3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.

1.9 OFFICES

- .1 Provide office heated to 22°C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.

	.2	Provide a clearly marked and fully stocked first-aid case in a readily available location.
	.3	Subcontractors may provide their own offices as necessary. Direct location of these offices.
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 SANITARY FACILITIES	.1	Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
	.2	Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.
1.12 CONSTRUCTION SIGNAGE	.1	No other signs or advertisements, other than warning signs, are permitted on site.
	.2	Signs and notices for safety and instruction shall be in both official languages. Graphic symbols shall conform to CAN/CSA-Z321.
	.3	Maintain approved signs and notices in good condition for duration of project, and dispose of off-site on completion of project or earlier if directed by Departmental Representative.
1.13 PROTECTION AND MAINTENANCE OF TRAFFIC	.1	Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.
	.2	Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs

- .3 Protect travelling public from damage to person and property.
- .4 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .5 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
- .6 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .7 Dust control: adequate to ensure safe operation at all times.
- .8 Provide snow removal during period of Work.

1.14 CLEAN-UP

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

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

<u>1.1 RELATED SECTIONS</u>	.1	Section 01 51 00 - Temporary Utilities.
	.2	Section 01 52 00 - Construction Facilities.
<u>1.2 INSTALLATION AND REMOVAL</u>	.1	Provide temporary controls in order to execute Work expeditiously.
	.2	Remove from site all such work after use.
<u>1.3 HOARDING</u>	.1	Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.
	.2	Erect temporary site enclosure using modular freestanding fencing: galvanized, minimum 1.8 m high, chain link or welded steel mesh, pipe rail. Provide one lockable truck entrance gate and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys. Maintain fence in good repair.
<u>1.4 GUARD RAILS AND BARRICADES</u>	.1	Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.
	.2	Provide as required by governing authorities and as indicated.
<u>1.5 WEATHER ENCLOSURES</u>	.1	Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
	.2	Design enclosures to withstand wind pressure and snow loading.

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|---|----|---|
| <u>1.6 DUST TIGHT
SCREENS</u> | .1 | Provide dust tight screens or 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. |
| <u>1.7 ACCESS TO SITE</u> | .1 | Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work. |
| <u>1.8 PUBLIC TRAFFIC
FLOW</u> | .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. |
| <u>1.9 FIRE ROUTES</u> | .1 | Maintain access to property including overhead clearances for use by emergency response vehicles. |
| <u>1.10 PROTECTION FOR
OFF-SITE AND PUBLIC
PROPERTY</u> | .1 | Protect surrounding private and public property from damage during performance of Work. |
| | .2 | Be responsible for damage incurred. |
| <u>1.11 PROTECTION OF
BUILDING FINISHES</u> | .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. |
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PART 2 - PRODUCTS

<u>2.1 NOT USED</u>	.1	Not Used.
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PART 3 - EXECUTION

<u>3.1 NOT USED</u>	.1	Not Used.
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END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 45 00 - Quality Control.

1.2 REFERENCES

- .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>.

1.3 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.

1.4 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.

1.5 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.

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1.6 STORAGE,
HANDLING AND
PROTECTION

- .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 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.

1.7 TRANSPORTATION

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

1.8 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 due to product failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Amount or Contract Time.

1.9 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.

1.10 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.

1.11 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.

1.12 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.

1.13 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.

1.14 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.

1.15 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.

1.16 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.

1.17 EXISTING UTILITIES

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

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 EXISTING
SERVICES

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

1.2 LOCATION OF
EQUIPMENT AND
FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.3 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.

1.4 SUBMITTALS

- .1 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
- .2 Submit certificate noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

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PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 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 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 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 Remove samples of installed Work for testing.
- .6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .10 Restore work with new products in accordance with requirements of Contract Documents.
- .11 Submit proposed materials, finishes and installation method for patching to Departmental Representative for approval, prior to patching.
- .12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .13 Fit Work airtight to pipes, ducts, sleeves, conduits, and other penetrations through surfaces.
- .14 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00, full thickness of the construction element.

- .15 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, recycling, composting and anaerobic digestion 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.

END OF SECTION

PART 1 - GENERAL

1.1 PROJECT
CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by contractors.
- .2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Provide on-site containers for collection of waste materials and debris.
- .5 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 20.
- .6 Remove waste material and debris from site and deposit in waste container at end of each working day.
- .7 Dispose of waste materials and debris off site.
- .8 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.
- .9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .12 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 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 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
- .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .14 Remove dirt and other disfiguration from exterior surfaces.
- .15 Clean and sweep roofs, gutters, areaways, and sunken wells.
- .16 Sweep and wash clean paved areas.

- .17 Clean equipment and fixtures to a sanitary condition;
clean or replace filters of mechanical equipment.
- .18 Clean roofs, downspouts, and drainage systems.
- .19 Remove debris and surplus materials from crawl areas
and other accessible concealed spaces.
- .20 Remove snow and ice from access to building.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 CONSTRUCTION & DEMOLITION WASTE

- .1 Carefully deconstruct and source separate materials/equipment and divert, from D&C waste destined for landfill to maximum extent possible. 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.
 - .1 Indicate how material being removed from the site will be reused, recycled, composted or anaerobically digested.
- .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 and Energy, 135 St. Clair Avenue West, Toronto, ON, M4V 1P5.
 - .2 Telephone: 800-565-4923 or 416-323-4321.
 - .3 Fax: 416-323-4682.
-

- .2 Recycling Council of Ontario: 215 Spadina Avenue, #225,
Toronto, ON, M5T 2C7.
- .1 Telephone: 416-657-2797
- .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
<u>Inquiries</u> | Fax |
|----------|---------|-----------------------------|-----|
|----------|---------|-----------------------------|-----|

Ontario	Ministry of Environment and Energy 135 St Clair Avenue West Toronto, ON M4V 1P5 Environment Canada Toronto, ON	(416) 323-4321 (800) 565-4923 (416) 734-4494	(416) 323-4682
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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 Certificates required by Fire Commissioner, utility companies have been submitted.
 - .5 Operation of systems have been demonstrated to Owner's personnel.
 - .6 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 re-inspection.

1.2 CLEANING

- .1 In accordance with Section 01 74 11.
- .2 Remove waste and surplus materials, rubbish and construction facilities from the site 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.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 01 91 13 - General Commissioning (CX)-
Requirements.
- .2 Section 01 79 00 - Demonstration and Training.

1.2 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 and French.
- .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.

1.3 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 CAD files in dwg format on a CD or USB drive.

1.4 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 specified in Section 01 45 00.
- .6 Training: Refer to Section 01 79 00.

1.5 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.
 - .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.
- .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".

1.6 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.

1.7 FINAL SURVEY

- .1 Submit final survey certificate certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.8 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 Contractor'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 in Section 01 45 00 and 01 91 13.
 - .15 Additional requirements: As specified in individual specification sections.

1.9 MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .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.

1.10 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.

1.11 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.

1.12 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.

1.13 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.

1.14 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 Departmental Representative'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.

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Region Project		Page 8
Building Works		
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PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 01 91 13 - General Commissioning (CX) Requirements.

1.2 DESCRIPTION

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

1.3 QUALITY CONTROL

- .1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Building's personnel, and provide written report that demonstration and instructions have been completed.
- .2 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.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Report shall give time and date of each demonstration and training, with list of persons present.

1.4 CONDITIONS FOR
DEMONSTRATIONS

- .1 Equipment has been inspected and put into operation in accordance with Section 01 91 13.
- .2 Testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 and equipment and systems are fully operational.

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1.5 PREPARATION

- .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.
- .1 Verify that conditions for demonstration and instructions comply with requirements.
- .2 Verify that designated O&M personnel are present.

1.6 DEMONSTRATION
AND INSTRUCTIONS

- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled 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.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.
- .2 Related Sections:
 - .1 Section 01 91 31 - Commissioning (CX) Plan.
 - .2 Section 01 91 33 - Commissioning Forms.
 - .3 Section 01 91 41 - Commissioning Training.
 - .4 Section 01 91 51 - Building Management Manual (BMM).
- .3 Acronyms:
 - .1 AFD - Alternate Forms of Delivery, service provider.
 - .2 BMM - Building Management Manual.
 - .3 Cx - Commissioning.
 - .4 EMCS - Energy Monitoring and Control Systems.
 - .5 O&M - Operation and Maintenance.
 - .6 PI - Product Information.
 - .7 PV - Performance Verification.
 - .8 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
 - .2 Ensure appropriate documentation is compiled into the BMM.
 - .3 Effectively train O&M staff.
- .2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance

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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.

.4 AFD managed projects the term Departmental Representative in Cx specifications to be interpreted as AFD Service Provider.

1.3 COMMISSIONING OVERVIEW

.1 Section 01 91 31.

.2 For Cx responsibilities refer to Section 01 91 31.

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

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

.5 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 facility 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.

.6 Departmental Representative will issue Certificate of Substantial Performance when:

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

.2 Equipment, components and systems have been commissioned.

.3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

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

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

1.5 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review contract documents, confirm by writing to Departmental Representative.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
 - .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf-ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Submit complete start-up documentation to Departmental Representative.
 - .7 Have Cx schedules up-to-date.
 - .8 Ensure systems have been cleaned thoroughly.
 - .9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.
 - .10 Ensure "As-Built" system schematics are available.
- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.
 - .1 Submit no later than 4 weeks after award of Contract:
 - .1 Name of Contractor's Cx agent.
 - .2 Draft Cx documentation.
 - .3 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.

1.8 COMMISSIONING DOCUMENTATION

- .1 Refer to Section 01 91 33.
- .2 Departmental Representative to review and approve Cx documentation.
- .3 Provide completed and approved Cx documentation to Departmental Representative.

1.9 COMMISSIONING SCHEDULE

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

1.10 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings: Section 01 32 16 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. Section 01 32 16. Departmental Representative to call a

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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 Departmental Representative, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.11 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.

1.12 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.

1.13 MANUFACTURER'S INVOLVEMENT

- .1 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Provide testing documentation for approval by Departmental Representative.
 - .3 Arrange for Departmental Representative to witness tests.
 - .4 Obtain written approval of test results and documentation from Departmental Representative before delivery to site.
- .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of

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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.

.3 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.

.4 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.

1.14 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 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.

.3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.

.4 Document required tests on approved PV forms.

.5 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 removed from site and replace with new.
 - .2 Subject new equipment/systems to specified start-up procedures.

1.15 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.

1.16 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.

1.17 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.

1.18 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.

1.19 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.

1.20 COMMISSIONING PERFORMANCE VERIFICATION

- .1 Carry out Cx:
 - .1 Under actual 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.

1.21 WITNESSING COMMISSIONING

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

1.22 AUTHORITIES

- .1 Where specified start-up, testing or commissioning

HAVING JURISDICTION

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.

1.23 COMMISSIONING
CONSTRAINTS

- .1 Since access into secure or sensitive areas will be very difficult after occupancy it is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems in these areas before issuance of the Certificate of Substantial Performance, using, if necessary, simulated thermal loads.

1.24 EXTRAPOLATION
OF RESULTS

- .1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

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

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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

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

COMMISSIONING

- | | | |
|---|----|---|
| <u>1.31 TRAINING</u> | .1 | In accordance with Section 01 91 41. |
| <u>1.32 MAINTENANCE
MATERIALS, SPARE
PARTS, SPECIAL
TOOLS</u> | .1 | Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract. |
| <u>1.33 OCCUPANCY</u> | .1 | Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility. |
| <u>1.34 INSTALLED
INSTRUMENTATION</u> | .1 | Use instruments installed under Contract for TAB and PV if: <ul style="list-style-type: none"> .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. |
| <u>1.35 PERFORMANCE
VERIFICATION
TOLERANCES</u> | .1 | Application tolerances: <ul style="list-style-type: none"> .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: <ul style="list-style-type: none"> .1 To be of higher order of magnitude than equipment or system being tested. |
| | .3 | Measurement tolerances during verification: <ul style="list-style-type: none"> .1 Unless otherwise specified actual values to be within +/-2% of recorded values. |
| <u>1.36 OWNER'S
PERFORMANCE TESTING</u> | .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

<u>2.1 NOT USED</u>	.1	Not Used.
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PART 3 - EXECUTION

<u>3.1 NOT USED</u>	.1	Not Used.
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END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.
- .2 Related Sections:
 - .1 Section 01 91 13 - General Commissioning (CX) Requirements.
 - .2 Section 01 91 33 - Commissioning Forms.
 - .3 Section 01 91 41 - Commissioning Training.
 - .4 Section 01 91 51 - Building Management Manual (BMM).

1.2 REFERENCES

- .1 American Water Works Association (AWWA).
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2010, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 14-2010, Standard for the Installation of Standpipe and Systems.
 - .3 NFPA 20-2010, Standard for the Installation of Stationary Fire Pumps for Fire Protection.
- .3 Public Works and Government Services Canada (PWGSC)
 - .1 PWGSC - Commissioning Guidelines CP.4 -3rd edition-03.
- .4 Underwriters' Laboratories of Canada (ULC).

1.3 GENERAL

- .1 Provide a fully functional facility:
 - .1 Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
 - .2 Facility user and O&M personnel have been fully trained in aspects of installed systems.
 - .3 Optimized life cycle costs.
 - .4 Complete documentation relating to installed equipment and systems.
- .2 Term "Cx" in this section means "Commissioning".

- .3 Use this Cx Plan as master planning document for Cx:
 - .1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.
 - .2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.
 - .3 Sets out deliverables relating to O&M, process and administration of Cx.
 - .4 Describes process of verification of how built works meet design requirements.
 - .5 Produces a complete functional system prior to issuance of Certificate of Occupancy.
 - .6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:
 - .1 Overview of Cx.
 - .2 General description of elements that make up Cx Plan.
 - .3 Process and methodology for successful Cx.
- .4 Acronyms:
 - .1 Cx - Commissioning.
 - .2 BMM - Building Management Manual.
 - .3 EMCS - Energy Monitoring and Control Systems.
 - .4 MSDS - Material Safety Data Sheets.
 - .5 PI - Product Information.
 - .6 PV - Performance Verification.
 - .7 TAB - Testing, Adjusting and Balancing.
 - .8 WHMIS - Workplace Hazardous Materials Information System.
- .5 Commissioning terms used in this Section:
 - .1 Bumping: short term start-up to prove ability to start and prove correct rotation.
 - .2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.4 DEVELOPMENT OF 100% CX PLAN

- .1 Cx Plan to be 95% completed before added into Project Specifications.
- .2 Cx Plan to be 100% completed within 8 weeks of award of contract to take into account:
 - .1 Approved shop drawings and product data.
 - .2 Approved changes to contract.
 - .3 Contractor's project schedule.
 - .4 Cx schedule.
 - .5 Contractor's, sub-contractors', suppliers' requirements.

.6 Project construction team's and Cx team's requirements.

.3 Submit completed Cx Plan to Departmental Representative and obtain written approval.

1.5 REFINEMENT OF CX PLAN

- .1 During construction phase, revise, refine and update Cx Plan to include:
 - .1 Changes resulting from Client program modifications.
 - .2 Approved design and construction changes.
- .2 Revise, refine and update every 6 weeks during construction phase. At each revision, indicate revision number and date.
- .3 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.
- .4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

- .1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.
- .2 Project Manager will select Cx Team consisting of following members:
 - .1 PWGSC Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
 - .2 PWGSC Quality Assurance Commissioning Manager: ensures Cx activities are carried out to ensure delivery of a fully operational project including:
 - .1 Review of Cx documentation from operational perspective.
 - .2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
 - .3 Protection of health, safety and comfort of occupants and O&M personnel.
 - .4 Monitoring of Cx activities, training, development of Cx documentation.
 - .5 Work closely with members of Cx Team.
- .3 Departmental Representative is responsible for:
 - .1 Organizing Cx.
 - .2 Monitoring operations Cx activities.
 - .3 Witnessing, certifying accuracy of reported results.

- .4 Witnessing and certifying TAB and other tests.
- .5 Developing BMM.
- .6 Ensuring implementation of final Cx Plan.
- .7 Performing verification of performance of installed systems and equipment.
- .8 Implementation of Training Plan.
- .4 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with contract documents, including:
 - .1 Testing.
 - .2 TAB.
 - .3 Performance of Cx activities.
 - .4 Delivery of training and Cx documentation.
 - .5 Assigning one person as point of contact with Departmental Representative and PWGSC Cx Manager for administrative and coordination purposes.
- .5 Contractor's Cx agent implements specified Cx activities including:
 - .1 Demonstrations.
 - .2 Training.
 - .3 Testing.
 - .4 Preparation, submission of test reports.
- .6 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:
 - .1 Receiving facility.
 - .2 Day-to-day operation and maintenance of facility.

1.7 CX PARTICIPANTS

- .1 Employ the following Cx participants to verify performance of equipment and systems:
 - .1 Installation contractor/subcontractor:
 - .1 Equipment and systems except as noted.
- .2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.
 - .1 To include performance verification.
- .3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.
- .4 Specialist Cx agency:
 - .1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.
- .5 Client: responsible for intrusion and access security systems.

- .6 Ensure that Cx participant:
 - .1 Could complete work within scheduled time frame.
 - .2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel, including:
 - .1 Modify ventilation rates to meet changes in off-gassing.
 - .2 Changes to heating or cooling loads beyond scope of EMCS.
 - .3 Changes to EMCS control strategies beyond level of training provided to O&M personnel.
 - .4 Redistribution of electrical services.
 - .5 Modifications of fire alarm systems.
 - .6 Modifications to voice communications systems.
- .7 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.

1.8 EXTENT OF CX

- .1 Cx Structural and Architectural Systems:
 - .1 Architectural and structural:
 - .1 Beam and slab deflection.
 - .4 Accessibility and operational safety.
 - .3 Vertical transportation systems:
 - .1 Passenger elevators.
 - .2 Freight elevators.
 - .4 Doors, related hardware:
 - .1 New door hardware.
- .2 Commission electrical systems and equipment:
 - .1 Low voltage below 750 V:
 - .1 Low voltage equipment.
 - .2 Low voltage distribution systems.
 - .2 Lighting systems:
 - .1 Lighting equipment.
 - .2 Emergency lighting systems, including battery packs.
 - .3 Fire alarm systems, equipment:
 - .1 Annunciators.
 - .2 Control panels.
 - .3 Fire alarm battery banks.

1.9 DELIVERABLES RELATING TO O&M

- .1 General requirements:
 - .1 Compile English documentation.

PERSPECTIVES

.2 Documentation to be computer-compatible format ready for inputting for data management.

- .2 Provide deliverables:
- .1 Warranties.
 - .2 Project record documentation.
 - .3 Inventory of spare parts, special tools and maintenance materials.
 - .4 Maintenance Management System (MMS) identification system used.
 - .5 WHMIS information.
 - .6 MSDS data sheets.
 - .7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

1.10 DELIVERABLES
RELATING TO THE CX
PROCESS

- .1 General:
- .1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.
- .2 Definitions:
- .1 Cx as used in this section includes:
 - .1 Cx of components, equipment, systems, subsystems, and integrated systems.
 - .2 Factory inspections and performance verification tests.
- .3 Deliverables: provide:
- .1 Cx Specifications.
 - .2 Startup, pre-Cx activities and documentation for systems, and equipment.
 - .3 Completed installation checklists (ICL).
 - .4 Completed product information (PI) report forms.
 - .5 Completed performance verification (PV) report forms.
 - .6 Results of Performance Verification Tests and Inspections.
 - .7 Description of Cx activities and documentation.
 - .8 Description of Cx of integrated systems and documentation.
 - .9 Training Plans.
 - .10 Cx Reports.
 - .11 Prescribed activities during warranty period.
- .4 Departmental Representative to witness and certify tests and reports of results provided to Departmental Representative.
- .5 Departmental Representative to participate.

1.11 PRE-CX
ACTIVITIES AND
RELATED
DOCUMENTATION

- .1 Items listed in this Cx Plan include the following:
 - .1 Pre-Start-Up inspections: by Departmental Representative prior to permission to start up and rectification of deficiencies to Departmental Representative's satisfaction.
 - .2 Departmental Representative to use approved check lists.
 - .3 Departmental Representative will monitor all of these pre-start-up inspections.
 - .4 Include completed documentation with Cx report.
 - .5 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by Departmental Representative and does not form part of Cx specifications.
 - .6 Departmental Representative will monitor some of these inspections and tests.
 - .7 Include completed documentation in Cx report.
- .2 Pre-Cx activities - ARCHITECTURAL AND STRUCTURAL:
 - .1 Slab and beam deflection test: test after removal of temporary supports and concrete has cured to ensure adequacy for raised floors.
 - .2 Vertical transportation:
 - .1 Passenger and freight elevators.
 - .3 Doors, related hardware:
 - .1 Door hardware.
- .3 Pre-Cx activities - ELECTRICAL:
 - .1 Lighting systems:
 - .1 Emergency lighting systems:
 - .1 Tests to include verification of lighting levels and coverage, initially by disrupting normal power.
 - .2 Fire alarm systems: test after other safety and security systems are completed. Testing to include a complete verification in accordance with ULC requirements. Departmental Representative has witnessed and certified report, demonstrate devices and zones to Departmental Representative.

1.12 START-UP

- .1 Startup components, equipment and systems.
- .2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to

start-up, under Contractor's direction, equipment and systems.

- .3 Departmental Representative to monitor all of these start-up activities.
 - .1 Rectify start-up deficiencies to satisfaction of Departmental Representative.
- .4 Performance Verification (PV):
 - .1 Approved Cx Agent to perform.
 - .1 Repeat when necessary until results are acceptable to Departmental Representative.
 - .2 Use procedures modified generic procedures to suit project requirements.
 - .3 Departmental Representative to witness and certify reported results using approved PI and PV forms.
 - .4 Departmental Representative to approve completed PV reports and provide to Departmental Representative.
 - .5 Departmental Representative reserves right to verify up to 30% of reported results at random.
 - .6 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.13 CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Perform Cx by specified Cx agency using procedures developed by Departmental Representative and approved by Departmental Representative.
- .2 Departmental Representative to monitor Cx activities.
- .3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.
- .4 Departmental Representative to witness, certify reported results of, Cx activities and forward to Departmental Representative.
- .5 Departmental Representative reserves right to verify a percentage of reported results at no cost to contract.

1.14 CX OF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION

- .1 Cx to be performed by specified Cx specialist, using procedures developed by Departmental Representative and approved by Departmental Representative.
- .2 Tests to be witnessed by Departmental Representative and documented on approved report forms.
- .3 Upon satisfactory completion, Cx specialist to prepare Cx Report, to be certified by Departmental Representative and submitted to Departmental

Representative for review.

- .4 Departmental Representative reserves right to verify percentage of reported results.
- .5 Integrated systems to include:
 - .1 Fire alarm systems.
- .6 Identification:
 - .1 In later stages of Cx, before hand-over and acceptance Departmental Representative, Contractor, Property Manager and Cx Manager to co-operate to complete inventory data sheets and provide assistance to PWGSC in full implementation of MMS identification system of components, equipment, sub-systems, systems.

1.15 INSTALLATION
CHECK LISTS (ICL)

- .1 Refer to Section 01 91 33.

1.16 PRODUCT
INFORMATION (PI)
REPORT FORMS

- .1 Refer to Section 01 91 33.

1.17 PERFORMANCE
VERIFICATION (PV)
REPORT

- .1 Refer to Section 01 91 33.

1.18 DELIVERABLES
RELATING TO
ADMINISTRATION OF
CX

- .1 General:
 - .1 Because of risk assessment, complete Cx of occupancy, weather and seasonal-sensitive equipment and systems in these areas before building is occupied.

1.19 CX SCHEDULES

- .1 Prepare detailed Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule. Include:
 - .1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:
 - .1 Design criteria, design intents.
 - .2 Pre-TAB review: 28 days after contract award, and before construction starts.
 - .3 Cx agents' credentials: 60 days before start of Cx.

- .4 Cx procedures: 3 months after award of contract.
- .5 Cx Report format: 3 months after contract award.
- .6 Discussion of heating/cooling loads for Cx: 3 months before start-up.
- .7 Submission of list of instrumentation with relevant certificates: 21 days before start of Cx.
- .8 Notification of intention to start TAB: 21 days before start of TAB.
- .9 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.
- .10 Notification of intention to start Cx: 14 days before start of Cx.
- .11 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14 days before start of integrated system Cx.
- .12 Identification of deferred Cx.
- .13 Implementation of training plans.
- .14 Cx of smoke management/control systems: after Cx of related systems is completed and 7 days before proposed date of Cx these systems.
- .15 Cx stair shaft pressurization systems: at same time as emergency evacuation exercises.
- .16 Cx reports: immediately upon successful completion of Cx.
- .17 Emergency evacuation exercises: after at same time as Cx of stair shaft pressurization systems.
- .2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Property Manager.
- .3 6 months in Cx schedule for verification of performance in all seasons and wear conditions.
- .2 After approval, incorporate Cx Schedule into Construction Schedule.
- .3 Contractor, Contractor's Cx agent, and Departmental Representative will monitor progress of Cx against this schedule.
- .1 Systems to be tested as required by codes:
 - .1 Where testing is required as part of a regulatory process and where Cx procedures are developed and are appropriate to project, perform tests as required by such codes.
 - .2 Departmental Representative to witness these

1.20 CX SCHEDULE
FOR ELECTRICAL
SYSTEMS

tests as part of Quality Assurance role.

- .2 Produce a schedule of Cx activities in a bar chart format to a scale that will ensure legibility. Bar chart to indicate:
 - .1 Sequences of testing equipment and systems, interrelationship between tests, duration of tests and training periods.
 - .2 Cx resources which will be committed to this project to ensure completion by prescribed dates.
 - .3 Training plan.
 - .4 Cx documentation plan.
- .3 Distribution system:
 - .1 Testing and Cx to be defined in construction specifications.
- .4 Emergency lighting systems:
 - .1 Perform tests by interrupting normal power.
 - .2 Thereafter verify adequacy of coverage.
- .5 Fire alarm systems:
 - .1 Verify operation of these systems after aspects of life safety and security systems are complete.
 - .2 Testing to be monitored by Departmental Representative and include complete verification in accordance with ULC requirements.
 - .3 After receipt by Departmental Representative of Cx Report, Cx specialist to demonstrate devices and zones to Cx Manager, Project Manager and Property Manager.
- .6 Cx requirements to be included in construction specifications.

1.21 CX REPORTS

- .1 Submit reports of tests, witnessed and certified by Departmental Representative to Departmental Representative who will verify reported results.
- .2 Include completed and certified PV reports in properly formatted Cx Reports.
- .3 Before reports are accepted, reported results to be subject to verification by Departmental Representative.

1.22 ACTIVITIES DURING WARRANTY PERIOD

- .1 Cx activities must be completed before issuance of Interim Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:
 - .1 Fine tuning of HVAC systems.
 - .2 Adjustment of ventilation rates to promote good

indoor air quality and reduce deleterious effects of VOCs generated by off-gassing from construction materials and furnishings.
.3 Full-scale emergency evacuation exercises.

1.23 TRAINING PLANS .1 Refer to Section 01 91 41.

1.24 FINAL SETTINGS .1 Upon completion of Cx to satisfaction of Departmental Representative lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Use.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Commissioning forms to be completed for equipment, system and integrated system.
- .2 Related Sections:
 - .1 Section 01 91 13 - General Commissioning (CX) Requirements.
 - .2 Section 01 91 31 - Commissioning (CX) Plan.
 - .3 Section 01 91 41 - Commissioning Training.
 - .4 Section 01 91 51 - Building Management Manual (BMM).

1.2 INSTALLATION/START- UP CHECK LISTS

- .1 Include the following data:
 - .1 Product manufacturer's installation instructions and recommended checks.
 - .2 Special procedures as specified in relevant technical sections.
 - .3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.
- .2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.
- .3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.
- .4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.
- .5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT
INFORMATION (PI)
REPORT FORMS

- .1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the BMM at completion of work.
- .2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's approval.

1.4 PERFORMANCE
VERIFICATION (PV)
FORMS

- .1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.
- .2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.
- .3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative's approval.

1.5 SAMPLES OF
COMMISSIONING FORMS

- .1 Departmental Representative will develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with specification data.
- .2 Revise items on Commissioning forms to suit project requirements.
- .3 Samples of Commissioning forms and a complete index of produced to date will be attached to this section.

1.6 CHANGES AND
DEVELOPMENT OF NEW
REPORT FORMS

- .1 When additional forms are required, but are not available from Departmental Representative develop appropriate verification forms and submit to Departmental Representative for approval prior to use.
 - .1 Additional commissioning forms to be in same format as provided by Departmental Representative.

1.7 COMMISSIONING
FORMS

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
 - .1 Departmental Representative provides Contractor project-specific Commissioning forms with Specification data included.
 - .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
 - .3 Confirm operation as per design criteria and intent.
 - .4 Identify variances between design and operation and reasons for variances.
 - .5 Verify operation in specified normal and emergency modes and under specified load conditions.
 - .6 Record analytical and substantiating data.
 - .7 Verify reported results.
 - .8 Form to bear signatures of recording technician and reviewed and signed off by Departmental Representative.
 - .9 Submit immediately after tests are performed.
 - .10 Reported results in true measured SI unit values.
 - .11 Provide Departmental Representative with originals of completed forms.
 - .12 Maintain copy on site during start-up, testing and commissioning period.
 - .13 Forms to be both hard copy and electronic format with typed written results in Building Management Manual in accordance with Section 01 91 51.

1.8 LANGUAGE

- .1 To suit the language profile of the awarded contract.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

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PART 3 - EXECUTION

<u>3.1 NOT USED</u>	.1	Not Used.
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END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 This Section specifies roles and responsibilities of Commissioning Training.
- .2 Related Sections:
 - .1 Section 01 91 13 - General Commissioning (CX) Requirements.
 - .2 Section 01 91 31 - Commissioning (CX) Plan.
 - .2 Section 01 91 33 - Commissioning Forms.
 - .4 Section 01 91 51 - Building Management Manual (BMM).

1.2 TRAINEES

- .1 Trainees: personnel selected for operating and maintaining this facility. Includes Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.
- .2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

- .1 Departmental Representative will provide:
 - .1 Descriptions of systems.
 - .2 Instruction on design philosophy, design criteria, and design intent.
- .2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:
 - .1 Start-Up, operation, shut-down of equipment, components and systems.
 - .2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.
 - .3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.
- .3 Contractor and equipment manufacturer to provide instruction on:
 - .1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

- .1 Training to be detailed and duration to ensure:
 - .1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.
 - .2 Effective on-going inspection, measurements of system performance.
 - .3 Proper preventive maintenance, diagnosis and trouble-shooting.
 - .4 Ability to update documentation.
 - .5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

- .1 Instructors to be responsible for content and quality.
- .2 Training materials to include:
 - .1 "As-Built" Contract Documents.
 - .2 Operating Manual.
 - .3 Maintenance Manual.
 - .4 Management Manual.
 - .5 TAB and PV Reports.
- .3 Project Manager, Commissioning Manager and Facility Manager will review training manuals.
- .4 Training materials to be in a format that permits future training procedures to same degree of detail.
- .5 Supplement training materials:
 - .1 Transparencies for overhead projectors.
 - .2 Multimedia presentations.
 - .3 Manufacturer's training videos.
 - .4 Equipment models.

1.6 SCHEDULING

- .1 Include in Commissioning Schedule time for training.
- .2 Deliver training during regular working hours, training sessions to be 3 hours in length.
- .3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

- .1 Be responsible for:
 - .1 Implementation of training activities,
 - .2 Coordination among instructors,

-
- .3 Quality of training, training materials,
 - .2 Departmental Representative will evaluate training and materials.
 - .3 Upon completion of training, provide written report, signed by Instructors, witnessed by Departmental Representative.
-
- 1.8 TRAINING
CONTENT
-
- .1 Training to include demonstrations by Instructors using the installed equipment and systems.
 - .2 Content includes:
 - .1 Review of facility and occupancy profile.
 - .2 Functional requirements.
 - .3 System philosophy, limitations of systems and emergency procedures.
 - .4 Review of system layout, equipment, components and controls.
 - .5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
 - .6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.
 - .7 Maintenance and servicing.
 - .8 Trouble-shooting diagnosis.
 - .9 Inter-action among systems during integrated operation.
 - .10 Review of O&M documentation.
 - .3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.
-
- 1.9 VIDEO-BASED
TRAINING
-
- .1 Manufacturer's videotapes/DVDs/Blu-ray to be used as training tool with Departmental Representative's review and written approval 3 months prior to commencement of scheduled training.
 - .2 On-Site training videos:
 - .1 Videotape or record training sessions for use during future training.
 - .2 To be performed after systems are fully commissioned.
 - .3 Organize into several short modules to permit incorporation of changes.
 - .3 Production methods to be professional and high quality.
-

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 This section is limited to portions of the Building Management Manual (BMM) provided to Departmental Representative by Contractor.
- .2 Related Sections:
 - .1 Section 01 91 13 - General Commissioning (CX) Requirements.
 - .2 Section 01 91 31 - Commissioning (CX) Plan.
 - .3 Section 01 91 33 - Commissioning Forms.
 - .4 Section 01 91 41 - Commissioning Training.
- .3 Acronyms:
 - .1 BMM - Building Management Manual.
 - .2 Cx - Commissioning.
 - .3 HVAC - Heating, Ventilation and Air Conditioning.
 - .4 PI - Product Information.
 - .5 PV - Performance Verification.
 - .6 TAB - Testing, Adjusting and Balancing.
 - .7 WHMIS - Workplace Hazardous Materials Information System.

1.2 GENERAL REQUIREMENTS

- .1 Standard letter size paper 216 mm x 279 mm.
- .2 Methodology used to facilitate updating.
- .3 Drawings, diagrams and schematics to be professionally developed.
- .4 Electronic copy of data to be in a format accepted and approved by Departmental Representative.

1.3 APPROVALS

- .1 Prior to commencement, co-ordinate requirements for preparation, submission and approval with Departmental Representative.

1.4 GENERAL
INFORMATION

- .1 Provide Departmental Representative the following for insertion into appropriate Part and Section of BMM:
 - .1 Complete list of names, addresses, telephone and fax numbers of Contractor, sub-contractors that participated in delivery of project - as indicated in Section 1.2 of BMM.
 - .2 Summary of architectural, structural, fire protection, mechanical and electrical systems installed and commissioned - as indicated in Section 1.4 of BMM.
 - .1 Including sequence of operation as finalized after commissioning is complete as indicated in Section 2.0 of BMM.
 - .3 Description of building operation under conditions of heightened security and emergencies as indicated in Section 2.0 of BMM.
 - .4 System, equipment and components Maintenance Management System (MMS) identification - Section 2.1 of BMM.
 - .5 Information on operation and maintenance of architectural systems and equipment installed and commissioned - Section 2.0 of BMM.
 - .6 Information on operation and maintenance of fire protection and life safety systems and equipment installed and commissioned - Section 2.0 of BMM.
 - .7 Information on operation and maintenance of mechanical systems and equipment installed and commissioned - Section 2.0 of BMM.
 - .8 Operating and maintenance manual - Section 3.2 of BMM.
 - .9 Final commissioning plan as actually implemented.
 - .10 Completed commissioning checklists.
 - .11 Commissioning test procedures employed.
 - .12 Completed Product Information (PI) and Performance Verification (PV) report forms, approved and accepted by Departmental Representative.
 - .13 Commissioning reports.

1.5 CONTENTS OF
OPERATING AND
MAINTENANCE MANUAL

- .1 For detailed requirements refer to Section 01 78 00.
- .2 Departmental Representative to review and approve format and organization within 12 weeks of award of contract.
- .3 Include original manufactures brochures and written information on products and equipment installed on this project.
- .4 Record and organize for easy access and retrieval of information contained in BMM.

- .5 Include completed PI report forms, data and information from other sources as required.
- .6 Inventory directory relating to information on installed systems, equipment and components.
- .7 Approved project shop-drawings, product and maintenance data.
- .8 Manufacturer's data and recommendations relating: manufacturing process, installation, commissioning, start-up, O&M, shutdown and training materials.
- .9 Inventory and location of spare parts, special tools and maintenance materials.
- .10 Warranty information.
- .11 Inspection certificates with expiration dates, which require on-going re-certification inspections.
- .12 Maintenance program supporting information including:
 - .1 Recommended maintenance procedures and schedule.
 - .2 Information to removal and replacement of equipment including, required equipment, points of lift and means of entry and egress.

1.6 LIFE SAFETY
COMPLIANCE (LSC)
MANUAL

- .1 Samples of LSC Manual will be available from Departmental Representative.
- .2 Content of Manual:
 - .1 All possible Emergency situations modes including: presence of fire and smoke, power failure, loss of water or pressure, chemical spills and refrigerant release.
 - .2 Failure of elevators and escalators.
 - .3 HVAC emergencies and fuel supply failures.
 - .4 Intrusion and security breach.
 - .5 Emergency provisions for natural disasters, bomb threats and other disruptive situations.
 - .6 Dedicated emergency generators for high security projects, medical facilities and computer systems.
 - .7 Emergency control procedures for fire, power and major equipment failure.
 - .8 Emergency contacts and numbers.
 - .9 Manual to be readily available and comprehensible to non-technical readers.

1.7 SUPPORTING
DOCUMENTATION FOR
INSERTION INTO
SUPPORTING
APPENDICES

- .1 Provide Departmental Representative supporting documentation relating to installed equipment and system, including:
 - .1 General:
 - .1 Finalized commissioning plan.
 - .2 WHMIS information manual.
 - .3 Approved "as-built" drawings and specifications.
 - .4 Procedures used during commissioning.
 - .5 Cross-Reference to specification sections.
 - .2 Architectural and structural:
 - .1 Inspection certificates, construction permits.
 - .2 Roof anchor log books.
 - .3 PV reports.
 - .3 Fire prevention, suppression and protection:
 - .1 Test reports.
 - .2 Smoke test reports.
 - .3 PV reports.
 - .4 Mechanical:
 - .1 Installation permits, inspection certificates.
 - .2 Piping pressure test certificates.
 - .3 Ducting leakage test reports.
 - .4 TAB and PV reports.
 - .5 Charts of valves and steam traps.
 - .6 Copies of posted instructions.
 - .5 Electrical:
 - .1 Installation permits, inspection certificates.
 - .2 TAB and PV reports.
 - .3 Electrical work log book.
 - .4 Charts and schedules.
 - .5 Locations of cables and components.
 - .6 Copies of posted instructions.
- .2 Assist Departmental Representative with preparation of BMM.

1.8 IDENTIFICATION
OF FACILITY

- .1 When submitting information to Departmental Representative for incorporation into BMM, use following system for identification of documentation:
 - .1 (1) Building; (2) Integrated systems; (3) Systems; (4) Sub-systems; (5) Components; (6) Control points for components.

1.9 USE OF CURRENT
TECHNOLOGY

- .1 Use current technology for production of documentation. Emphasis on ease of accessibility at all times, maintain in up-to-date state, compatibility with user's requirements.
- .2 Obtain Departmental Representative's approval before starting Work.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

1 PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Conform to Sections of Division 1 as applicable.

1.2 RELATED WORK

1.2.1 Friable Asbestos Removal: Section 02 13 83 Type 3 Asbestos Removal

1.2.2 Lead Disturbance Procedures: Section 02 13 85

1.2.3 Silica Disturbance Procedures: Section 02 13 86

1.2.4 Mercury Removal Procedures: Section 02 13 87

1.3 DESCRIPTION OF WORK

1.3.1 Types of asbestos present: Chrysotile present within texture plaster finish, pipe insulation, pipe fitting insulation and duct insulation. Asbestos-containing materials identified, location and quantities can be found within the Safetech Environmental Limited report titled "*Hazardous Building Materials Assessment – Stairway Fire Separation Project, Stairways # 1-5, 25-55 St. Clair Avenue East, Toronto, Ontario*" issued December 2, 2013.

1.3.2 Perform asbestos removal by full enclosure method. Type 2 procedures are applicable to the removal of friable materials that are <1.0m² in size. Fore areas >1.0m² refer to Section 02 13 83.

1.3.3 Maintain electrical and mechanical services passing through asbestos work area.

1.3.4 Seal all surfaces from which asbestos has been cleaned or removed with slow drying sealer.

1.3.5 Dispose of temporary enclosures, disposable equipment and any asbestos-containing or contaminated materials removed, as asbestos waste.

1.3.6 All work will be subject to inspection and air monitoring both inside and outside asbestos work area by Owner's Consultant. Any contamination of surrounding areas (indicated by visual inspection or air monitoring) shall necessitate complete enclosure and clean-up of affected areas.

1.4 DEFINITIONS

1.4.1 **HEPA Filter:** High Efficiency Particulate Aerosol filter at least 99.97 percent efficient in collecting 0.3 micrometer aerosol.

1.4.2 **Friable Material:** Material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.

- 1.4.3 **Polyethylene Sheeting:** Polyethylene sheeting 0.15 mm (6 mil) minimum thickness; with tape seals along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous polyethylene membrane protection.
- 1.4.4 **Authorized Visitor(s):** Construction Manager or person(s) representing regulatory agencies, and person(s) authorized by them.
- 1.4.5 **Asbestos Work Area(s):** Area(s) where work takes place which will, or may disturb asbestos-containing material, including overspray and fallen material, or settled dust that may contain asbestos.
- 1.4.6 **Curtained Doorway:** Device to allow ingress or egress from enclosure while permitting minimal air movement, typically constructed by placing 2 overlapping flaps of polyethylene sheeting (2 sheets of polyethylene per flap) attached to head and 1 jamb of existing or temporarily constructed door frame. Secure vertical edge of 1 flap along 1 vertical side of door frame, and vertical edge of other flap along opposite vertical side of door frame. Reinforce free edges of polyethylene with duct tape.
- 1.4.7 **Negative Pressure:** Reduced pressure within asbestos work area(s) established by extracting air directly from work area, and discharging directly to exterior of building. Discharged air first passes through HEPA filter. Extract sufficient air to ensure constant reduced pressure at perimeter of work area with respect to surrounding areas.
- 1.4.8 **Airlock:** 2 curtained doorways spaced minimum of 2 m (6') apart.

1.5 QUALITY ASSURANCE

- 1.5.1 Ensure work proceeds to Schedule and meets all requirements of this Section. Perform work so airborne asbestos, asbestos waste or water run off does not contaminate areas outside asbestos work enclosure.
- 1.5.2 Pay cost to Owner of inspection and air monitoring performed as result of failure to perform work satisfactorily.
- 1.5.3 Use only skilled and qualified workers for all trades required for this work.

1.6 REGULATIONS

- 1.6.1 Comply with Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations made under Occupational Health and Safety Act, Reg. 278/05, as amended, and local requirements pertaining to asbestos; provided that in case of conflict with these Specifications most stringent requirements shall apply.
- 1.6.2 Handle and dispose of contaminated waste as required by Ontario Regulation 347 as amended by 234/11, made under The Environmental Protection Act, as amended.

1.7 SUBMITTALS

1.7.1 Before Commencing Work:

- 1.7.1.1 Obtain and submit all necessary permits for transporting and disposal of asbestos waste.
- 1.7.1.2 Submit names of supervisory personnel who will be responsible for asbestos work area(s). One of supervisors must remain on Site at all times while asbestos removal or clean-up is occurring. Submit proof that supervisory personnel have attended training course on asbestos control (2 day minimum duration) and have performed supervisory function on at least 2 other asbestos control projects.
- 1.7.1.3 Submit proposed schedule showing phasing and proposed workforce related to each work area enclosure or repair operation.
- 1.7.1.4 Submit list of existing damage for acceptance.

1.8 WORKER AND VISITOR PROTECTION

- 1.8.1 **Instructions:** Before entering asbestos work area(s), instruct workers and visitors in use of respirators, entry and exit from enclosures and all aspects of work procedures and protective measures. Instruction shall be provided by competent person as defined by Occupational Health and Safety Act.
- 1.8.2 **Full Face Respirator:** Provide appropriate respiratory equipment for all persons within asbestos work area including authorized visitors. During specified work, workers, supervisors, and authorized visitors shall wear negative pressure half-face respirators with minimum P100 filter cartridges in accordance with NIOSH Part 84 requirements (Formerly high efficiency particulate aerosol (HEPA) cartridge filters). Replace filters daily or test according to manufacturer's specifications and replace as indicated. Respirators shall be acceptable to Occupational Health Branch of Ministry of Labour. Provide proper instruction to workers and visitors on use of respirators, including qualitative fit testing. No supervisor, worker or authorized visitor shall wear facial hair which affects seal between respirator and face. Maintain respiratory protection equipment in proper functioning and clean condition, or remove from site.
- 1.8.3 **Protective Clothing:** Provide workers and visitors in full-enclosure sites with full body coveralls with integral hoods. Once coveralls are worn in asbestos work area, treat and dispose of as asbestos contaminated waste. Workers and visitors shall also wear other protective apparel required by Ministry of Labour construction regulations.
- 1.8.4 Before entering enclosure(s) put on respirator with new or tested filters, clean coveralls and head covers. Wear coveralls with hoods up at all times.
- 1.8.5 Workers may leave enclosure, only after all disturbance of asbestos-containing materials is complete and enclosure has been cleaned-up. When leaving enclosure workers and visitors use HEPA vacuum to clean exterior of respirator to remove visible contamination, and remove gross contamination from coveralls and other protective equipment. Immediately upon leaving enclosure workers and visitors shall remove coveralls and wash face and hands thoroughly with soap and water; wet clean inside of respirator.

Remove filters and dispose of or test filters according to manufacturer's specifications. Place coveralls and used filters in receptacles for disposal with other asbestos contaminated materials. Coveralls can be reused, to maximum of 8 hours wear, if coveralls remain inside work area.

1.8.6 Do not eat, drink, smoke or chew gum or tobacco in enclosures.

1.8.7 Workers and visitors shall be fully protected as specified herein whenever possibility of disturbance of asbestos exists.

2 PART 2 - Products

2.2 MATERIALS

2.2.1 **Polyethylene Sheeting:** 0.15 mm (6 mil) minimum thickness unless otherwise specified; in sheet size to minimize joints.

2.2.2 **Rip-Proof Polyethylene:** 0.20 mm (8 mil) fabric made up from 0.13 mm (5 mil) weave and 2 layers 0.04 mm (1.5 mil) poly laminate, in sheet size to minimize joints.

2.2.3 **Tape:** Tape suitable for sealing polyethylene to surface encountered under both wet conditions using amended water, and dry conditions.

2.2.4 **Wetting Agent:** Non-sudsing surface active agent; mixed with water in concentration to provide thorough wetting of asbestos fibre: Asbestos-Wet, distributed by Asbetec Distributors, Richmond Hill, Ontario.

2.2.5 **Amended Water:** Water with wetting agent added.

2.2.6 **Asbestos Waste Receptors:** 2 separate containers of which 1 shall consist of 0.15 mm (6 mil) minimum thickness polyethylene bag. Other container may be 0.15 mm (6 mil) minimum thickness polyethylene bag or rigid sealable container such as metal or cardboard, fibre drum or wood box. Other container shall be adequate to prevent perforating rips, or tears in first container during filling, transport or disposal. Containers must be acceptable to disposal Site selected and Ministry of Environment and Energy.

2.2.7 **Sealer:** Sealer for purpose of trapping residual fibre debris. Product must have flame spread and smoke development ratings both less than 25. Product shall leave no stain when dry: TC-55 (clear), A/D Fire Protection Systems Inc., Scarborough, Ontario. For mechanical equipment, pipes, boilers, etc. use high temperature sealer only: Chil-Abate CP210, Childers Products Company, Mississauga, Ontario.

2.2.8 **Sprayer:** Garden-type portable manual sprayer, low velocity, capable of producing mist or fine spray.

2.2.9 **HEPA Vacuum:** Vacuum with all necessary fittings, tools and attachments. Air must pass HEPA filter before discharge.

3 PART 3 - Execution

3.2 FULL-ENCLOSURE ASBESTOS WORK AREAS

- 3.2.1 Move equipment, tools, and stored materials which can be moved without disturbing asbestos-containing materials.
- 3.2.2 Remove elements which can be removed without disturbing friable asbestos material.
- 3.2.3 If working from within building, request building personnel to shut off air handling and ventilation systems supplying or exhausting from asbestos work area enclosure(s). Ensure air-handling systems remain shut off for duration of work.
- 3.2.4 Erect wood or metal framing between asbestos work area and remaining building area, as necessary to support polyethylene sheeting enclosures. Free standing enclosure shall have completely sealed polyethylene top.
- 3.2.5 Use sufficient layers to provide adequate protection. Protect floors with at least 1 layer of polyethylene sheeting. Where walls are protected with sheeting, cover floors first so that wall polyethylene overlaps floor layer by at least 300 mm (12").
- 3.2.6 Where applicable clean previously contaminated surfaces with HEPA vacuum before covering with sheeting.
- 3.2.7 If enclosure is used for more than 1 shift, construct airlock for entry to and exit from enclosure. Clean enclosure prior to exiting at completion of each shift.
- 3.2.8 Establish negative pressure in asbestos work area. Operate negative pressure units or HEPA vacuums continuously from this time until completion of contaminated work.
- 3.2.9 Provide soap, water and towels for washing of worker's face and hands when exiting enclosure.
- 3.2.10 Maintain emergency and fire exits from asbestos work area, or establish alternative exits satisfactory to authorities having jurisdiction.
- 3.2.11 Ensure existing power supply to asbestos work area is isolated and disconnected where necessary. Do not disrupt power supply to remainder of building.

3.3 MAINTENANCE OF ENCLOSURES

- 3.3.1 Maintain enclosures in tidy condition.
- 3.3.2 Ensure barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.
- 3.3.3 Visually inspect enclosures at beginning of each working period.

3.4 COMMENCE ASBESTOS REMOVAL OR CLEANUP WORK WHEN

- 3.4.1 Arrangements have been made for disposal of waste.

- 3.4.2 Asbestos work areas enclosures and parts of building required to remain in use are effectively segregated. Negative pressure equipment is operating continuously.
- 3.4.3 Tools, equipment and materials waste receptors are inside enclosure.
- 3.4.4 Arrangements have been made for work area security.
- 3.4.5 Signs are displayed in all areas where access to sealed asbestos work areas possible. Signs shall read:

CAUTION

Asbestos Hazard Area

No Unauthorized Entry

Wear assigned protective equipment

Breathing asbestos dust may cause serious bodily harm.

- 3.4.6 Owner's Consultant has been notified of intention to proceed and has reviewed enclosures and equipment.

3.5 REMOVAL OF VINYL ASBESTOS TILE/ACOUSTIC CEILING TILE/DRYWALL

- 3.5.1 Before commencing work, prepare Site as described in articles 3.1, 3.2 and 3.3.
- 3.5.2 Seal opening to enclosure with tape after entry of worker. Worker shall remain inside enclosure until disturbed asbestos-containing materials are removed and enclosure has been effectively cleaned.
- 3.5.3 Perform work required inside enclosure.
- 3.5.4 Start removal by wedging heavy-duty scraper in seam of 2 adjoining materials and gradually forcing edge of material up and away from surface. Do not break off pieces, but continue to force balance of tile up.
- 3.5.5 When first area is removed, place it, without breaking into smaller pieces, into asbestos waste receptor.
- 3.5.6 Continue removal using hand tools and removing material intact wherever possible. When adhesive is spread heavily or is quite hard, it may prove easier to force scraper through tightly adhered areas by striking scraper handle with hammer using blows of moderate force while maintaining scraper at 25° to 30° angle to floor. When even this technique cannot loosen tile, removal can be simplified by heating tile with hot air gun or infrared heaters until heat penetrates through tile and softens adhesive. Do not use powered electric scrapers.
- 3.5.7 After removal of small area scrape up remaining debris with hand scraper until only thin smooth film remains. Where deposits are heavy or difficult to scrape, hot air gun or infrared heaters may be used. Deposit scrapings into asbestos waste receptors. Do not dry scrape surface of adhering pieces of tile.
- 3.5.8 On completion of area, clean vertical and horizontal surfaces with HEPA vacuum.

- 3.5.9 Trades personnel may enter enclosure to perform Type II operations under the guidance of competent worker.
- 3.5.10 When cleaning or removing asbestos-containing drywall walls within enclosure, spray asbestos-containing material with amended water. Saturate asbestos to prevent release of airborne fibres during removal. Place fully saturated asbestos directly into waste containers.
- 3.5.11 Treat materials removed including used polyethylene sheeting as asbestos contaminated waste and dispose of as such.
- 3.5.12 Following completion of work, clean surfaces from which asbestos has been disturbed with HEPA vacuum, or wet-sponge if appropriate to remove all visible material.
- 3.5.13 Carefully place asbestos waste in inner bag of asbestos waste receptor. Clean inner bag surface of gross contamination and place in clean 6 mil outer bag. If waste is likely to tear inner bag, then instead of outer bag use fibre or metal drum, cardboard or wood box, or other suitably sturdy container. After wet-sponging or vacuuming to remove visible asbestos, wet clean entire enclosure. Apply coat of sealer to all surfaces from which asbestos has been disturbed. Apply thinned coat (sufficient to coat all surfaces) to interior of polyethylene enclosure prior to tear down.

3.6 REMOVAL OF OTHER FRIABLE MATERIALS (<1.0M²)

- 3.6.1 Before commencing work, prepare Site as described in articles 3.1, 3.2 and 3.3.
- 3.6.2 Seal opening to enclosure with tape after entry of worker. Worker shall remain inside enclosure until disturbed asbestos-containing materials are removed and enclosure has been effectively cleaned.
- 3.6.3 Perform work required inside enclosure. Trades personnel may enter enclosure to perform Type II operations under the guidance of competent worker.
- 3.6.4 When cleaning or removing asbestos-containing material within enclosure, spray asbestos-containing material with amended water. Saturate asbestos to prevent release of airborne fibres during removal. Place fully saturated asbestos directly into waste containers.
- 3.6.5 Treat materials removed including used polyethylene sheeting as asbestos contaminated waste and dispose of as such.
- 3.6.6 Following completion of work, clean surfaces from which asbestos has been disturbed with HEPA vacuum, or wet-sponge if appropriate to remove all visible material.
- 3.6.7 Carefully place asbestos waste in inner bag of asbestos waste receptor. Clean inner bag surface of gross contamination and place in clean 6 mil outer bag. If waste is likely to

tear inner bag, then instead of outer bag use fibre or metal drum, cardboard or wood box, or other suitably sturdy container.

- 3.6.8 After wet-sponging or vacuuming to remove visible asbestos, wet clean entire enclosure. Apply coat of sealer to all surfaces from which asbestos has been disturbed. Apply thinned coat (sufficient to coat all surfaces) to interior of polyethylene enclosure prior to tear down.

3.7 TEAR DOWN OF PROTECTION

- 3.7.1 When dismantling enclosure, carefully roll polyethylene toward centre of enclosure. As polyethylene is rolled away, immediately remove any visible debris with HEPA vacuum.
- 3.7.2 Place polyethylene sheeting seals, tape, cleaning material, coveralls, and other contaminated waste in asbestos waste receptors for transport. Remove any debris fallen behind plastic with HEPA vacuum.
- 3.7.3 Clean up asbestos waste receptors and equipment used in work, and remove from asbestos work area(s) via drum and equipment decontamination enclosure systems, at appropriate time in sequence. Double bag waste immediately prior to transport from site to disposal bin.
- 3.7.4 Final review may be carried out by Owner's Consultant to ensure no dust or debris remains.

3.8 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

- 3.8.1 When clean-up is complete reinstall items removed to facilitate asbestos related operation, in their proper positions. Reconstruction and reinstallation shall be by tradesmen qualified in work being reinstalled or reconstructed.
- 3.8.2 At completion of work make good all damage not identified in pre-removal survey referred to in para. 1.7.1.4.

3.9 AIR MONITORING

- 3.9.1 Owner's Consultant may arrange for air samples to be taken from commencement of work until completion of cleaning operations, both inside and outside of asbestos work area(s) enclosures in accordance with NIOSH methods.
- 3.9.2 If air sampling is conducted, results of phase contrast microscopy analysis of the sample(s) must be lower than the criteria of 0.01 fibers/cc.

3.10 INSPECTION

- 3.10.1 From commencement of work until completion of clean-up operations, Clients Consultant may be present.

3.10.2 If visual inspection indicates that areas outside current asbestos work area enclosures are contaminated these areas are to be cleaned in same manner as that applicable to asbestos work areas, at no cost to Client.

3.10.3 Pay cost to provide re-inspection of work found not to be in accordance with these specifications and requirements of authorities having jurisdiction.

3.11 WASTE TRANSPORT AND DISPOSAL

3.11.1 Conform to requirements of Regulation 347 as amended by 234/11, made under Environmental Protection Act for Waste Management, transporting and disposal of hazardous waste.

3.11.2 Obtain Certificate of Approval from Ministry of Environment for waste management disposal system for asbestos.

3.11.3 Check with dump operator to determine type of waste containers acceptable.

3.11.4 Ensure shipment of containers to dump is taken by waste hauler licensed to transport asbestos waste.

3.11.5 Each load requires completion of bill of lading showing type and weight of hazardous waste being transported.

3.11.6 Co-operate with Ministry of Environment inspectors and immediately carry out instructions for remedial work at dump to maintain environment, at no additional cost to Owner.

3.11.7 Ensure dump operator is fully aware of hazardous material being dumped.

End of Section

1 **PART 1 - GENERAL**

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to Sections of Division 1 as applicable.

1.2 **RELATED WORK**

1.2.1 Friable Asbestos Removal: Section 02 13 82, Type 2 Asbestos Removal

1.2.2 Lead Disturbance Procedures: Section 02 13 85

1.2.3 Silica Disturbance Procedures: Section 02 13 86

1.2.4 Mercury Removal Procedures: Section 02 13 87

1.3 **DESCRIPTION OF WORK**

1.3.1 Types of asbestos present: Chrysotile present within pipe insulation, pipe fitting insulation, duct insulation and textured plaster finishes.

1.3.2 Friable asbestos containing materials to be removed utilizing Type 3 operations. Type 2 operations can be applied for the repair of friable materials or, removal of less than 1 square metre of friable asbestos containing materials.

1.3.3 Asbestos-containing materials identified can be found within the Safetech Environmental Limited report titled "*Hazardous Building Materials Assessment – Stairway Fire Separation Project, Stairways # 1-5, 25-55 St. Clair Avenue East, Toronto, Ontario*" issued December 2, 2013.

1.3.4 Perform asbestos removal by full enclosure method.

1.3.5 Seal surfaces from which asbestos has been removed and surfaces potentially contaminated with asbestos, with sealer.

1.3.6 Maintain only emergency electrical and mechanical services passing through asbestos work area. All other services must be deactivated during abatement work.

1.3.7 All work will be subject to inspection and air monitoring inside and outside asbestos work area by the Owner's Consultant. Any contamination of surrounding areas, indicated by visual inspection or air monitoring, shall necessitate complete cleanup of affected areas at no additional cost to the Owner.

1.3.8 Protect surfaces remaining within asbestos work area.

1.4 **DEFINITIONS**

1.4.1 **HEPA Filter:** High Efficiency Particulate Aerosol filter at least 99.97 percent efficient in collecting 0.3-micrometer aerosol.

- 1.4.2 **Friable Material:** Material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled pulverized or powdered.
- 1.4.3 **Polyethylene Sheeting:** Polyethylene sheeting of 0.15 mm (6 mil) minimum thickness with tape seals along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous membrane protection.
- 1.4.4 **Asbestos Work Area(s):** Area(s) where work takes place which will, or may, disturb asbestos-containing material, including overspray and fallen material, or settled dust that may contain asbestos.
- 1.4.5 **Curtained Doorway:** Device to allow ingress or egress from one room to another while permitting minimal air movement between rooms, typically constructed by placing 2 overlapping sheets of polyethylene sheeting (2 sheets of polyethylene sheeting per flap) attached to head and one jamb of existing or temporarily constructed door frame. Secure vertical edge of 1 flap along 1 vertical side of doorframe and vertical edge of other flap along opposite vertical side of doorframe. Reinforce free edges of polyethylene sheeting with duct tape.
- 1.4.6 **Negative Pressure:** Reduced pressure within asbestos work area(s) established by extracting air directly from work area, and discharging it directly to exterior of building. Discharged air first passes through HEPA filter. Extract sufficient air to ensure constant reduced pressure at perimeter of work area with respect to surrounding areas.
- 1.4.7 **DOP Test:** A testing method employing dioctyl phthalate aerosol for purpose of leak testing negative air units. **For this project, provide documentation that negative air units have been DOP tested within the last thirty days.**
- 1.5 **REGULATIONS**
- 1.5.1 Comply with Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations made under The Occupational Health and Safety Act, Ontario Regulation 278/05 and local requirements pertaining to asbestos, provided that in case of conflict with these Specifications. Most stringent requirements shall apply.
- 1.5.2 Handle and dispose of contaminated waste as required under Ontario Regulation 347/90, as amended by O. Reg. 234/11, General Waste Management made under The Environmental Protection Act.
- 1.5.3 Not later than ten days before commencing asbestos work on this project, notify in writing Ontario Ministry of Labour, Construction Health and Safety Branch located nearest to the area the abatement is being conducted. The information provided to the Ontario Ministry of Labour must comply with the requirements outlined in Section 11, subsection 3 of Ontario Regulation 278/05. Orally notify them before commencing work.
- 1.5.4 Notify sanitary landfill site in accordance with requirements of Ontario Regulation 347/90, as amended by O. Reg. 234/11, General Waste Management.
- 1.5.5 Contractor shall ensure that:

- 1.5.5.1 Measures and procedures prescribed under the Occupational Health & Safety Act and regulations are carried out.
- 1.5.5.2 Every employee and every worker on project complies with applicable act and regulations.
- 1.5.5.3 Health & safety of workers and public is protected.
- 1.5.5.4 All material handling, and associated equipment conform to and are operated in accordance with "Workplace Hazardous Materials Information System" (WHMIS).
- 1.5.5.5 Advise the Owner whenever work is expected to be hazardous to employees and/or public.
- 1.5.6 Contractor may be requested to provide information on their health & safety record.

1.6 **QUALITY ASSURANCE**

- 1.6.1 Ensure work proceeds to schedule, and meets all requirements of this Section. Perform work so that airborne asbestos, asbestos waste, or water runoff do not contaminate areas outside asbestos work enclosure.
- 1.6.2 Pay cost to the Owner of inspection and air monitoring performed as result of failure to perform work satisfactorily regarding quality, safety, or schedule.
- 1.6.3 Use only skilled and qualified workers for all trades required for this work.

1.7 **SUBMITTALS**

- 1.7.1 Before commencing work
- 1.7.2 Obtain and submit all necessary permits for transporting and disposal of asbestos waste.
- 1.7.3 Notice of Project and/or Notice to Inspector issued by the Ontario Ministry of Labour for the planned work.
- 1.7.4 Submit names of supervisory personnel who will be responsible for asbestos work area(s). One of these supervisors must remain on Site at all times asbestos removal or clean-up is occurring. Submit proof that supervisory personnel have attended training course on asbestos control (2 day minimum duration) and have performed supervisory function on at least 2 other asbestos removal projects.
- 1.7.5 Submit proof that all workers conducting abatement activities have successfully completed the Asbestos Abatement Worker Training Program approved by the Ministry of Training, Colleges and Universities and supervisors conducting abatement activities have successfully completed the Asbestos Abatement Supervisor Training Program approved by the Ministry of Training, Colleges and Universities as outlined in Section 20 of Ontario Regulation 278/05.

- 1.7.6 Submit list of existing damage for acceptance.
- 1.7.7 Laws of province of Ontario shall govern this work. Contractor shall observe all such laws and shall obtain and/or pay all permits, notices, fees, taxes, duties as may be required. Likewise, it is responsibility of contractor to comply with Workers Safety and Insurance Board and Occupational Health and Safety Act.
- 1.7.8 Before commencing any work, Contractor shall submit, in writing, confirmation of good standing with Workplace Safety and Insurance Owner (WSIB).
- 1.8 **WORKER AND VISITOR PROTECTION**
- 1.8.1 **Instructions:** Before entering asbestos work area, instruct workers and visitors in use of respirators, dress, showers, entry and exit from asbestos work areas, and all aspects of work procedures and protective measures. Instruction shall be provided by Competent Person as defined by Occupational Health and Safety Act.
- 1.8.2 **Full Face Respirator:** During wet removal and cleanup in enclosed asbestos work area workers, supervisors, and authorized visitors shall be supplied with and use air-purifying full-face respirator (APR) with HEPA cartridge filter. Replace filters daily or test according to manufacturer's specifications and replace as indicated. Respirators shall be acceptable to Occupational Health Branch of Ministry of Labour. Provide proper instruction to workers and visitors in use of respirators, including qualitative fit testing. Maintain respiratory protection equipment in proper functioning and clean condition.
- 1.8.3 **Protective Clothing:** Provide workers and visitors in full-enclosure sites with full body coveralls with integral hoods. Once coveralls are worn in asbestos work area, dispose of as contaminated waste. Workers and visitors shall wear other protective apparel required by Ministry of Labour regulations.
- 1.8.4 Before entering full-enclosure asbestos work area(s) remove street clothes in clean change room and put on respirator with new or tested filters, clean coveralls and head covers before entering equipment and access areas or asbestos work area. Store street clothes, uncontaminated footwear, towels etc. in clean change room.
- 1.8.5 Persons leaving full-enclosure asbestos work area(s) shall remove gross contamination from clothing before leaving asbestos work area. Proceed to equipment and access area and remove all clothing except respirator. Place contaminated work suit in receptacles for disposal with other asbestos contaminated materials. Footwear, clothing, hardhats, protective eyewear, etc., shall be left in equipment and access area to dry for later use. Still wearing respirator proceed naked to showers. Clean respirator to ensure that visible contamination is removed. After having thoroughly washed hair and body with shampoo and soap, remove respirator. Remove filters and dispose of in container provided for this purpose or test filters according to manufacturer's recommendation. Dispose of filters as necessary. Wet clean inside of respirator. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or clean before removing from equipment and access area, or carry in sealed plastic bag to next site.
- 1.8.6 Following showering, proceed to clean change room, dry off and dress in street clothes. Store respirators in fashion to allow them to be put on prior to entering asbestos work

area at start of next shift without contaminating clean area. If re-entry to asbestos work area is to take place after having left for eating or drinking, follow procedures in para. 1.8.5.

- 1.8.7 Removal of waste and equipment from holding room of waste decontamination enclosure system shall be performed by workers entering from outside. These workers shall wear clean coveralls and half-face, asbestos approved, respirator as specified in para 1.8.2 and 1.8.3. No worker shall use this system as means to leave or enter asbestos work area.
- 1.8.8 Do not eat, drink smoke or chew gum or tobacco at work site. Tobacco products are not allowed on property.
- 1.8.9 Workers and visitors shall be fully protected as specified herein when possibility of disturbance of asbestos exists.

2 PART 2 - PRODUCTS

2.1 MATERIALS

- 2.1.1 **Polyethylene:** 0.15 mm (6 mil) minimum thickness unless otherwise specified.
- 2.1.2 **Rip-Proof Polyethylene:** 0.20 mm (8 mil) fabric made up from 0.13 mm (5 mil weave and 2 layers 0.04 mm (1.5 mil).
- 2.1.3 **Tape:** Tape suitable for sealing polyethylene to surface encountered, under both wet conditions using amended water, and dry conditions.
- 2.1.4 **Wetting Agent:** Non-foaming surface active agent; mixed with water in concentration to provide thorough wetting of asbestos fibre: Standard of Acceptance, Asbesto-Wet, distributed by Asbetec Distributors, or equivalent.
- 2.1.5 **Amended Water:** Water with wetting agent added.
- 2.1.6 **Asbestos Waste Receptors:** Two separate containers of which 1 shall consist of 0.15 mm (**true 6 mil**) minimum thickness sealable polyethylene bag. Other container may be 0.15 mm (**true 6 mil**) minimum thickness polyethylene bag. Outer container shall be adequate to prevent perforating rips, or tears during filling, transport or disposal. Containers must be acceptable to disposal site selected, and the Ministry of Environment, and shall be clearly marked to indicate that contents contain asbestos.
- 2.1.7 **Sealer:** Sealer for purpose of trapping residual fibre debris. Product must have flame spread and smoke development ratings both less than 25. Product shall leave no stain when dry: Standard of acceptance - TC-55 (clear), A/D Fire Protection Systems Inc., Scarborough, Ontario, or equivalent. For mechanical equipment, piping and boilers, etc. use high temperature sealer only: Standard of acceptance - Chil-Abate CP210, Childers Products Company, or equivalent.
- 2.1.8 **Ground Fault Panel:** Portable electrical panel equipped with ground fault circuit interrupters (5 mA protection) of sufficient capacity to power all electrical equipment and

lights in asbestos work enclosure. Panel complete with ground fault interrupter lights, test switch to ensure unit is working, and reset switch

- 2.1.9 **HEPA Vacuum:** Vacuum with all necessary fittings, tools and attachments. Air must pass HEPA filter before discharge.
- 2.1.10 **Protective Coveralls:** Disposable full body coveralls complete with elasticized hoods made of spun polyolefin material Tyvek by Dupont or nonwoven material Kleenguard by Kimberley Clark.
- 2.1.11 **Flexible ducting:** Metal reinforced flexible ductwork, 12" diameter minimum.
- 2.1.12 **Negative Air Unit:** Portable air handling system, which extracts air directly from asbestos work area and discharges air outside building. Unit shall be fitted with prefilter and HEPA final filter. Air shall pass HEPA filter before discharge. Unit shall have pressure differential gauge to monitor filter loading. Unit shall have auto shut-off and warning system for HEPA filter failure. HEPA filter shall have separate hold down clamps to retain filter in place.
- 2.1.13 **Power Sprayer:** Standard of acceptance - Graco Maxi-wetter, or equivalent.
- 2.1.14 **Encapsulant:** Standard of acceptance - Ocean No. 666, Ocean Fire Retardants Inc., or equivalent, coloured bright red.

PART 3 - EXECUTION

3 PREPARATION

- 3.1 Full-enclosure Asbestos Work Area(s).
 - 3.1.1 The Owner will move equipment, tools, furnishings, and stored materials that can be moved without disturbing asbestos-containing materials.
 - 3.1.2 Request building personnel to deactivate air handling and ventilation systems supplying or exhausting from asbestos work area(s).
 - 3.1.3 All wall and horizontal surfaces shall be pre-cleaned using damp cloth or sponge techniques prior to placement of polyethylene sheeting to any wall or floor surfaces. H.E.P.A. equipped vacuum cleaners may also be used to perform this task.
 - 3.1.4 If necessary, caulk and seal ducts and duct shafts to remain in service as required, to make airtight. Cut and cap supply ducts with rigid sheet metal caps and seal. Perform work at appropriate time under contaminated conditions if necessary.
 - 3.1.5 Seal off openings such as doorways, windows, vents, service holes in walls and grilles to non-operating ducts with polyethylene sheeting with tape or with polyurethane foam as appropriate.
 - 3.1.6 Cover wall and floor surfaces with polyethylene sheeting sealed with tape. Provide two separately sealed layers of reinforced polyethylene sheeting. Separately seal floor

drains or openings. Use sufficient layers (2) and necessary sheathing for walking surface to protect floors which may be damaged. Cover floors first so that polyethylene extends at least 300 mm (12") up walls then cover walls to overlap floor sheathing. Provide additional protection for floors likely to be damaged by amended water, by covering floor with rip-proof polyethylene sheathing sealed with tape.

- 3.1.7 Cover with polyethylene sheathing, motors, heating units, fire apparatus, door closers, benches, shelving, storage racks, valves, taps, controllers, lights, and other fixtures and furnishings which are not being removed from asbestos work area and which could be damaged and/or which cannot be readily cleaned at completion of this work. Pre-clean surfaces potentially contaminated with asbestos, with HEPA vacuum or damp cloth prior to installing protection.
- 3.1.8 Install plywood enclosures, covered with rip-proof polyethylene sheathing to protect equipment or fixtures in asbestos work area(s) that may be damaged.
- 3.1.9 Establish negative pressure in asbestos work area as described in Para. 1.4.7. Negative pressure units shall have total rated capacity with filters in place sufficient to provide minimum 1 air change every 20 minutes in wet removal sites. Volume of air shall be sufficient to ensure airflow is maintained from clean areas into asbestos work area. Vent units to outside of building by removing, and later replacing, windows, and/or providing flexible ducting. Locate vents to discharge air away from building access points or sidewalks. Do not discharge air into building interior without obtaining approval from The Owner's Consultant. Leak test negative air units prior to commencement of abatement at operating position, using DOP method. Provide reports for unit efficiency test results within 48 hours of testing, including calibration certificates for testing equipment. Venting of exhaust air through occupied area shall be in rigid airtight ductwork. Operate negative pressure units continuously from this time until completion of final air monitoring. Replace pre-filters as necessary to maintain airflow. Maintain negative air pressure of 5 Pascal (0.02 inches water column) pressure reduction within asbestos enclosure with respect to surrounding areas.
- 3.1.10 Maintain emergency and fire exits from asbestos work area, or establish alternative exits satisfactory to authorities having jurisdiction.
- 3.1.11 Ensure existing power supply to asbestos work area is isolated and disconnected where necessary. Do not disrupt power supply to remaining areas of building. Provide ground fault electrical system where application of amended water is required for wetting asbestos containing materials. Supply all electrical apparatus from this ground fault system. Ensure safe installation of electrical lines and equipment.
- 3.1.12 Provide temporary lighting in asbestos work area to levels that will permit work to be done safely and well.
- 3.1.13 Provide fire extinguisher at each emergency exit, and in decontamination facilities. Protect extinguishers with polyethylene sheathing in manner that will not hamper emergency use.

3.2 WORKERS' DECONTAMINATION ENCLOSURE SYSTEM

- 3.2.1 Construct workers' decontamination enclosure at entrance to each asbestos work area. Worker decontamination enclosure system shall comprise three interconnecting rooms as follows:
- 3.2.2 Provide a set of curtain doorways between each room, and at both dirty and clean entrances to enclosure systems.
- 3.2.3 **Equipment and Access Room:** Build room between shower room and asbestos work area. Install waste receptor, and storage facilities for worker's shoes and any protective clothing to be reworn in asbestos work areas. Equipment and access room shall be large enough to accommodate specified facilities, and other equipment needed, and at least one worker allowing sufficient space to undress comfortably. Minimum size 3 square metres (30 sq. ft.).
- 3.2.4 **Shower Room:** Build room between clean room and equipment and access room. Provide constant separate supplies of hot and cold water. Provide valves controllable at shower(s) to regulate water temperature. Provide rigid piping with watertight connections and connect to water sources and drains. Provide soap, clean towels and appropriate containers for disposal of used respirator filters. Direct wastewater to sanitary sewer drains via water filtering system consisting of a minimum 2-stage filtering system (25-micron and 5-micron filters).
- 3.2.5 **Clean Room:** Build room between shower room and clean areas outside of enclosures. At doorway to clean room, provide vented wood door, with locking passage set. Provide hangers for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install water heater, if required.
- 3.3 **WASTE AND EQUIPMENT DECONTAMINATION ENCLOSURE SYSTEM**
- 3.3.1 Construct system comprised of three linked rooms: Purpose of this system is to provide means to decontaminate drums, scaffolding, material containers, vacuum and spray equipment; and other tools and equipment for which worker decontamination system is not suitable. Provide curtain doorways between rooms, and at both dirty and clean entrances to Enclosure System.
- 3.3.2 **Staging Area:** Build staging area in asbestos work area for gross removal of dust and debris from waste containers and equipment, labeling and sealing of waste containers, and temporary storage pending removal to container cleaning room.
- 3.3.3 **Container Cleaning Room:** Build container cleaning room between staging area and holding room. Room shall be of sufficient size to allow proper washing of equipment and drums or double bagging of asbestos waste. Treat wash water as asbestos contaminated waste.
- 3.3.4 **Holding Room:** Build holding room between container cleaning room and uncontaminated area. Holding room shall be of sufficient size to accommodate largest item of equipment used and ten waste containers.
- 3.4 **CONSTRUCTION OF DECONTAMINATION ENCLOSURES**

- 3.4.1 **Floor:** Prior to erecting wall framing, lay 1 sheet of rip-proof polyethylene sheeting over floor area to be covered by enclosures. Turn 600 mm (24") of rip-proof polyethylene sheeting up outside of enclosure, overlapping with polyethylene sheeting covering perimeter walls. Provide second layer of rip-proof polyethylene sheeting to all floors, extending 600 mm up inside of enclosure walls.
- 3.4.2 **Walls:** Build load-bearing walls of 39 mm x 89 mm (2" x 4") wood framing, 400 mm (16") o.c. with continuous top and sill plates. Cover both sides walls with polyethylene sheeting. Walls exposed to asbestos work area shall be covered with min. 9 mm (3/8") plywood sheeting or hardboard. Caulk seal and tape plywood joints. Walls exposed to occupied area shall be covered with good one side 9 mm plywood.
- 3.4.3 **Roof:** Size of joists shall be determined by span, loads, use and Code. Use as a minimum 39 mm x 138 mm (2" x 6") joists. Cover joists with 19 mm (3/4") plywood sheeting. Seal and tape joints, and cover with two layers of rip-proof polyethylene sheeting. At underside of joists install one layer of polyethylene sheeting.
- 3.4.4 **Doorways:** Build curtain doorways designed so that when workers or drums and equipment move through doorway, one of two barriers comprising doorway always remains closed.

3.5 MAINTENANCE OF ENCLOSURES

- 3.5.1 Maintain enclosures in tidy condition.
- 3.5.2 Ensure barriers and polyethylene sheeting linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.
- 3.5.3 Visually inspect enclosures at beginning and end of each working period.

3.6 DO NOT COMMENCE ASBESTOS REMOVAL WORK UNTIL

- 3.6.1 Arrangements have been made for disposal of waste.
- 3.6.2 Asbestos work areas and decontamination enclosures are effectively segregated. Negative pressure equipment is operating continuously.
- 3.6.3 Tools, equipment and waste materials receptors are on hand.
- 3.6.4 Arrangements have been made with The Owner's Consultant for work area security.
- 3.6.5 Signs are displayed in areas where access to sealed asbestos work area is possible. Signs shall read:

CAUTION

Asbestos Hazard Area
No Unauthorized Entry
Wear assigned protective equipment
Breathing asbestos dust may cause serious bodily harm.

- 3.6.6 Proof of notification to Ministry of Labour has been submitted.
- 3.6.7 The Owner's Consultant has been notified of intention to proceed and has reviewed enclosures, equipment and procedures.
- 3.7 **CONTAMINATED PREPARATION FOR FULL-ENCLOSURE ASBESTOS WORK AREA**
- 3.7.1 Before performing any contaminated work, prepare site as described in articles 3.1, 3.2, 3.3, 3.4, 3.5, and 3.6. Perform work of 3.7.2 and 3.7.3 with air handling system disabled and during quiet hours.
- 3.7.2 Using full protective procedures including amended water and HEPA vacuum, install upper seals as necessary to allow polyethylene sheeting to be fastened to structure. Each of two sheets forming wall of enclosure shall be fastened separately to deck using tape, spray adhesive, rapid setting foam or other suitable method. Provide suitable framing to support polyethylene sheeting. Seal holes in existing perimeter walls, columns, deck etc., to ensure an airtight asbestos work area.
- 3.7.3 Promptly seal holes or penetrations in structure above ceiling, ducts, etc. to provide airtight enclosure around asbestos work area(s).
- 3.7.4 Protect electrical, communication, life safety and control systems to remain in place in asbestos work area with polyethylene sheeting.
- 3.7.5 Seal joints and holes in uninsulated HVAC ductwork to remain operational through an asbestos work area, using tape and rip-proof polyethylene sheeting.
- 3.8 **REMOVAL**
- 3.8.1 In areas of wet removal of spray or trowel applied material, spray asbestos with amended water using airless spray equipment. Saturate asbestos to prevent release of airborne fibres during removal. Fully saturated asbestos may be scraped directly into waste containers or may be allowed to fall to floor.
- 3.8.2 Remove asbestos-containing mechanical insulation in layers, while maintaining all exposed surfaces of insulation or lagging in wet condition. Full saturation of insulation will not be required if material is immediately bagged and not allowed to fall to floor.
- 3.8.3 Following bulk removal of above noted asbestos containing materials, demolish section(s) of mechanical systems as required to access asbestos-containing material. Bag all waste and dispose of as asbestos waste.
- 3.8.4 Seal ends of pipe insulation at perimeters of asbestos work area with heavy coat of high temperature sealer.
- 3.8.5 Place asbestos waste into asbestos waste receptors. Double polyethylene bags are to be used, inner bag shall be cleaned of gross contamination and placed in a clean **6 mil** outer polyethylene bag in container cleaning room immediately prior to transfer from

Site.

- 3.8.6 Treat all materials removed to expose asbestos, as asbestos-contaminated waste unless such materials are specified to be re-used.

3.9 **CLEAN-UP**

- 3.9.1 Clean surfaces from which asbestos has been removed with brushes and vacuum or wet-sponge to remove visible dust and debris.

- 3.9.2 Remove sealed and labeled asbestos waste receptors and dispose of in authorized disposal area in accordance with requirements of disposal authority.

- 3.9.3 After brushing and wet-sponging to remove visible asbestos, wet clean entire asbestos work area including equipment and access area, polyethylene sheeting and equipment used in process. Floor and wall surfaces, ducts, and similar items not covered with polyethylene sheeting must be wet cleaned.

- 3.9.4 Request visual inspection and acceptance. Following inspection and acceptance, apply heavy coat of slow drying sealer to all surfaces from which asbestos has been removed. Apply thinned coat (sufficient to coat all surfaces) to other surfaces in asbestos work area including all polyethylene sheeting and surfaces scheduled for demolition. Allow minimum of 12 hours flushing time with no disturbance of asbestos work area. Operate negative air units during this period.

3.10 **DISMANTLING OF PROTECTION**

- 3.10.1 If air sampling by The Owner's Consultant shows that levels in asbestos work area do not exceed 0.01 fibres/cc. as determined by NIOSH 7400 Method, A counting rules, proceed with final dismantling of enclosure.

- 3.10.2 Remove polyethylene sheeting exposed during contaminated work including upper surfaces plus any underlying sheeting contaminated by water leaks, rips, tears, or exposed by failure of upper layer. Wear half face piece respirator and disposable coveralls during removal of sheeting. Carefully roll sheeting away from walls to centre of asbestos work area. As sheeting is rolled away from walls and corners, HEPA vacuum visible debris.

- 3.10.3 While removing top layer of sheeting from surfaces protected by two layers of sheeting, cut lower sheeting so as to expose horizontal surfaces that may be contaminated with asbestos debris. HEPA vacuum any visible debris.

- 3.10.4 Place polyethylene sheeting, seals, tape, cleaning material, clothing, and other contaminated waste in asbestos waste receptors for transport. Remove with HEPA vacuum any debris which may have fallen behind sheeting.

- 3.10.5 Clean asbestos work area(s), equipment and access area, washing/showering room, and other enclosures that may have been contaminated during work.

3.10.6 Clean asbestos waste receptors and equipment used in work and remove from asbestos work area(s) via drum and equipment decontamination enclosure system, at an appropriate time in sequence.

3.10.7 Remove hoardings, temporary lighting, equipment and facilities provided for work. A final review may be carried out by the Owner's Consultant to ensure that no dust or debris remains. Asbestos abatement contractor responsible for inspecting and cleaning all adjacent spaces to the asbestos abatement work area. Adjacent work areas to be left free of construction related dust and debris.

3.11 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

3.11.1 When cleanup is complete re-establish mechanical and electrical systems to remain operative in proper working order. Arrange for, and pay costs of electrical or mechanical repairs needed due to work of this Section.

3.11.2 Make good all damage at completion of work not identified in pre-removal survey.

3.12 AIR MONITORING

3.12.1 The Owner's Consultant will arrange for air samples to be taken from commencement of work until completion of cleaning operations, both inside and outside of asbestos work area(s) enclosures in accordance with NIOSH methods or with Fibrous Aerosol Monitor manufactured by MIE Inc., Bedford, Mass. The Owner's Consultant for this project will be Safetech Environmental Limited.

3.12.2 If air monitoring or visual inspection shows that areas outside current asbestos work area(s) enclosure or decontamination facilities are contaminated above 0.01 fibre/cc., clean these areas in same manner as that applicable to asbestos work areas, at no cost to the Owner.

3.12.3 Air clearance sampling will be done in accordance with O. Reg. 278/05. The air clearance sampling will be conducted following aggressive air sampling methods as outlined in US Environmental Protection Agency "Guidance for Controlling Asbestos-Containing Materials in Buildings – Published June 1985 – Appendix M – Section M.1.5". All equipment required for aggressive air sampling (other than pumps for samples) will be provided by contractor conducting abatement work. A minimum of 2,400 L of air will be collected for each sample. An abatement area is deemed clear only if every air sample collected within the affected area has a concentration of fibres that does not exceed 0.01 fibres/cc. The number of air clearance samples to be collected are based on Ontario Regulation. 278/05, Table 3.

3.12.4 If air monitoring in work areas shows airborne fibre levels exceed normal levels for wet removal, workers shall use positive pressure supplied air respirators with full-face piece.

3.12.5 If final air sampling by the Owner's Consultant shows that levels in completed asbestos work area do not exceed 0.01 fibres/cc. as determined by NIOSH 7400 Method - "A" counting rules, proceed with dismantling of enclosures.

3.12.6 Clearance level is < 0.01 f/cc.

3.13 INSPECTION

3.13.1 From commencement of work until completion of clean-up operations, the Owner's Consultant will be present on a full time basis; both inside and outside asbestos work area(s). The Owner's Consultant for this project will be Safetech Environmental Limited.

3.13.2 If asbestos work area(s) or adjacent areas are found unacceptable in accordance with standards specified or required by authorities having jurisdiction, correct such deficiencies at no cost to the Owner.

3.13.3 Pay cost to provide re-inspection of work found not to be in accordance with these specifications and requirements of authorities having jurisdiction.

3.14 WASTE TRANSPORT AND DISPOSAL

3.14.1 Conform to requirements of Regulation 347/90 as amended by O. Reg. 326/03 - General Waste Management under Environmental Protection Act for Waste Management, transporting and disposal of hazardous waste.

3.14.2 Check with dump operator to determine type of waste containers acceptable.

3.14.3 Ensure shipment of containers to dump is taken by waste hauler licensed to transport asbestos waste. Waste hauler in possession of valid Ministry of Environment Certificate of Approval to transport asbestos waste.

3.14.4 Each load requires completion of bill of lading showing type and weight of hazardous waste being transported. Provide copies of bill of lading indicating acceptance of waste at landfill.

3.14.5 Co-operate with Ministry of Environment inspectors and immediately carry out instructions for remedial work at dump to maintain environment, at no additional cost to the Owner.

3.14.6 Ensure dump operator is fully aware of hazardous material being dumped.

3.14.7 Ensure that containers used for dumping are locked and covered at all times.

END OF SECTION

1 PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Conform to Sections of Division 1 as applicable.

1.2 RELATED WORK

1.2.1 Friable Asbestos Removal: Section 02 13 83, Type 3 Asbestos Removal

1.2.2 Friable Asbestos Removal: Section 02 13 82, Type 2 Asbestos Removal

1.2.3 Silica Disturbance Procedures: Section 02 13 86

1.2.4 Mercury Removal Procedures: Section 02 13 87

1.3 SITE CONDITIONS

1.3.1 Paints containing lead in excess of 0.009% by dry weight are suspected to be present on plaster walls and ceilings and will be, or potentially will be, disturbed during the course of renovation activities.

1.4 DESCRIPTION OF WORK

1.4.1 Disturbance of Lead Based Building Materials:

1.4.1.1 Stabilize any loose and flaking paint and HEPA vacuum any paint flake debris encountered prior to initializing demolition activity and on surfaces scheduled to remain (ie: precast concrete ceiling, ducts, etc) that are not part of demolition within the designated work areas. For locations and quantities present in project areas, please refer to Safetech Environmental Limited "*Hazardous Building Materials Assessment – Stairway Fire Separation - Stairways # 1-5, 25-55 St. Clair Avenue East, Toronto, Ontario*" issued December 2, 2013

1.4.1.2 Loose and flaking paint to be removed and all surfaces stabilized to prevent further flaking. This work may be performed using drop sheets and utilizing polyethylene enclosures ensuring that all lead related work is contained to prevent the spread of lead containing particles. Paint flakes may be HEPA vacuumed directly into vacuum or scraped off surfaces using hand scraper. All waste to be bagged and labelled for proper disposal. All lead related work to be conducted in accordance with Type 2a procedures outlined in the Ministry of Labour guideline, "Lead on Construction Projects" dated April 2011.

1.4.2 Remove lead dust, clean and decontaminate all surfaces within work area.

1.4.3 Work area surfaces may be HEPA vacuumed with vacuum cleaner contents collected and disposed of as hazardous waste.

1.4.4 Dispose of all waste as lead contaminated including insulation, polyethylene drop sheets, coveralls, respirator filters, and all porous materials that cannot be properly cleaned and decontaminated.

1.4.5 This sequence to be repeated for each section of work.

1.5 REFERENCES/REGULATIONS

1.5.1 Comply with Federal, Provincial and local authority requirements. The more stringent requirements shall apply in the event of a conflict with any particular authority or jurisdiction. Regulations and Guidelines include:

1.5.2 Regulations made under the Occupational Health and Safety Act, Revised Statutes of Ontario, 1990, Chapter O.1 as amended.

1.5.3 The Occupational Health and Safety Act, Regulation for Construction Projects, O. Reg. 213/91, amended to O. Reg. 96/11.

1.5.4 The Occupational Health and Safety Act, Regulation Respecting Lead, O. Reg. 490/09.

1.5.5 Ministry of Labour Guideline regarding Lead on Construction Projects, April 2011.

1.5.6 Ministry of Environment, Regulation 347/90 amended to 234/11 for disposal of hazardous waste.

1.6 DEFINITIONS

1.6.1 **Authorized Visitor(s):** Owner's Consultant or persons representing regulatory agencies, and person(s) authorized by either of them

1.6.2 **Work Area(s):** Area(s) where work takes place which will, or may disturb lead paint and lead dust.

1.6.3 **HEPA Filter:** High Efficiency Particulate Aerosol filter at least 99.97 percent efficient in collecting 0.3-micrometer aerosol.

1.6.4 **HEPA Vacuum:** High Efficiency Particulate Aerosol filtered vacuum equipment acceptable to local provincial Ministry of Labour, and Health Canada. Ensure vacuums are equipped with hoses, fittings, and nozzle attachments. Maintain vacuum equipment and system properly.

1.6.5 **Polyethylene Sheeting:** Polyethylene sheeting of 0.15 mm (6 mil) minimum thickness with tape seals along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous polyethylene membrane protection.

1.6.6 **Peel Away 1:** Chemical product for removing paints and other adhesives manufactured by Dumond Chemical Inc., 1501 Broadway, New York, NY 10036, or equivalent.

1.6.7 **Work Area:** Polyethylene enclosed portion of work area where disturbance of lead containing paint and generated dust to take place.

1.7 SUBMITTALS

1.7.1 Submit names of supervisory personnel who will be responsible for Lead abatement

work area(s). One of these supervisors must remain on site at all times while lead paint disturbance, removal or cleanup is occurring. Submit proof that supervisory personnel have attended training course on lead control and have performed supervisory function on at least 2 other lead removal projects of similar size of this project.

- 1.7.2 Proof of worker training for lead abatement work.
- 1.7.3 Proof of worker training for fall arrest and proper use of safety harness assembly and equipment.
- 1.7.4 Certificates indicating each worker has had proper respirator fit test for the respirator appropriate for work being performed.
- 1.7.5 Written determination from an occupational physician for each worker stating that the worker is fit to perform lead abatement work and is capable of performing work wearing specified respiratory protection. Each worker should also be enrolled in a lead surveillance program.
 - 1.7.5.1 Submit prior to commencement of work and at completion of project, blood test results for all workers who have had a minimum of 5 days lead exposure on the project. Results must be made available for review by Owner's Consultant.
- 1.7.6 Submit list of existing damage for acceptance.
- 1.7.7 Laws of province of Ontario shall govern this work. Contractor shall observe all such laws and shall obtain and/or pay all permits, notices, fees, taxes, and duties as may be required. Likewise, it is the responsibility of contractor to comply with Workplace Safety and Insurance Board (WSIB).
- 1.7.8 Before commencing any work, Contractor shall submit, in writing, confirmation of good standing with Workplace Safety and Insurance Board (WSIB).
- 1.7.9 Submit proposed schedule showing phasing and scheduling.
- 1.7.10 Submit proof satisfactory to Owner's Consultant that suitable arrangements have been made to dispose of lead containing waste in accordance with requirements of authority having jurisdiction.
- 1.7.11 **Instruction and Training**
 - 1.7.11.1 Before commencing work provide satisfactory proof that every worker has had instruction and training in hazards of lead exposure, in personal hygiene and work practices, and in use, cleaning, and disposal of respirators and protective clothing.
 - 1.7.11.2 Instruction and training on respirators includes:
 - Limitations of equipment,
 - Inspection and maintenance of equipment,
 - Fitting of equipment, and disinfecting of equipment.
 - 1.7.11.3 The Abatement Contractor to post on the job bulletin board instructions, procedures and information pertaining to abatement work.

1.8 WORKER AND VISITOR PROTECTION

1.8.1 **Instructions:** Before entering lead removal work area(s), instruct workers and Authorized Visitor(s) in use of respirators, and all aspects of Work procedures and protective measures. Provide instruction by competent person as defined by The Occupational Health and Safety Act.

1.8.1.1 Provide disposable full body coveralls and approved respiratory protection to authorized visitors.

1.8.2 **Respirators:** Provide workers with personally issued and marked half face air purifying respirators with P100 high efficiency (HEPA) cartridge filters. Provide approved respirators to Authorized Visitor(s). Provide sufficient filters and cartridges so workers can install new filters and cartridges following disposal of used filters and cartridges before re-entering contaminated areas. Respirators shall be acceptable to Occupational Health Branch of Ministry of Labour.

1.8.2.1 The Maximum Use Concentration (MUC) of a APR fitted with P100 filters for all work performed inside removal work area is 0.50 mg/m^3 . Should airborne lead concentrations exceed this value, all work must stop and work practices modified to reduce exposure to acceptable levels.

1.8.2.2 Provide instruction in use of respirators, including qualitative fit testing. No worker or Authorized Visitor(s) may have facial hair which prevents proper contact between respirator face-piece and skin. Alternatively, supplied air positive pressure respirator or supplied air positive pressure hood or helmet may be provided. Maintain respirators in proper functioning and clean condition, or remove from Site.

1.8.3 **Protective Clothing:** Workers and Authorized Visitor(s) shall wear disposable full body personal protective apparel including attached head covering. In addition workers are expected to wear nitrile gloves and protective eye goggles as is required by Ministry of Labour construction regulations. Once worn, protective coveralls shall be discarded and disposed of as lead contaminated waste

1.8.4 Do not eat, drink, smoke or chew gum or tobacco in lead removal work area.

1.8.5 Workers and Authorized Visitors shall wash hands and face when leaving lead removal work area. Contractor to provide workers with a designated washroom facility.

1.9 PRODUCTS

1.10 **Polyethylene:** 0.15 mm (6 mil) minimum thickness unless otherwise specified; in sheet size to minimize joints.

1.11 **Rip-Proof Polyethylene:** 0.20 mm (8 mil) fabric made up from 0.13 mm (5 mil weave and 2 layers 0.04 mm (1.5 mil) poly laminate, in sheet size to minimize joints.

1.12 **Tape:** Tape suitable for sealing polyethylene to surface encountered, under both wet conditions using amended water, and dry conditions.

- 1.13 **Waste Receptors:** Two separate containers of which 1 shall consist of 0.15 mm (6 mil) minimum thickness sealable polyethylene bag. Other container may be 0.15 mm (6 mil) minimum thickness polyethylene bag. Other container shall be adequate to prevent perforating rips, or tears during filling, transport or disposal. Containers must be acceptable to disposal site selected, and Ministry of Environment.
- 1.14 **Sprayer:** Garden type, portable manual sprayer, low velocity, capable of producing fine spray.
- 1.15 **Ground Fault Panel:** Portable electrical panel equipped with ground fault circuit interrupters (5 mA protection) of sufficient capacity to power all electrical equipment and lights in Lead work enclosure. Panel complete with ground fault interrupter lights, test switch to ensure unit is working, and reset switch. Installed by licensed electrician.
- 1.16 **HEPA Vacuum:** Vacuum with all necessary fittings, tools and attachments. Air must pass HEPA filter before discharge.
- 1.17 **Protective Coveralls:** Disposable full body coveralls complete with elasticized hoods made of spun polyolefin material Tyvek by Dupont or nonwoven material Kleenguard by Kimberley Clark.
- 1.18 **Power Sprayer:** Graco Maxi-wetter or equivalent, from Hazmasters Environmental, Pickering, Ontario.
- 3 **Execution**
 - 3.1 PREPARATION
 - 3.1.1 Full-Enclosure Lead Work Area(s)
 - 3.1.2 Seal off openings such as doorways, windows, vents, service holes in walls and grilles to non-operating ducts with polyethylene sheeting sealed with tape or with polyurethane foam as appropriate.
 - 3.1.3 Polyethylene enclosure that is impermeable to dust that is supported and secured by structure with sealed joints, and entrances to work area equipped with overlapping tarps as air locks. Existing polyethylene enclosures to be utilized.
 - 3.1.4 Request building personnel to shut off air handling and ventilation systems supplying or exhausting from asbestos work area enclosure(s). Ensure air-handling systems remain shut off for duration of work.
 - 3.1.5 Maintain emergency and fire exits from Lead work area, or establish alternative exits satisfactory to authorities having jurisdiction.
 - 3.1.6 Ensure existing power supply to Lead work area is isolated and disconnected where necessary. Do not disrupt power supply to remaining areas of building. Provide ground fault electrical system when necessary. Supply all electrical apparatus from this ground fault system. Ensure safe installation of electrical lines and equipment.
 - 3.1.7 Provide temporary lighting in Lead work area to levels that will permit work to be done

safely and well.

- 3.1.8 Establish negative pressure in lead work area. Operate negative pressure units or HEPA vacuums continuously from this time until completion of contaminated work.
- 3.1.9 Provide fire extinguisher at each emergency exit, and in decontamination facilities. Protect extinguishers with polyethylene sheeting in manner that will not hamper emergency use.
- 3.1.10 Provide soap, water and towels for washing of worker's face and hands when exiting enclosure.

3.2 **WORKERS' DECONTAMINATION**

- 3.2.1 Construct workers' decontamination system at entrance to lead work area. Worker decontamination enclosure system shall comprise two rooms as follows:
 - 3.2.1.1 Provide a set of curtain doorways between each room, and at both dirty and clean entrances to enclosure systems.
 - 3.2.1.2 **Dirty Change Room:** Build room at entrance to lead work area. Install waste receptor, and storage facilities for worker's shoes and any protective clothing to be re-worn in lead work areas. Equipment and access room shall be large enough to accommodate specified facilities, and other equipment needed, and at least one worker allowing sufficient space to undress comfortably. Provide washing facilities in equipment room.
 - 3.2.1.3 **Clean Room:** Build room between dirty room and clean areas outside of enclosures. At doorway to clean room, provide vented wood door, with locking passage set. Provide hangers for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install water heater, if required.

3.3 **MAINTENANCE OF ENCLOSURES**

- 3.3.1 Maintain enclosures in tidy condition.
- 3.3.2 Ensure barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.
- 3.3.3 Visually inspect enclosures at beginning and end of each working period.

3.4 **DO NOT COMMENCE LEAD ABATEMENT WORK UNTIL**

- 3.4.1 Arrangements have been made for disposal of waste.
- 3.4.2 Lead work area and decontamination enclosure is effectively segregated. Negative pressure equipment is operating continuously.
- 3.4.3 Tools, equipment and materials waste receptors are on hand.
- 3.4.4 Arrangements have been made with Owner's Consultant for work area security.
- 3.4.5 Signs are displayed in areas where access to sealed Lead work area is possible. Signs

shall read:

CAUTION

Lead Hazard Area
No Unauthorized Entry
Wear assigned protective equipment
Breathing Lead dust may cause serious bodily harm.

- 3.4.6 Owner's Consultant has been notified of intention to proceed and has reviewed enclosures, equipment and procedures.

3.5 CONTAMINATED PREPARATION FOR FULL-ENCLOSURE LEAD WORK AREA

- 3.5.1 Before performing any contaminated work, prepare site as described in articles 3.1, 3.2, 3.3, 3.4, 3.5, and 3.6.

- 3.5.2 Promptly seal holes or penetrations in structure to provide air tight enclosure around Lead work area(s).

3.8 REMOVAL

- 3.8.1 Remove lead containing paint using hand methods. Dust and debris to be HEPA vacuumed to remove all lead containing material.

- 3.8.2 Hand tools may also be used to perform required cutting of lead sheeting and/or pipe.

- 3.8.3 For areas where lead paint cannot be effectively removed using hand methods, utilize the Peel Away 1 System manufactured by Dumond Chemical Inc. 1501 Broadway, New York, NY 10036 or equivalent.

- 3.8.4 If HEPA vacuuming, place full vacuum bags into waste receptors. Double polyethylene bags are to be used, inner bag shall be cleaned of gross contamination and placed in a clean 6 mil outer polyethylene bag in container cleaning room immediately prior to transfer from Site.

3.9 CLEAN-UP

- 3.9.1 Clean surfaces from which lead has been removed with brushes and HEPA vacuum or wet-sponge to remove visible dust and debris. HEPA vacuum all surfaces to ensure free of dust and debris.

- 3.9.2 Remove sealed and labeled lead waste receptors and dispose of to authorized disposal area in accordance with requirements of disposal authority.

- 3.9.3 After brushing and wet sponging to remove visible lead dust, damp clean entire work area including equipment and access area, polyethylene sheeting and equipment used in process.

- 3.9.4 Request visual inspection and acceptance. There should be no dust on ducts, scaffold or platform, sills, building surfaces or enclosure, where applicable. Following inspection and acceptance, allow minimum of 2 hours flushing time with no disturbance of work area.

3.10 **TEAR DOWN OF PROTECTION**

- 3.10.1 Remove polyethylene sheeting exposed during contaminated work including upper surfaces plus any underlying sheeting contaminated by water leaks, rips, tears, or exposed by failure of upper layer. Wear half face piece respirator and disposable coveralls during removal of sheeting. Carefully roll sheeting away from walls to center of lead work area. As sheeting is rolled away from walls and corners, HEPA vacuum visible debris.
- 3.10.2 Place polyethylene sheeting, seals, tape, cleaning material, clothing, and other contaminated waste in Lead waste receptors for transport. Remove any debris fallen behind sheeting with HEPA vacuum.
- 3.10.3 Clean up lead work area(s), equipment and access area, washing and other enclosures that may have been contaminated during work.
- 3.10.4 Clean up lead waste receptors and equipment used in work and remove from work area(s) via drum and equipment decontamination enclosure system, at an appropriate time in sequence.
- 3.10.5 Remove hoardings, temporary lighting, equipment and facilities provided for work.
- 3.10.6 A final review may be carried out by Owner's Consultant to ensure that no dust or debris remains.
- 3.10.7 Worker to properly decontaminate him/herself before each break and before going home at completion of work shift. Wash centre to have plenty of soap and hot water, and towels. Instruction to be provided for proper hygiene practices.
- 3.10.8 Perform work in manner to reduce dust creation to lowest levels practicable. Work is subject to visual inspection and air monitoring. Any contamination of surrounding areas indicated by visual inspection or air monitoring shall require complete enclosure and clean up of affected areas.

3.11 **FIELD QUALITY CONTROL**

3.11.1 **Air Monitoring**

- 3.11.2 Owner's Consultant may arrange for air samples to be taken from commencement of work until completion of cleaning operations in accordance with NIOSH methods. Air samples may be collected both inside the building during abatement activity and inside enclosed abatement work area.
- 3.11.3 Cooperate with Owner's Consultant in collection of air samples, including requiring workers to wear sampling pumps for up to half shift periods. Workers shall exercise care not to damage sampling equipment.

- 3.11.4 Air sampling for lead to be performed within occupied areas of building by Owner's Consultant prior to the commencement of work to establish typical background levels.
- 3.11.5 During the course of work, additional air samples for lead will be taken periodically inside the building, adjacent to ongoing work. Airborne concentrations of these contaminants are not to significantly exceed the established background levels and at no point should the time-weighted average concentrations exceed $1/10^{\text{th}}$ of the Ontario regulated exposure limits for lead ($50\mu\text{g}/\text{m}^3$).
- 3.11.6 Should airborne concentrations of lead $1/10^{\text{th}}$ of these limits, Abatement Contractor must immediately stop work, determine the source of infiltration and repair the problem. Abatement Contractor will also be responsible for cleanup of internal locations within the building adjacent to where work was being performed.
- 3.11.7 In addition to the above limits, indoor air quality guidelines for lead ($1.5\mu\text{g}/\text{m}^3$) would be used as a secondary limit for comparison as provided in the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 62-2001, "*Ventilation for Acceptable Indoor Air Quality*".
- 3.12 **INSPECTION**
- 3.12.1 From commencement of work until completion of clean-up operations, Owner's Consultant may be present periodically; both inside and outside lead removal work area(s).
- 3.12.2 If lead work area(s) or adjacent areas, are found unacceptable in accordance with standards specified or required by authorities having jurisdiction, correct such deficiencies at no cost to Owner.
- 3.12.3 Pay cost to provide re-inspection of work found not in accordance with these specifications and requirements of authorities having jurisdiction.
- 3.12.4 Cooperate with and assist inspection and testing company's personnel during inspection and testing.
- 3.13 **CLEAN-UP**
- 3.13.1 Frequently during work and immediately after completion of work, clean up dust and waste containing lead using HEPA vacuum or by damp mopping.
- 3.13.2 Place dust and waste containing lead in sealed dust-tight waste bags. Treat drop sheets as lead waste. Wet and fold drop sheets to contain dust and then place in waste bags.
- 3.13.3 Immediately before their removal from work area, and disposal, clean each filled waste bag using damp cloths or HEPA vacuum.
- 3.13.4 Seal and remove from Site. Dispose of in accordance with requirements of Provincial authority having jurisdiction. Supervise dumping and ensure dump operator is fully aware of hazardous nature of material being dumped and that guidelines and regulations for lead disposal are followed.
- 3.13.5 Perform final clean up of work areas and adjacent areas affected by work using HEPA

vacuum.

3.14 **DISPOSAL**

- 3.14.1 Conform to requirements of Regulation 347 as amended by 234/11 under Environmental Protection Act for Waste Management, transporting and disposal of hazardous waste.
- 3.14.2 Dispose of lead waste in accordance with requirements of Provincial and federal authority having jurisdiction.
- 3.14.3 Cooperate with Ministry of Environment inspectors and immediately carry out instructions for remedial work at dump to maintain environment, at no additional cost to Owner.
- 3.14.4 Provided Owner's Consultant with original copy of waste shipping manifest for disposed lead containing waste issued by dump operator. Contractor is responsible for completing all required manifest documentation for each load leaving the site.

END OF SECTION

1.0 GENERAL

1.1 General Requirements

- 1.1.1 Comply with requirements of Division 1.

1.2 Related Work

- 1.2.1 Friable asbestos removal: Section 02 13 83, Type 3 Asbestos Removal
- 1.2.2 Friable asbestos removal: Section 02 13 82, Type 2 Asbestos Removal
- 1.2.3 Lead Disturbance Procedures: Section 02 13 85
- 1.2.4 Mercury Removal Procedures: Section 02 13 87

1.3 Description of Work

- 1.3.1 Removing/demolishing of building materials suspected to contain silica including but not limited to: brick, refractory brick, concrete, concrete block, cement, mortar, ceiling tiles and gypsum board, following Type 1, Type 2, and/or Type 3 operations and procedures as outlined in the Ontario Ministry of Labour Guideline – Silica on Construction Projects dated April 2011.
- 1.3.2 Work involving the removal or disturbance of other silica containing materials to be performed during Phase 2.
- 1.3.3 Materials identified to contain Silica can be found within the Safetech Environmental Limited report titled "*Hazardous Building Materials Assessment – Stairway Fire Separation Project - Stairways # 1-5, 25-55 St. Clair Avenue East, Toronto, Ontario*" issued December 2, 2013.
- 1.3.4 All work may be subject to inspection and/or air sampling (clearance and/or exposure monitoring) inside and outside work areas by Client's Consultant. Any contamination of surrounding areas, indicated by visual inspection or air monitoring, shall necessitate complete clean-up of affected areas.

1.4 Definitions

- 1.4.1 **Silica:** means crystalline silica in a respirable form. Silica is the primary component of many construction materials. The best-known and most abundant type of crystalline silica is quartz. Other forms of crystalline silica include cristobalite, tridymite and tripoli. Some commonly used construction materials containing silica include: abrasives used for blasting, brick, refractory brick, plaster, concrete, concrete block, cement, mortar, granite, sandstone, quartzite, slate, gunite, mineral deposits, rock and stone, sand, fill dirt, top soil and asphalt containing rock or stone.
- 1.4.2 **Silica Work Area:** Area where work takes place, which will, or may, disturb silica-containing material.

- 1.4.3 **Authorized Visitors:** Client's Consultant and/or person(s) representing regulatory agencies, and person(s) authorized by them.
- 1.4.4 **HEPA Filter:** High Efficiency Particulate Aerosol filter, at least 99.97% efficient in collecting a 0.3 micron aerosol. Each filter should be individually tested and certified to have an efficiency of not less than 99.97 percent when challenged with 0.3 micron dioctylphthalate (DOP) particles. DOP test must be conducted immediately prior to commencement of work and certificate presented to owner and/or consultant.
- 1.4.5 **Effective:** implies that the dust collection system should be capable of controlling airborne silica concentration levels to below 0.05 milligrams per cubic metre (mg/m³).
- 1.4.6 **Competent Person:** A worker who is qualified because of knowledge, training, and experience to perform work, is familiar with relevant acts and regulations that apply to the work, and has knowledge of all potential or actual dangers to health or safety in work.

1.5 Regulations, Guidelines, & Industry Standards

1.5.1 Contractor shall:

- 1.5.1.1 Comply with Federal, Provincial, and local requirements pertaining to silica, provided that in any case of conflict among these requirements or with these specifications, most stringent requirements shall apply.
- 1.5.1.2 Carry out measures and procedures prescribed under the Ontario Regulation 490/09, Designated Substance – Silica.
- 1.5.1.3 Protect health and safety of workers by ensuring compliance with the specific occupational exposure limits (OELs) for silica. The OEL for cristobalite silica is 0.05 mg/m³ of air as an 8-hour daily or 40 hour weekly time-weighted average. The OEL for quartz and tripoli silica is 0.10 mg/m³. Measures and procedures that ensure construction workers receive the same standard of protection as workers covered by O. Reg. 490 should be implemented on construction projects where exposure to silica is a hazard. Such measures and procedures are deemed to be in compliance with section 25(2) (h) of the OHS Act, as taking "every precaution reasonable in the circumstances for the protection of a worker."
- 1.5.1.4 Carry out measures and procedures prescribed under the Ontario Regulation 213/91, as amended by Ontario Regulation 628/05 – Regulation for Construction Projects; Ontario Regulation 860/90 – Workplace Hazardous Materials Information System (WHMIS); and Ontario Ministry of Labour Guideline – Silica on Construction Projects dated September 2004.
- 1.5.1.5 Comply with Ontario Environmental Protection Act Regulation 347/90, as amended by O. Reg. 234/11 - General-Waste Management.
- 1.5.1.6 Ensure every employee and every worker on project complies with applicable acts and regulations.
- 1.5.1.7 Provide instruction and training by a competent person to every worker in the following subjects: WHMIS training, hazards of silica exposure, recognition of typical operations

containing silica, personal hygiene, the use, cleaning and disposal of respirators and personal protective equipment.

1.5.1.8 Protect health and safety of workers and public.

1.5.2 Contractor may:

1.5.2.1 Be requested to provide information on their health and safety record.

1.5.2.2 Be required to provide a copy of their respiratory protection program.

1.5.2.3 Be requested to provide periodic medical examinations for all workers who may be exposed to respirable crystalline silica.

1.6 Internal Policies & Procedures

1.6.1 Ensure that internal policies and procedures of the clients are complied with including, but not limited to the following:

1.6.1.1 All contractors/consultants will not enter designated areas unless trained and appropriately garmented, including appropriate medical clearance which may include medical monitoring and immunization.

1.6.1.2 Have a competent supervisor onsite at all times to supervise work of their employees/subcontractors for large projects.

1.6.1.3 Provide sufficient number of workers trained in first aid on large projects.

1.6.1.4 Do not modify, shut down, open, tap into or alter facilities systems without permission.

1.7 Quality Assurance

1.7.1 Ensure work proceeds on schedule, and meets all requirements of this Section.

1.7.2 Pay cost to Client for inspection performed as a result of failure to perform work satisfactorily regarding quality, safety, or schedule.

1.7.3 Use only skilled and qualified workers for all the trades required for this work.

1.8 Submittals

1.8.1 Before commencing work:

1.8.1.1 Laws of the province of Ontario shall govern this work. Contractor shall observe all such laws and shall obtain and/or pay all permits, notices, fees, taxes, duties as may be required.

1.8.1.2 Submit names of supervisor personnel who will be responsible for silica work area(s).

1.8.1.3 Contractor shall submit, in writing, confirmation of good standing with Workplace Safety and Insurance Board and transcription of insurance.

- 1.8.1.4 Submit documentation including test results for fire and flammable data and Material Safety Data Sheets for materials and chemicals to be used.

1.9 Worker and Visitor Protection

- 1.9.1 **Instruction and Training:** Before commencing work, provide to owner and/or consultant satisfactory proof that every worker has had instruction and training in WHMIS; hazards of silica exposure, including health effects and symptom recognition; personal hygiene; respirator requirements; work measures and procedures; and use, cleaning and disposal of respirators and protective equipment by a competent person as defined by Occupational Health and Safety Act.
- 1.9.2 **Respirators:** NIOSH-approved respirators may be worn during silica removal activities as per Ontario Regulation 490/09. Silica dust on personal respirators should be removed by damp wiping or HEPA vacuuming. Respirators should be selected in accordance with the NIOSH assigned protection factors. A summary of respirator requirements based on anticipated concentration of airborne silica can be found in Table 1. Maintenance and care for respirators should be conducted as per Canadian Standards Association Z94.4-02 Selection, Use, and Care of Respirators Guideline. If Contractor can demonstrate that the silica exposure levels are below the OEL, respirators may not be required.

Table 1: Respirator Requirements

Silica Removal Operations	Required Respirator
<p>Type 1 Silica Removal Operations (> 0.05 to 0.50 mg/m3 of silica in the form of cristobalite and tridymite) (> 0.10 to 1.0 mg/m3 of silica in the form of quartz and tripoli)</p> <ul style="list-style-type: none"> The drilling of holes in concrete or rock that is not part of a tunneling operation or road construction. Milling of asphalt from concrete highway pavement. Charging mixers and hoppers with silica sand (sand consisting of at least 95% silica) or silica flour (finely ground sand consisting of at least 95% silica) Any other operation at a project that requires the handling of silica-containing material in a way that may result in a worker being exposed to airborne silica. Entry into a dry mortar removal or abrasive blasting area while airborne dust is visible for less than 15 minutes for inspection and/or sampling. Working within 25 metres of an area where compressed air is being used to remove silica-containing dust outdoors. 	<p>NIOSH APF = 10</p> <ul style="list-style-type: none"> Half-mask particulate respirator with N-, R-, or P-series filter and 95, 99, or 100 percent efficiency.
<p>Type 2 Silica Removal Operations (> 0.50 to 2.5 mg/m3 of silica in the form of cristobalite and tridymite) (> 1.0 to 5.0 mg/m3 of silica in the form of quartz and tripoli)</p> <ul style="list-style-type: none"> Removal of silica containing refractory materials with a jackhammer. The drilling of holes in concrete or rock that is part of a tunneling operation or road construction. The use of a power tool to cut, grind, or polish concrete, masonry, terrazzo or refractory materials. The use of a power tool to remove silica-containing materials. The use of a power tool indoors to chip or break and remove concrete, masonry, stone, terrazzo or refractory materials. 	<p>NIOSH APF = 50</p> <ul style="list-style-type: none"> Full-facepiece air-purifying respirator with any 100-series particulate filter. Tight-fitting powered air-purifying respirator with any 100-series particulate filter. Full-facepiece supplied-air respirator operated in demand mode. Half-mask or full-facepiece supplied air respirator operated in continuous-flow mode.

Silica Removal Operations	Required Respirator
<ul style="list-style-type: none"> Tunneling (operation of the tunnel boring machine, tunnel drilling, or tunnel mesh installation). Tuckpointing and surface grinding. Dry method dust clean-up from abrasive blasting operations. Dry mortar removal with an electric or pneumatic cutting device. The use of compressed air outdoors for removing silica dust. Entry into area where abrasive blasting is being carried out for more than 15 minutes. 	
<p>Type 3 Silica Removal Operations (> 2.5 mg/m³ of silica in the form of cristobalite and tridymite) (> 5.0 mg/m³ of silica in the form of quartz and tripoli)</p> <ul style="list-style-type: none"> Abrasive blasting with an abrasive that contains ≥ 1% silica. Abrasive blasting of a material that contains ≥ 1% silica. 	<p>NIOSH APF ≥ 1000</p> <ul style="list-style-type: none"> Type CE abrasive-blast supplied air respirator operated in a positive pressure mode with a tight-fitting half-mask facepiece. Type CE abrasive-blast supplied air respirator operated in a pressure demand or positive pressure mode with a tight-fitting facepiece.

1.9.3 **Protective Clothing:** Provide workers and visitors in silica work area(s) with disposable and/or washable work clothes, including shoe covers. Work clothes that are contaminated with silica dust should not be worn outside the work area(s). Silica dust on washable work clothes should be removed by damp wiping or HEPA vacuuming and washed in facilities suitable for handling silica contaminated laundry before reusing. Provide or have access to appropriate washing facility equipped with clean water, soap, and individual towels for washing hands and face of workers. The washing facility shall be used by every worker when leaving silica work area(s) and if feasible, the washing facility should include a shower.

1.9.4 Workers who may be exposed to silica on a regular basis should undergo a pre-placement medical assessment and periodic medical examinations.

1.9.5 A worker shall not eat, drink, chew gum, or use tobacco products in work area(s).

2.0 PRODUCTS

2.1 Materials

2.1.1 **HEPA Vacuum:** High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

2.1.2 **Polyethylene sheeting sealed with tape:** Polyethylene sheeting of type and thickness specified sealed with tape along all edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide a continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealants, and to prevent escape of silica dust through sheeting into a clean area.

2.1.3 **Tape:** Tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.

3.0 EXECUTION

3.1 Preparation

- 3.1.1 Equipment, tools, furnishings, and stored materials which can be moved, without disturbing silica-containing materials have been moved by Contractor.
- 3.1.2 Seal all opening or voids in work area(s), such as vents, service holes in walls and air handling ducts as appropriate with plugs and/or tape and/or caulking and/or polyethylene sheeting sealed with tape.
- 3.1.3 Building personnel have shut off air handling and ventilation systems (if applicable) supplying or exhausting from silica work area(s)/enclosure(s). Ensure air handling systems remain shut off during duration of work.
- 3.1.4 Before disturbing silica-containing material, install polyethylene drop sheets as appropriate to control spread of dust.
- 3.1.5 Establish ropes, barriers and/or partial enclosures in order to prevent unauthorized personnel from entering work area(s).
- 3.1.6 If significant concentrations of dust are being generated the work should be re-evaluated by a qualified person and additional procedures should be implemented such as: a full enclosure should be erected using polyethylene sheeting (or in the event that the sheeting needs support, wood framing may also be used) in order to separate silica work area(s) from remaining building areas. The Ontario Ministry of Labour Guideline – Silica on Construction Projects dated September 2004 should be consulted for all additional recommended requirements.
- 3.1.7 Emergency and fire exits are established from silica work area(s), or alternative exits have been established satisfactory to authorities having jurisdiction.
- 3.1.8 Temporary lighting in silica work area(s) has been provided (if necessary) to level that will permit work to be done safely and well where necessary.
- 3.1.9 Signs are displayed in all areas where access to silica work area(s) is possible. Signs should be at least 500 mm x 350 mm and state the date and place of the silica removal project. Such signs shall read in large, clearly visible letters:

CAUTION

Silica Dust Hazard

No Unauthorized Entry

Wear Assigned Personal Protective Equipment

- 3.1.10 Arrangements have been made with Client for work area security.
- 3.1.11 Client's Consultant has been notified of intention to proceed and has reviewed equipment and procedures.

3.2 Removal



- 3.2.1 Seal opening to polyethylene enclosure with tape or ensure appropriate barriers are in place after entry of worker(s).
- 3.2.2 Perform work required within silica enclosure(s)/work area(s) using appropriate dust control measures, including a mechanical ventilation system and/or wetting, and/or the use of a dust collection system if practical. Compressed air or dry sweeping should be avoided.
- 3.2.3 The work area(s) should be thoroughly wetted prior to and/or during all silica removal operations.
- 3.2.4 Continuous cleaning during removal work operations should be conducted to control the spread of silica dust.

3.3 Clean-Up

- 3.3.2 Clean all surfaces by washing down with water and vacuuming with a HEPA vacuum until no visible residue remains to prevent dust-containing silica from spreading.
- 3.3.3 Workers exposed to silica should be provided with or have access to washing facilities equipped with clean water, soap, and individual towels.
- 3.3.4 Silica dust on personal protective clothing and equipment should be removed by damp wiping or HEPA vacuuming.
- 3.3.5 When exiting the enclosure(s)/area(s), dispose of contaminated disposable work clothes as construction waste.
- 3.3.6 All workers and visitors in the silica work area(s) must properly decontaminate themselves prior to leaving the work area.

3.4 Air Monitoring

- 3.4.1 If air monitoring is conducted to determine the concentrations of airborne silica, Client's Consultant shall arrange for air samples to be taken as required inside of silica work area(s) and/or enclosure(s). These air sampling results can then be used to determine if the engineering controls implemented (Type 1, 2, or 3) are providing adequate protection for workers.

3.5 Re-Establishment of Objects and Systems

- 3.5.1 Reconstruct items demolished (if required) which are to remain and reinstall objects and items in their proper positions which were removed to facilitate silica removal operations. Reconstruction and reinstallation shall be done by tradesmen qualified in work being reinstalled or reconstructed.
- 3.5.2 Re-establish mechanical and electrical systems (if required) to remain operative in proper working order. Arrange for, and pay costs of, electrical or mechanical repairs needed due to this work.

3.6 Inspection

- 3.6.1 From commencement of work until completion of clean-up operations, Client's Consultant may be present on an as required basis, both inside and outside silica work area(s).
- 3.6.2 Pay cost to provide re-inspection of work found not in accordance with these specifications and requirements of authorities having jurisdiction.

3.7 Disposal of Waste

- 3.7.1 Conform to requirements of Ontario Environmental Protection Act Regulation 374/90, as amended by O. Reg. 234/11 – General Waste Management.

End of Section

1.0 GENERAL

1.1 General Requirements

- 1.1.1 Comply with requirements of Division 1.

1.2 Related Work

- 1.2.1 Friable asbestos removal: Section 02 13 83, Type 3 Asbestos Removal
- 1.2.2 Friable asbestos removal: Section 02 13 82, Type 2 Asbestos Removal
- 1.2.3 Lead Disturbance Procedures: Section 02 13 85
- 1.2.4 Silica Disturbance Procedures: Section 02 13 86

1.3 Description of Work

- 1.3.1 Remove, package and recycle/dispose of all mercury vapour containing fluorescent light tubes that are located throughout project areas schedule for redevelopment. Mercury-containing components identified can be found within Safetech Environmental Limited's report titled "*Hazardous Building Materials Assessment – Specific to Stairway Fire Separation Project-Stairways # 1-5, 25-55 St. Clair Avenue East, Toronto, Ontario*" issued December 2, 2013.
- 1.3.2 All work may be subject to inspection by Client's Consultant.

1.4 Regulations

- 1.4.1 Comply with Federal, Provincial and local requirements, provided that in any case of conflict among those requirements or with these Specifications more stringent requirements shall apply. Work shall be performed under regulations in effect at time work is performed. Regulations include but are not limited to the following:
- 1.4.2 Environmental Protection Act, Revised Statutes of Ontario 1990, Chapter E. 19.
- 1.4.3 Canadian Environmental Protection Act, Revised Statutes of Canada 1985, c.16.
- 1.4.4 Ministry of Environment Regulations for the disposal of mercury waste, including R.R.O. 1990, Regulation 347/90 as amended by O. Reg. 234/11.
- 1.4.5 Ontario Regulation 490/09 respecting Mercury.

1.5 Instruction and Training

- 1.5.1 Ensure that all workers likely to handle mercury-containing items are trained in use of Mercury Spill Kit and are trained in handling of mercury.

2.0 PRODUCTS

2.1 Materials

- 2.1.1 **Cardboard Containers:** New or used cardboard boxes. Suitable for packaging of fluorescent light tubes to prevent breakage of tubes.

2.2 Equipment

- 2.2.1 **Mercury Spill Response Kit** consisting of following:

- 2.1.1.1 HEPA vacuum dedicated for use with mercury spills
- 2.1.1.2 Air-purifying cartridge respirators with mercury absorbing cartridges and an end-of-life service indicator
- 2.1.1.3 Surgical gloves to prevent skin exposure when handling droplets of mercury
- 2.2.1.4 Neutralizing compound such as 20% calcium polysulfide or 20% sodium thiosulfide to clean spilled surfaces

3.0 EXECUTION

3.1 Packaging of Fluorescent Light Tubes

- 3.1.1 Carefully remove fluorescent light tubes from fixtures wipe with a damp cloth or clean with a HEPA filtered vacuum and place in cardboard containers.
- 3.1.2 Place tubes in container as they are removed from fixtures. Ensure that tubes are packaged in a manner to prevent breakage.
- 3.1.2 Avoid rough handling of tubes to avoid breakage.
- 3.1.3 Store full containers in a central location on site.

3.2 Disposal

- 3.2.1 Do not dispose of fluorescent light tubes containing mercury with other construction waste or in a landfill.
- 3.2.2 Dispose of mercury containing equipment at a recycling facility approved by Consultant. Recycling company must have the following minimum requirements:
- 3.2.3 Offer complete recycling of all parts (i.e., lamps, caps, clips etc.)
- 3.2.4 Must be able to supply contractor with packaging material, if necessary

End of Section

PART 1 - GENERAL

1.1 SUMMARY

- .1 Comply with requirements of this Section when performing following Work:
 - .1 Removal of asbestos containing material from piping, equipment, at locations indicated in "Limited Asbestos & Designated Substances Survey".
 - .2 Removal or disturbance of one square metre or less of friable asbestos containing material during the repair, alteration, maintenance or demolition of all or part of machinery or equipment, or of a building.
 - .3 Enclosure of friable asbestos containing material as indicated in "Hazardous Building Materials Reassessment" and "Asbestos Abatement Vertical Mechanical Shafts" report.
 - .4 Removing non-friable asbestos containing materials by breaking, cutting, drilling, abrading, grounding, sanding or vibrating at locations indicated in "Hazardous Building Materials Reassessment" and "Asbestos Abatement Vertical Mechanical Shafts" report if:
 - .1 The material is not wetted to control the spread of dust or fibres, and
 - .2 The work is done only by means of non-powered hand-held tools.
 - .5 Removing non-friable asbestos containing materials by breaking, cutting, drilling, abrading, grounding, sanding or vibrating at locations indicated in "Hazardous Building Materials Reassessment" and "Asbestos Abatement Vertical Mechanical Shafts" report if the work is done by means of power tools that are attached to dust-collecting devices equipped with HEPA filters.
 - .6 Removing more than one square metre of drywall in which joint-filling compounds that are asbestos containing materials have been used.
 - .7 Removing of asbestos containing material from a pipe, duct or similar structure using a glove bag.

1.2 SECTION INCLUDES

- .1 Requirements and procedures for asbestos abatement of asbestos containing materials of the type described within.

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1.3 REFERENCES

- .1 O.Reg. 278/05, Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations.
- .2 A Guide to the Regulations respecting Asbestos on Construction Projects and in Buildings and Repair Operations released in November 2007,
<http://www.labour.gov.on.ca/english/hs/asbestos/index.html>.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.205-2003, Sealer for Application of Asbestos Fibre Releasing Materials.
- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .6 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .7 Underwriters' Laboratories of Canada (ULC).
- .8 "Designated Substances and Hazardous Materials Assessment Specific to Stairway Fire Separation Project, Stairways # 1-5 25/55 St. Clair Ave East, Toronto Ontario " prepared by Safetech Environmental Ltd. and attached at the end of specifications attached at the end of specifications.
- .9 "Reassessment of Asbestos Containing Building Materials 25/55 St.Clair Avenue East" survey report dated February 14, 2011, prepared by Safetech Environmental Ltd. The report is attached at the end of specifications.
- .10 Hazardous Building Materials Reassessment, Floors 2-9 - Mechanical Areas, Pipe Shafts, Elevator Shafts, Elevator Penthouse, 25/55 St. Clair Ave. East, Toronto, Ontario, dated August 21, 2012, prepared by Safetech Environmental Ltd.
- .11 "25-55 St.Clair Ave. Elevator Shaft Evaluation FINAL" survey report dated November 13, 2013, prepared by Read, Jones, Christoffersen Consulting Engineers The report is attached at the end of specifications.

1.4 DEFINITIONS

- .1 Amended Water: water with non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.
- .2 Asbestos Containing Materials (ACMs): materials that contain 0.5 per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen materials and settled dust.
- .3 Asbestos Work Area: area where work takes place which will, or may disturb ACMs.
- .4 Authorized Visitors: Engineers, or designated representatives, and representatives of regulatory agencies.
- .5 Competent worker person: in relation to specific work, means a worker who:
 - .1 Is qualified because of knowledge, training and experience to perform the work.
 - .2 Is familiar with the provincial and federal laws and with the provisions of the regulations that apply to the work.
 - .3 Has knowledge of all potential or actual danger to health or safety in the work.
- .6 Friable Materials: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .7 Glove Bag: prefabricated glove bag as follows:
 - .1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.
 - .2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.
 - .3 Equipped with reversible double pull double throw zipper on top and at approximately mid-section of the bag.
 - .4 Straps for sealing ends around pipe.
- .8 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any dimension at 99.97% efficiency.
- .9 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
- .10 Occupied Area: any area of building or work site that is outside Asbestos Work Area.

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- .11 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.
- .12 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for scope of work.

1.5 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00.
- .2 Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of asbestos containing waste in accordance with requirements of authority having jurisdiction.
- .3 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.
- .4 Submit proof of Contractor's Asbestos Liability Insurance.
- .5 Submit to Departmental Representative necessary permits for transportation and disposal of asbestos containing waste and proof that asbestos containing waste has been received and properly disposed.
- .6 Submit proof satisfactory to Departmental Representative that all asbestos workers have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene, entry and exit from Asbestos Work Area, aspects of work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.
- .7 Submit proof that supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.
- .8 Submit Worker's Compensation Board status and transcription of insurance.
- .9 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:
 - .1 Encapsulants;
 - .2 Amended water;
 - .3 Slow drying sealer.

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- .10 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at the time work is performed.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.
 - .2 Safety Requirements: worker and visitor protection.
 - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:
 - .1 Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.

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.2 Disposable type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing to consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing. It includes suitable footwear, and it to be repaired or replaced if torn.

.3 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.

.4 Before leaving Asbestos Work Area, the worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.

.5 Ensure workers wash hands and face when leaving Asbestos Work Area. Facilities for washing are located as indicated on drawings.

.6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

.7 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.

.2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

1.7 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.

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- .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 Separate for reuse and recycling and place in designated containers in accordance with Waste Management Plan.
- .5 Place materials defined as hazardous or toxic in designated containers.
- .6 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .7 Fold up metal banding, flatten and place in designated area for recycling.
- .8 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial/Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 0.15 mm thick (6 mil) bags or leak proof drums. Label containers with appropriate warning labels.
- .9 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.8 EXISTING CONDITIONS

- .1 Refer to "Hazardous Building Materials Reassessment" and "Asbestos Abatement Vertical Mechanical Shafts" report.
- .2 Reports and information pertaining to ACMS to be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this specification.
- .2 Notify Departmental Representative of friable material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

1.9 SCHEDULING

- .1 Hours of Work: perform work involving hazardous materials abatement outside of normal working hours. Include in Contract Sum additional costs due to this requirement.

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1.10 TRAINING AND INSTRUCTIONS

- .1 Before beginning Work, provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, in use of glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing.
- .2 Instruction and training related to respirators includes, at minimum:
 - .1 Fitting of equipment.
 - .2 Inspection and maintenance of equipment.
 - .3 Disinfecting of equipment.
 - .4 Limitations of equipment.
- .3 Instruction and training must be provided by competent, qualified person.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Drop and Enclosure Sheets:
 - .1 Polyethylene: 0.15 mm thick.
 - .2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.
- .2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in concentration to provide thorough wetting of asbestos containing material.
- .3 Waste Containers: contain waste in two separate containers.
 - .1 Inner container: 0.15 mm thick sealable polyethylene bag or where glove bag method is used, glove bag itself.
 - .2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.
 - .3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site.
- .4 Glove bag:
 - .1 Acceptable materials: safe-T-Strip products in configuration suitable for Work, or Alternative material approved by addendum during tendering period in accordance with Instructions to Tenderers.

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- .2 The glove bag to be equipped with:
 - .1 Sleeves and gloves that are permanently sealed to the body of the bag to allow the worker to access and deal with the insulation and maintain a sealed enclosure throughout the work period.
 - .2 Valves or openings to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct or similar structure.
 - .3 A tool pouch with a drain.
 - .4 A seamless bottom and a means of sealing off the lower portion of the bag.
 - .5 A high strength double throw zipper and removable straps, if the bag is to be moved during the removal operation.
- .5 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.
- .6 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.
 - .1 Sealer: flame spread and smoke developed rating less than 50 and be compatible with new fireproofing.
- .7 Encapsulant: penetrating type conforming to CAN/CGSB-1.205, ULC listed.

PART 3 - EXECUTION

3.1 SUPERVISION

- .1 Minimum of one Supervisor for every ten workers is required.
- .2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.

3.2 PROCEDURES

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.
- .2 Before beginning Work, at each access to Asbestos Work Area, install warning signs in both official languages in upper case 'Helvetica Medium' letters reading as follows, where number in parentheses indicates font size to be used: 'CAUTION ASBESTOS HAZARD AREA (25 mm) / NO UNAUTHORIZED ENTRY (19 mm) / WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) / BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)'.

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- .3 Before beginning Work remove visible dust from surfaces in work area where dust is likely to be disturbed during course of work.
 - .1 Use HEPA vacuum or damp cloths where damp cleaning does not create hazard and is otherwise appropriate.
 - .2 Do not use compressed air to clean up or remove dust from any surface.
- .4 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.
 - .1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in work areas where dust or contamination cannot otherwise be safely contained.
 - .2 When [removing suspended ceilings and walls themselves do not enclose work area and when removing asbestos containing material from piping or equipment and "glove bag" method is not used erect enclosure of polyethylene sheeting around work area, shut off mechanical ventilation system serving work area and seal ventilation ducts to and from work area.
- .6 Remove loose material by HEPA vacuum; thoroughly wet friable material containing asbestos to be removed or disturbed before and during Work unless wetting creates hazard or causes damage.
 - .1 Use garden reservoir type low - velocity sprayer or airless spray equipment capable of producing mist or fine spray.
 - .2 Perform Work in a manner to reduce dust creation to lowest levels practicable.
- .7 Pipe Insulation Removal Using Glove Bag:
 - .1 A glove bag not to be used to remove insulation from a pipe, duct or similar structure if:
 - .1 It may not be possible to maintain a proper seal for any reason including, without limitation:
 - .1 The condition of the insulation.
 - .2 The temperature of the pipe, duct or similar structure.
 - .2 The bag could become damaged for any reason including, without limitation.
 - .1 The type of jacketing.
 - .2 The temperature of the pipe, duct or similar structure.
 - .2 Upon installation of the glove bag, inspect bag for any damage or defects. If any damage or defects are found, the glove bag is to be repaired or replaced. The glove bag to be inspected at regular intervals for damage and defects, and repair or replaced, as appropriately. The asbestos containing contents of the damaged or defective glove bag found during removal

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are to be wetted and the glove bag and its contents are to be removed and disposed of in an appropriate waste disposal container. Any damaged or defective glove bags are not be reused.

.3 Place tools necessary to remove insulation in tool pouch. Wrap bag around pipe and close zippers. Seal bag to pipe with cloth straps.

.4 Place hands in gloves and use necessary tools to remove insulation. Arrange insulation in bag to obtain full capacity of bag.

.5 Insert nozzle of garden reservoir type sprayer into bag through valve and wash down pipe and interior of bag thoroughly. Wet surface of insulation in lower section of bag.

.6 To remove bag after completion of stripping, wash top section and tools thoroughly. Remove air from top section through elasticized valve using a HEPA vacuum. Pull polyethylene waste container over glove bag before removing from pipe. Release one strap and remove freshly washed tools. Place tools in water. Remove second strap and zipper. Fold over into waste container and seal.

.7 After removal of bag ensure that pipe is free of residue. Remove residue using HEPA vacuum or wet cloths. Ensure that surfaces are free of sludge which after drying could release asbestos dust into atmosphere. Seal exposed surfaces of pipe and ends of insulation with slow drying sealer to seal in any residual fibres.

.8 Upon completion of Work shift, cover exposed ends of remaining pipe insulation with polyethylene taped in place.

.8 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.

.9 Cleanup:

.1 Frequently during Work and immediately after completion of work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.

.2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.

.3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.

.4 Seal and remove double bagged waste from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal authority having jurisdiction. Supervise dumping and ensure that dump

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operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for asbestos disposal are followed.

.5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

3.3 AIR MONITORING

- .1 From beginning of Work until completion of cleaning operations, Departmental Representative to take air samples on daily basis outside of Asbestos Work Area enclosures in accordance with Provincial, Occupational Health and Safety Regulations, PWGSC requirements.
 - .1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.
- .2 If air monitoring shows that areas outside Asbestos Work Area enclosures are contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area.
- .3 Ensure that respiratory safety factors are not exceeded.
- .4 During the course of Work, Departmental Representative to measure fibre content of air outside Work areas by means of air samples analyzed by Phase Contrast Microscopy (PCM).
 - .1 Stop Work when PCM measurements exceed 0.05 f/cc and correct procedures.
- .5 During the course of Work, Departmental Representative to measure fibre content of air outside Work areas by means of fibrous aerosol monitors (FAM).
 - .1 When FAM readings exceed 0.25 f/cc, adopt more stringent Work procedures immediately and perform PCM test.
 - .2 Stop Work when PCM measurements exceed 0.01 f/cc and correct procedures.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Comply with requirements of this Section when performing following Work:
 - .1 Removal of lead based paint from walls ceilings, as indicated on drawings and in "Hazardous Building Materials Reassessment" report, using power tools with an effective dust collection system equipped with HEPA filter.
 - .2 Removal of lead-containing dust using air mist extraction system.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-Z180.1-00(R2005), Compressed Breathing Air and Systems.
- .2 Department of Justice Canada
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .3 Health Canada
 - .1 Workplace Hazardous Materials Information System (WHMIS), Material Safety Data Sheets (MSDS).
- .4 Human Resources and Social Development Canada (HRSDC)
 - .1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.
- .5 Ontario Ministry of Labour
 - .1 O. Reg 490/09, Designated Substances as amended by O. Reg. 148/12 and O. Reg. 149/12.
- .6 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .7 U.S. Environmental Protection Agency (EPA)
 - .1 EPA 747-R-95-007-1995, Sampling House Dust for Lead.
- .8 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (NIOSH)
 - .1 NIOSH 94-113 - NIOSH Manual of Analytical Methods (NMAM), 4th Edition (1994).
- .9 U.S. Department of Labour - Occupational Safety and Health Administration (OSHA) - Toxic and Hazardous Substances Lead in Construction Regulation - 29 CFR 1926.62-1993.
- .10 Underwriters' Laboratories of Canada (ULC).

- .11 "25-55 St.Claire Ave. Elevator Shaft Evaluation FINAL" survey report dated November 13, 2013, prepared by Read, Jones, Christoffersen Consulting Engineers. The report is attached at the end of specifications.
- .12 "Hazardous Building Materials Remediation Procedures Stairway Fire Separation Project, Stairways #1-5, Stairway Fire Separation Project, Stairways #1-5, 25/55 St.Claire Avenue East, Toronto, Ontario M5A 2A3, November 2013, attached at the end of specifications.

1.3 DEFINITIONS

- .1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .2 Authorized Visitors: Departmental Representative or designated representatives of regulatory agencies.
- .3 Occupied Area: area of building or work site outside Work Area.
- .4 Dioctyl Phthalate (DOP) Test: testing method used to evaluate particle penetration and air flow resistance properties of filtration materials - HEPA filter leak test.
- .5 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Appropriate capacity for scope of work.
- .6 Airlock: ingress or egress system without permitting air movement between contaminated area and uncontaminated area. Consisting of two curtained doorways at least 2 m apart.
- .7 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed as follows:
 - .1 Place two overlapping sheets of polyethylene over existing or temporarily framed doorway, secure each along top of doorway, secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.
 - .2 Reinforce free edges of polyethylene with duct tape and add weight to bottom edge to ensure proper closing.
 - .3 Overlap each polyethylene sheet at openings 1.5 m on each side.
- .8 Action level: employee exposure, without regard to usage of respirators, to an airborne concentration of lead of 50 micrograms per cubic metre of air calculated as an 8-hour time-weighted average (TWA). Maximum precautions for lead abatement are based on airborne lead concentrations greater than 1.25 milligrams per cubic meter of air within Work Area.

- .9 Competent person: individuals capable of identifying existing lead hazards in workplace and taking corrective measures to eliminate them.
- .10 Lead in Dust: wipe sampling on the vertical and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.
- .11 Negative Air Pressure Machine: extracts air directly from work area and filters extracted air through a HEPA filter, discharge air to exterior of building.
 - .1 Maintain pressure differential of 5 to 7 Pa relative to adjacent areas outside of work areas. Machine to be equipped with alarm to warn of system breakdown, and equipped with instrument to continuously monitor and automatically record pressure differences.

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
 - .2 Provide proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of lead based paint waste in accordance with requirements of authority having jurisdiction.
 - .3 Provide: Provincial and local requirements for Notice of Project Form.
 - .4 Provide proof of Contractor's General and Environmental Liability Insurance.
 - .5 Quality Control:
 - .1 Provide Departmental Representative necessary permits for transportation and disposal of lead based paint waste and proof it has been received and properly disposed.
 - .2 Provide proof satisfactory to Departmental Representative that employees had instruction on hazards of lead exposure, respirator use, dress, entry and exit from Work Area, and aspects of work procedures and protective measures.
 - .3 Provide proof that supervisory personnel have attended lead abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.
 - .6 Product data:
 - .1 Provide documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:
 - .1 Encapsulants.
 - .2 Amended water.
 - .3 Slow drying sealer.
-

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to lead, in case of conflict among those requirements or with these specifications the more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Health and Safety:
 - .1 Require construction work to be in compliance with the occupational health and safety regulations in 01 35 29.
 - .2 Safety Requirements: worker and visitor protection.
 - .1 Protective equipment and clothing to be worn by workers while in Lead Work Area includes:
 - .1 Leads removal using power tool: respirator NIOSH approved and equipped with filter cartridges with assigned protection factor of 50, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure in Lead Work Area. Provide sufficient filters so workers can install new filters following disposal of used filters and before re-entering contaminated areas.
 - .2 Abrasive blasting of lead paint: NIOSH approved and equipped with filter cartridges with assigned protection factor of 1000, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure in Lead Work Area. Respirator to be equivalent Type CE abrasive blast supplied air respirator operated in a pressure demand or positive pressure mode with a tight-fitting full-face-piece. Compressed air used to supply supplied air respirators to meet breathing air purity requirements of CAN/CSA-Z180.1. Where an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor/alarm to be provided.
 - .3 Disposable protective clothing that does not readily retain or permit skin contamination, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.
 - .2 Requirements for workers:
 - .1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters, clean coveralls and head covers before entering Equipment and Access Rooms or Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.
 - .2 Remove gross contamination from clothing before leaving work area. Place contaminated work suits in receptacles for disposal with other lead contaminated materials. Leave reusable items except

respirator in Equipment and Access Room. When not in use in work area, store work footwear in Equipment and Access Room. Upon completion of lead abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or from Equipment and Access Room.

.3 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers not use this system as means to leave or enter Work Area.

.3 Eating, drinking, chewing, and smoking are not permitted in Work Area.

.4 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual lead abatement.

.5 Ensure workers wash hands and face when leaving Lead Work Area. Facilities for washing are located as indicated on drawings.

.6 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.

.7 Ensure no person required to enter Work Area has facial hair that affects seal between respirator and face.

.8 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.

.2 Instruct Authorized Visitors in use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Work Area.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

.2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.3 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, and Municipal regulations. Dispose of lead waste in sealed double thickness 0.15 mm thick bags or leak proof drums. Label containers with appropriate warning labels.

.4 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.7 EXISTING CONDITIONS

- .1 Reports and information pertaining to lead based paint to be handled, removed, or otherwise disturbed and disposed of during this Project are available for inspection at Departmental Representative's offices.
- .2 Notify Departmental Representative of lead based paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

1.8 SCHEDULING

- .1 Not later than 10 days before beginning Work on this Project notify the following in writing; where appropriate.
 - .1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.
 - .2 Provincial Ministry of Labour.
 - .3 Disposal Authority.
- .2 Inform sub trades of presence of lead-containing materials identified in Existing Conditions.
- .3 Provide Departmental Representative copy of notifications prior to start of Work.
- .4 Hours of Work: perform work involving lead abatement outside of normal working hours. Include in Contract Sum additional costs due to this requirement.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Polyethylene 0.15 mm unless otherwise specified; in sheet size minimize joints.
- .2 FR polyethylene: 0.15 mm woven fibre reinforced fabric bonded both sides with polyethylene.
- .3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.
- .4 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for trapping residual lead paint residue.
- .5 Lead waste containers: metal or fibre type acceptable to dump operator with tightly fitting covers and 0.15 mm sealable polyethylene liners.
 - .1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

PART 3 - EXECUTION

3.1 SUPERVISION

- .1 Approved Supervisor must remain within Work Area during disturbance, removal, or handling of lead based paints.

3.2 PREPARATION

- .1 Remove and wrap items to be salvaged or reused, and transport and store in area specified by Departmental Representative.
- .2 Work Area:
 - .1 Shut off and isolate HVAC system to prevent lead dust and particulate dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.
 - .2 Pre-clean fixed casework, and equipment within work areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.
 - .3 Clean work areas using HEPA vacuum. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum.
 - .4 Install negative pressure machine system and operate continuously from installation of polyethylene sheeting until completion of final cleanup. Provide automatic continuous monitoring and recording instrument of pressure difference.
 - .5 Seal off openings, corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.
 - .6 Cover floor surfaces in work area from wall to wall with FR polyethylene drop sheets to protect existing floor during removal.
 - .7 Build airlocks at entrances and exits from work areas to ensure work areas are always closed off by one curtained doorway when workers enter or exit.
 - .8 At point of access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used:
 - .1 CAUTION LEAD HAZARD AREA (25 mm).
 - .2 NO UNAUTHORIZED ENTRY (19 mm)
 - .3 WEAR ASSIGNED PROTECTIVE EQUIPMENT AND RESPIRATOR (19 mm).
 - .4 BREATHING LEAD CONTAMINATED DUST CAUSES SERIOUS BODILY HARM (7 mm).
 - .9 Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Authority having jurisdiction.
 - .10 Where water application is required for wetting lead containing materials, provide temporary water supply by use of appropriately sized hoses for application of water as required.

- .11 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.
- .3 Worker Decontamination Enclosure System:
- .1 Worker Decontamination Enclosure System includes Equipment and Access Room and Clean Room, as follows:
- .1 Equipment and Access Room: construct between exit and work areas, with two curtained doorways, one to the rest of the suite, and one to work area. Install waste receptor and storage facilities for workers' shoes and protective clothing to be re-worn in work areas. Build large enough to accommodate specified facilities, equipment needed, and at least one worker allowing sufficient space to change comfortably.
- .2 Clean Room: construct with curtained doorway to outside of enclosures. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.
- .4 Construction of Decontamination Enclosures:
- .1 Construct framing for enclosures or use existing rooms. Line enclosure with polyethylene sheeting and seal with tape, apply two layers of FR polyethylene on floor.
- .2 Construct curtain doorways between enclosures so when people move through or waste containers and equipment are moved through doorway, one of two closure comprising doorway always remains closed.
- .3 Shower room in decontamination facility to be provided with the following:
- .1 Hot and cold water or water of constant temperature not less than 40 degrees Celsius or more than 50 degrees Celsius.
- .2 Individual controls inside to regulate water flow and temperature.
- .4 Prior to each shift in which a decontamination facility is being used, a competent person should inspect the facility to ensure that there are no defects that would allow lead-containing dust to escape. Defects should be repaired before the facility is used. The decontamination facility should be maintained in a clean and sanitary condition.
- .5 Separation of Work Areas from Occupied Areas:
- .1 Barriers between Work Area and occupied area to be constructed as follows:
- .1 Construct floor to ceiling lumber or metal stud framing, cover with polyethylene sheeting and seal with duct tape. Apply 9 mm plywood over polyethylene sheeting. Seal plywood joints and between adjacent materials with surface film forming sealer, to create airtight barrier.

.2 Cover plywood with polyethylene sheeting and sealed with duct tape.

- .6 Maintenance of Enclosures:
 - .1 Maintain enclosures in tidy condition.
 - .2 Ensure barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately.
 - .3 Visually inspect enclosures at beginning of each working day.
 - .4 Use smoke test method to test effectiveness of barriers as directed by Departmental Representative.

3.3 LEAD - BASE PAINT ABATEMENT

- .1 Removal of lead based paint to be performed using power tools that are attached to dust-collecting vacuums with HEPA filters.
- .2 Remove lead based paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.
- .3 Wet method to be used to reduce dust generation. Examples of wet methods include wetting surfaces, wet scraping, and wet shovelling. Wet method not be used if it creates a hazard or cause damage to equipment or to project. Power tools to be equipped with a shroud, and to be kept flush with surface.
- .4 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove immediate from working area to staging area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.
- .5 After completion of stripping work, wire brush and wet sponge surface to remove visible material. During this work keep surfaces wet. After wire brushing and wet sponging, wet clean and HEPA vacuum entire work area including Equipment and Access Room. Compressed air or dry sweeping not be used to clean up lead-containing dust or waste. After inspection and approval by Departmental Representative apply continuous coat of slow drying sealer to surfaces. Do not disturb work area for 8 hours, no entry, activity, or ventilation other than operation negative air machine during this period.
- .6 After enclosing lead painted surfaces, wet clean work area and equipment and access room. During settling period no entry, activity, or ventilation will be permitted.

3.4 INSPECTION

- .1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from requirements not been approved in writing by Departmental Representative will result in Work shutdown, at no cost to Departmental Representative.
- .2 Departmental Representative will inspect work for:
 - .1 Adherence to specific procedures and materials.
 - .2 Final cleanliness and completion.
 - .3 No additional costs will be allowed for additional labour or materials required to provide specified performance level.
- .3 When lead dust leakage from Work Area occurs Departmental Representative will order Work shutdown.
 - .1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.5 LEAD SURFACE SAMPLING - WORK AREAS

- .1 Final lead surface sampling conducted as follows:
 - .1 After Work Area has passed a visual inspection for cleanliness approved by Departmental Representative and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period of 8 hours has passed, Departmental Representative will perform lead wipe sampling in Work Area.
 - .1 Final lead wipe sampling results from horizontal and vertical surfaces must show lead levels of less than 40 micrograms of lead in dust per square foot. Samples collected and analyzed in accordance with EPA 747-R-95-007.
 - .2 If wipe sampling results show levels of lead dust in excess of 40 micrograms per square foot, re-clean work area at contractor's expense and apply another acceptable coat of lock-down agent to surfaces.
 - .3 Repeat as necessary until lead dust levels are less than 40 micrograms per square foot.

3.6 FINAL CLEANUP

- .1 Following specified cleaning procedures, and when lead wipe sampling is below acceptable concentrations proceed with final cleanup.
- .2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum.
- .3 Place polyethylene sheets, tape, cleaning material, clothing, and contaminated waste in plastic bags and sealed labelled waste containers for transport.
- .4 Clean-up Work areas, Equipment and Access Room, and other contaminated enclosures.

- .5 Remove sealed waste containers and equipment used in Work and remove from work areas at appropriate time in cleaning sequence.
- .6 Conduct final check to ensure no dust or debris remain on surfaces as result of dismantling operations.

3.7 RE-ESTABLISHMENT
OF OBJECTS AND
SYSTEMS

- .1 Repair or replace objects damaged in course of work to their original state or better, as directed by Departmental Representative.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

- .1 Work in this section includes the following:
 - .1 Chipping and breaking out all deteriorated, spalled and delaminated concrete, defective cold joints, and the subsequent filling of voids, cracks and rebuilding of exterior surface profiles.
 - .2 Rebuild all broken concrete to its original shape in particular surface voids deeper than 6 mm and spalled surfaces.
 - .3 Coating of interior wall and ceiling surfaces.
 - .4 For quantity estimate of repair of concrete slab edge/beam delaminations refer to "25/55 St. Clair Avenue East, Toronto, ON - Elevator Shaft Evaluation FINAL" report, dated November 13, 2013, prepared by Read Jones Christoffersen Consulting Engineers, and "Additional Scope Stair A" document dated November 7, 2013 Both documents are attached at the end of the specifications.

1.2 REFERENCES

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO T277-07(2011), Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration (ASTM C1202-05).
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C109/C109M-13, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
 - .2 ASTM C157/C157M-08, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
 - .3 ASTM C190-85, Method of Test for Tensile Strength of Hydraulic Cement Mortars (Withdrawn 1990).
 - .4 ASTM C348-08, Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
 - .5 ASTM C469/C469M-10, Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression.
 - .6 ASTM C666/C666M-03(2008), Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
 - .7 ASTM C1059/C1059M-99(2008), Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete.

- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 19.24-M90 (withdrawn), Multicomponent, Chemical-Curing Sealing Compound.
- .4 International Concrete Repair Institute (ICRI):
 - .1 ICRI Concrete Repair Terminology 2010.

1.3 PRODUCT DATA SHEETS

- .1 Submit product data sheets of specified materials in accordance with Sections 01 33 00 and 01 78 00.
- .2 Before commencing work, submit for Departmental Representative's approval list of materials and methods proposed for the work in accordance with Sections 01 33 00 and 01 78 00.

1.4 ENVIRONMENTAL CONDITIONS

- .1 Apply exterior base and finish coatings during dry weather and when imminent weather forecast is favourable to proper application and curing in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Patching compound (for 6-50 mm horizontal and 6-25 mm for vertical applications): fast setting, non-shrink, premixed, requiring addition of water only, free of wax, metal, tar, emulsion and calcium chloride.
 - .1 Compressive strength: to ASTM C109/C109M, 24 MPa at 24 h and 44 MPa at 28 d.
 - .2 Flexural strength: to ASTM C348, 6.8 MPa at 7 d, 8.5 MPa at 28 d.
 - .3 Tensile strength: to ASTM C190, 4 MPa at 7 d, 5.5 MPa at 28 d.
 - .4 Modulus of elasticity: to ASTM C469/C469M, 1.5 x 10,000 MPa at 28 d.
- .2 Bonding agent: acrylic polymer emulsion formulated for bonding new concrete to cured concrete, non-yellowing, water based, compatible with and recommended by patching compound manufacturer.
 - .1 Compressive strength: to ASTM C109/C109M, 31 MPa at 28 days.
 - .2 Flexural strength: to ASTM C348, 12.4 MPa at 28 days.

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- .3 Tensile strength: to ASTM C190, 2.4 MPa at 28 days.
- .4 Freeze/thaw resistance: to ASTM C666/C666M, Method A, durability; 102 at 300 cycles.
- .3 Base coating: cement base waterproof coating for concrete, chloride-free, compressive strength to ASTM C109/C109M, 42 MPa at 28 days, premixed, requiring addition of water and bonding agent, colour: white.
 - .1 Compressive strength: to ASTM C109/C109M, 42 MPa at 28 days.
 - .2 Flexural strength: to ASTM C348, 7 MPa at 28 days.
 - .3 Tensile strength: to ASTM C190, 3 MPa at 28 days.
 - .4 Freeze/thaw resistance: to ASTM C666/C666M, pass.
- .4 Finish coating: 100% acrylic emulsion paint for concrete; weather, alkali, acid and mildew resistant, colour: colour from manufacturer's standard range.
- .5 Fiber reinforced cementitious mortar: two part acrylic modified cement.
 - .1 Compressive strength: 41 MPa at 7 days, 57.2 MPa at 28 days, to ASTM C109/C109M.
 - .2 Flexural strength: 5.3 MPa at 7 days, 11.0 MPa at 28 days, to ASTM C348.
 - .3 Bond strength: 13.8 MPa at 7 days, 20 MPa at 28 days to ASTM C1059/C1059M.
 - .4 Rapid chloride permeability: 1600/low to AASHTO T277.
 - .5 Length change %: to ASTM C157/C157M at 28 days, 0.043% in water, -0.052% in air.
- .6 Water: potable.
- .7 Aggregate: 6 to 9 mm clean limestone or pea gravel.
- .8 Joint filler: extruded polyethylene, closed cell, Shore A hardness 20, tensile strength, 140 to 200 kPa, outsized 30 to 50%, CFC free.
- .9 Sealant: multi-component, chemical curing to CAN/CGSB-19.24, Type 2, Class B, white, Ecologo certified, primer recommended by sealant manufacturer.

2.2 EQUIPMENT

- .1 Pneumatically operated scabbler with high-speed tungsten carbide tipped pistons to pulverize protective coatings, laitance, and concrete substrate in a single process, leaving surface clean with

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uniformly keyed texture, ready to receive new protective coatings, toppings and overlays and the following:

- .1 Production rate: 1.9-2.8 m²/hour at 1.6 mm surface removal.
- .2 Size: 305 mm long x 150 mm wide x 305 mm high.
- .3 Air consumption: 1.7 m³/min.
- .4 Vacuum flow:
- .5 Interfacable with self-cleaning, high efficiency HEPA filtered vacuum.

- .2 Mobile, high performance HEPA Vacuum/Drumming System as follows:

- .1 Two-stage positive filtration of hazardous particles.
 - .1 First stage: Automatic self-cleaning by reverse-flow pulses of high pressure air. Efficiency of 95% at 1 micron.
 - .2 Second stage: HEPA efficiency of 99.7% at 0.3 microns.
- .2 Controlled-seal drum fill system to allow filling, sealing, removal and waste drum replacement under controlled vacuum system.
- .3 Size: 1219 mm long x 711 mm wide x 1828 mm high.
- .4 Automatic, full-drum level alarm.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- .1 Remove protective coatings using pneumatically operated scabbler and HEPA vacuum/drumming system.
 - .1 Remove drums from site. Dispose of in accordance with requirements of Provincial and Federal authorities having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for designated substances disposal are followed.
- .2 Remove loose, spalled, cracked, eroded and disintegrated concrete to solid surface, 9 mm minimum depth.
- .3 Chisel under perimeter of areas to be patched.
- .4 Sandblast loose rust and scale from exposed steel surfaces.
- .5 Clean area of loose material, dirt, oil and scale.

- .6 Clean cracks 6 mm thick or wider with pressurized water jet or sandblasting.
- .7 Chip and break out all deteriorated concrete, previous repairs that are delaminated, existing delaminations and defective cold joints to sound concrete. Chip concrete away from exposed rusted surfaces of reinforcing bars, chipping should extend for a distance of about 150 mm along the bars beyond evident rusting. If chipping operation results in a bar becoming debonded from the concrete, the concrete behind the debonded bar shall be cut out to a depth of at least 25 mm.
- .8 Rout out wall cracks wider than 1 mm to a width and depth of 6 mm minimum and clean free of dust and debris, for subsequent filling.

3.2 MIXING

- .1 Patching compound:
 - .1 To manufacturer's written instructions.
 - .2 Mechanically mix using drill mixer. Ensure components are thoroughly mixed.
 - .3 Apply immediately.
 - .4 Dispose of mix not used immediately, do not retemper.
 - .5 6.8 kg of aggregate may be added to 25 kg bag of patching compound for large cavities and patches in excess of 25 mm thick.
- .2 Base coating:
 - .1 To manufacturer's written instructions.
 - .2 Mix 1 part bonding agent to 3 parts water.
 - .3 Add bonding mixture to base coating and mix to cement mortar consistency with 50 to 76 mm slump.

3.3 SURFACE REPAIRS

- .1 Following surface preparation previously described, rebuild surface profile and fill with patching compound and bonding agent.
- .2 Install repair material in accordance with manufacturer's written instructions.
- .3 Mix patching compound to batter consistency and apply by brush over dampened concrete within patching area. Slush mix over old concrete within patching area. Slush mix over old concrete surface, with brush coat before filling patch with heavier, trowel coat of patching

compound. Place and level patching compound within five to ten minutes after mixing water is added. Apply in successive 12 mm to 25 mm layers. Scratch first layer, cool with water and apply second layer within 15 to 20 minutes. Sponge float surface. If patch gets hot and turns light grey, cool by wetting. Keep patch damp 30 to 45 minutes after filling.

- .4 Where patching interior buttress apply patching compound over and under primed reinforcing bars in similar manner as described in item 3.4.3 above. All previously embedded steel should be first thoroughly covered and slushed with brush coat before application of heavier trowel coat.
- .5 Repair scaled or spalled concrete and missing corners deeper or greater than 6 mm with patching compound and bonding agent to render a regular flush surface. When rebuilding projecting concrete s such as cracked caps key into existing concrete by means of edge cutting a minimum depth of 20 mm. Protect other trades work and/or other prepared surfaces from patching material spills.

3.4 BASE COATING APPLICATION

- .1 Following surface repairs, apply base coating to all wall surfaces.
- .2 Brush on two coats, total coverage 1.5 kg/m2 in accordance with manufacturer's written instructions. Bring surface true and level. When coat has set, sponge float to uniform texture.
- .3 Let cure for a minimum of 24 hours prior to application of finish coating in accordance with manufacturer's, recommendations.

3.5 FINISH COATING INTERIOR APPLICATION

- .1 Prepare interior surface by sanding to remove loose paint, efflorescence and heavy rust to staining adequate substrate.
- .2 Patch holes and spalls with patching compound.
- .3 Rout out and fill prepared cracks with patching compound.
- .4 Protect equipment with drop sheets.

- .5 Brush or roll on two coats, total coverage 4.0 m²/l in accordance with manufacturer's written instructions. Coat interior wall and ceiling surfaces with finish coating. Allow minimum 3 to 4 hours wait between coats.

3.6 SEALANT
INSTALLATION

- .1 Clean and dry joints.
- .2 Insert joint filler where applicable to a depth of 1/2 joint width, minimum 6 mm.
- .3 Prime joints when recommended by sealant manufacturer.
- .4 Apply sealant in accordance with manufacturer's instructions.
- .5 Form smooth, concave surface.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-09/A23.2-09, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete.
 - .2 CAN/CSA-A179-04(R2009), Mortar and Grout for Unit Masonry.
 - .3 CAN/CSA-A371-04(R2014), Masonry Construction for Buildings.
 - .4 CAN/CSA-A3000-08, Cementitious Materials Compendium; CAN/CSA-A3002-08, Masonry and Mortar Cement.
- .2 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
 - .1 SCAQMD Rule 1168-05, Adhesive and Sealant Applications.
- .3 For quantity estimate of repair of mortar joints refer to "25/55 St. Clair Avenue East, Toronto, ON - Elevator Shaft Evaluation FINAL" report, dated November 13, 2013, prepared by Read Jones Christoffersen Consulting Engineers, and "Additional Scope Stair A" document dated November 7, 2013 Both documents are attached at the end of the specifications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Provide submittals in accordance with Section 01 33 00.
 - .2 Provide manufacturer's printed product literature, specifications and datasheets. Include product characteristics, performance criteria, and limitations.
 - .3 Provide two copies of Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS) in accordance with Section 01 35 29, painting, colour additives and admixtures. Expressed as grams per litre (g/L).
- .2 Samples:
 - .1 Samples: provide samples in accordance with Section 01 33 00, supplemented as follows:
 - .1 Provide two 150 mm size samples of mortar.
 - .2 Provide confirmation of source or product data sheet, prior to mixing or preparation of mortars, to Departmental Representative of:
 - .1 Aggregate: course aggregate and sand.

- .2 Cement.
- .3 Lime.

- .3 Manufacturer's Instructions:
 - .1 Provide manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

- .1 Test Reports: certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, supplemented as follows:
 - .1 Submit laboratory test reports.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.
- .4 Mock-ups:
 - .1 Construct mock-ups in accordance with Section 01 45 00 supplemented as follows:
 - .1 Construct mock-up sample panel of pointing, repointing.
 - .2 Sample panel: 900 mm x 900 mm using proposed procedures, colours, texture, finish and workmanship.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handles masonry mortar and grout materials in accordance with Section 01 61 00, supplemented as follows:
 - .1 Deliver prepackaged, dry-blended mortar mix to project site in labelled plastic-lined bags each bearing name and address of manufacturer, production codes or batch numbers, and colour or formula numbers.
 - .2 Maintain mortar, grout and packaged materials clean, dry, and protected against dampness, freezing, traffic and contamination by foreign materials.
- .2 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

1.5 SITE CONDITIONS

- .1 Ambient Conditions: maintain materials and surrounding air temperature to:
 - .1 Minimum 10 degrees C prior to, during, and 48 hours after completion of masonry work.
 - .2 Maximum 32 degrees C prior to, during, and 48 hours after completion of masonry work.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Use same brands of materials and source of aggregate for entire project.
- .2 Cement:
 - .1 Portland Cement: to CAN/CSA-A3000, Type GU.
 - .1 Use low VOC products in compliance with SCAQMD Rule 1168.
 - .2 Mortar Cement: to CAN/CSA-A3002 and CAN/CSA-A179, Type N, S, integral water repellents.
 - .1 Use low VOC products in compliance with SCAQMD Rule 1168.
 - .4 Packaged Dry Combined Materials for mortar: to CAN/CSA-A179, Type S, using gray colour cement.
- .3 Aggregate: supplied by one supplier.
 - .1 Fine Aggregate: to CAN/CSA-A179, natural sand, manufactured sand or silica sand.
 - .2 Course Aggregate: to CAN/CSA-A179.
- .4 Water: clean and potable.
- .5 Hydrated Lime: to CAN/CSA-A179, Type S.
- .6 Bonding Agent: epoxy type.
- .7 Polymer Latex: organic polymer latex admixture of butadiene-styrene type non-emulsifiable bonding admixture.

2.2 MORTAR MIXES

- .1 Mortar for interior masonry:
 - .1 Loadbearing: Type S based on proportion specifications.
 - .2 Non-Loadbearing: Type N based on proportion specifications.
-

- .2 Pointing Mortar: CAN/CSA-A179, Type N using property specification.
- .3 Parging mortar: type N to CAN/CSA-A179.
- .4 Following applies regardless of mortar types and uses specified above:
 - .1 Mortar for grouted reinforced masonry: type S based on proportion specifications.

2.3 MORTAR MIXING

- .1 Mix mortar ingredients in accordance with CAN/CSA-A179 in quantities needed for immediate use.
- .2 Maintain sand uniformly damp immediately before mixing process.
- .3 Do not use anti-freeze compounds including calcium chloride or chloride based compounds.
- .4 Do not add air entraining admixture to mortar mix.
- .5 Use a batch type mixer in accordance with CAN/CSA-A179.
- .6 Pointing mortar: prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour no more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.
- .7 Re-temper mortar only within two hours of mixing, when water is lost by evaporation.
- .8 Use mortar within 2 hours after mixing at temperatures of 32°C, or 2-1/2 hours at temperatures under 10°C.

2.6 GROUT MIXES

- .1 Grout: Minimum compressive strength of 12.5 MPa at 28 days. Maximum aggregate size and grout slump: CAN/CSA-A179.

2.7 GROUT MIXING

- .1 Mix batched and delivered grout in accordance with CAN/CSA-A23.1/A23.2 transit mixed.
- .2 Mix grout ingredients in quantities needed for immediate use in accordance with CAN/CSA-A179 fine grout.

- .3 Add admixtures in accordance with manufacturer's instructions; mix uniformly.
- .4 Do not use calcium chloride or chloride based admixtures.

2.8 MIX TESTS

- .1 Testing Mortar Mix:
 - .1 Test mortar to requirements of Section 01 45 00, and in accordance with CAN/CSA-A179, for proportion specification. Test prior to construction and during construction for:
 - .1 Compressive strength.
 - .2 Consistency.
 - .3 Mortar aggregate ratio.
 - .4 Sand/cement ratio.
 - .5 Water content and water/cement ratio.
 - .6 Air content.
 - .7 Splitting tensile strength.
- .2 Testing Grout Mix:
 - .1 Test grout to requirements of Section 01 45 00, and in accordance with CAN/CSA-A179, for proportion specification. Test prior to construction and during construction for:
 - .1 Compressive strength.
 - .2 Sand/cement ratio.
 - .3 Water content and water/cement ratio.
 - .4 Slump.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Request inspection of spaces to be grouted.

3.2 PREPARATION

- .1 Apply bonding agent to existing surfaces.
- .2 Plug clean-out holes with masonry units. Brace masonry for wet grout pressure.

3.3 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.

3.4 CONSTRUCTION

- .1 Do masonry mortar and grout work in accordance with CAN/CSA-A179 except where specified otherwise.
- .2 Apply parging in uniform coating not less than total 10 mm thick, where indicated.

3.5 MIXING

- .1 All pointing mortar can be mixed using a regular paddle mixer. Only electric motor mixers are permissible. Mixers run on hydrocarbons are not permitted, due to fumes. Mixing by hand must be pre-approved by the Departmental Representative.
- .2 Clean all mixing boards and mechanical mixing machine between batches.
- .3 Mortar must be weaker than the units it is binding.
- .4 Contractor to appoint one individual to mix mortar, for duration of project. In the event that this individual must be changed, mortar mixing must cease until the new individual is trained, and mortar mix is tested.

3.6 MORTAR PLACEMENT

- .1 Install mortar to manufacturer's instructions.
- .2 Install mortar to requirements of CAN/CSA-A179.
- .3 Install mortar and grout to CAN/CSA-A179.
- .4 Remove excess mortar from grout spaces.

3.7 GROUT PLACEMENT

- .1 Install grout in accordance with manufacturer's instructions.
- .2 Install grout in accordance with CAN/CSA-A179.
- .3 Work grout into masonry cores and cavities to eliminate voids.
- .4 Do not install grout in lifts greater than 400 mm, without consolidating grout by rodding.
- .5 Do not displace reinforcement while placing grout.

3.8 FIELD QUALITY
CONTROL

- .1 Site Tests, Inspection: in accordance with Section 01 45 00 supplemented as follows:
 - .1 Test and evaluate mortar prior to construction and during construction in accordance with CAN/CSA-A179.
 - .2 Test and evaluate grout prior to construction and during construction to CAN/CSA-A179; test in conjunction with masonry unit sections specified.
- .2 Manufacturer's Field Services: in accordance with Section 01 45 00.

3.9 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .2 Remove droppings and splashings using clean sponge and water.
- .3 Clean masonry with low pressure clean water and soft natural bristle brush.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

3.10 PROTECTION OF
COMPLETED WORK

- .1 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C126-13, Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
 - .2 ASTM C212-10, Standard Specification for Structural Clay Facing Tile.
 - .3 ASTM C270-12a, Standard Specification for Mortar for Unit Masonry.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA A82.4/A82.5/A82.6-M1978(R1998), Structural Clay Load-Bearing Wall Tile/Structural Clay Non-Load-Bearing Tile/Standard Methods for Sampling and Testing Structural Clay Tile.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 For quantity estimate of repair of clay brick, block and tile refer to "25/55 St. Clair Avenue East, Toronto, ON - Elevator Shaft Evaluation FINAL" report, dated November 13, 2013, prepared by Read Jones Christoffersen Consulting Engineers, and "Additional Scope Stair A" document dated November 7, 2013. Both documents are attached at the end of the specifications.

1.2 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00.
 - .1 Test reports:
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

- .2 Instructions: submit manufacturer's installation instructions.
- .2 Manufacturer's Field Reports: manufacturer's field reports specified.

1.3 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver masonry units to site as packaged by manufacturer.
 - .4 Offload masonry units packages using equipment that will not damage the surfaces.
 - .5 Do not use brick tongs to move or handle masonry.
- .2 Storage and Protection:
 - .1 Ensure that masonry units are not in direct contact with the ground.
 - .2 Do not double stack cubes of masonry units.
 - .3 Cover masonry units with non-staining waterproof membrane covering.
 - .4 Keep units dry.
 - .5 Allow air circulation around units.
 - .6 Installation of wet or stained masonry units is prohibited.
 - .7 Keep masonry units in individual cardboard packaging provided by manufacturer until units are ready to be installed.
- .3 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Structural clay load bearing tile: ASTM C126 Type 1.
 - .1 Finish: plaster base.
 - .2 Colour: as selected by Departmental Representative from manufacturer's standard range, and to match approved sample.

- .3 Sizes to match existing brick and solid units.
- .2 Structural clay facing tile: to ASTM C212, type FTS, class Special Duty.
 - .1 Colour and texture: to match approved samples.
 - .2 Size: to match existing clay tiles.
 - .3 Number of faces: single.

2.3 ACCESSORIES

- .1 Mortar conform to ASTM C270 and Section 04 05 12.
- .2 Admixtures and additives for workability are not permitted.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Clay tile:
 - .1 Bond: to match existing.
 - .2 Coursing height: to match existing.
 - .3 Jointing:
 - .1 Raked.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 11.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 04 05 12 - Masonry Mortar and Grout.

1.2 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM E336-11, Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A165 Series-04(R2009), CSA Standards on Concrete Masonry Units (covers: A165.1, A165.2, A165.3).
 - .2 CAN/CSA-A371-04(R2009), Masonry Construction for Buildings.
 - .3 CSA S304.1-04(R2010), Design of Masonry Structures.
- .3 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
 - .1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
- .4 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S101-07, Standard Methods of Fire Endurance Tests of Building Construction and Materials.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
 - .2 Product Data:
 - .1 Product Data: provide product data, including manufacturer's printed data sheets and catalog pages illustrating products to be incorporated into project for specified products.
 - .3 Samples:
 - .1 Provide unit samples in accordance with Section 01 33 00.
-

- .4 Manufacturer's Written Instructions: provide in accordance with Section 01 33 00.

1.4 QUALITY ASSURANCE SUBMITTALS

- .1 Certificates: provide in accordance with Section 01 33 00.
- .2 Test and Evaluation Reports: provide certified test reports in accordance with Section 01 33 00.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle concrete unit masonry in accordance with Section 01 61 00.
- .2 Packaging Waste Management:
 - .1 Separate and recycle waste materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Standard concrete block units: to CAN/CSA-A165 Series (CAN/CSA-A165.1).
 - .1 Classification: H/15/A/M and SF/15/A/M.
 - .2 Sizes: to match existing.
 - .3 Special shapes: provide bull-nosed units for exposed corners. Provide purpose-made shapes for lintels, beams and bond beams. Provide additional special shapes as indicated.

2.2 REINFORCEMENT

- .1 Reinforcement: to CAN/CSA-A371, adjustable.

2.3 CONNECTORS

- .1 Connectors: to CAN/CSA-A370, minimum Level 2 corrosion protection.
-

<u>2.4 MORTAR MIXES</u>	.1	Mortar and mortar mixes in accordance with Section 04 05 12.
<u>2.5 GROUT MIXES</u>	.1	Grout and grout mixes in accordance with Section 04 05 12.
<u>2.6 CLEANING COMPOUNDS</u>	.1	Use low VOC products in compliance with SCAQMD Rule 1168.
	.2	Compatible with substrate and acceptable to masonry manufacturer for use on products.
	.3	Cleaning compounds compatible with concrete unit masonry and in accordance with manufacturer's written recommendations and instructions.
<u>2.7 TOLERANCES</u>	.1	Tolerances for standard concrete unit masonry tolerances in accordance with CAN/CSA-A165.1, supplemented as follows: .1 Maximum variation between units within specific job lot not to exceed 2 mm. .2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm. .3 Out of square tolerance not to exceed 2 mm.
<u>PART 3 - EXECUTION</u>		
<u>3.1 EXAMINATION</u>	.1	Verify surfaces and conditions are ready to accept work of this Section.
	.2	Commencing installation means acceptance of existing substrates.
<u>3.2 PREPARATION</u>	.1	Protect adjacent finished materials from damage due to masonry work.
<u>3.3 INSTALLATION</u>	.1	Concrete block units: .1 Bond: running. .2 Coursing height: 200 mm for one block and one joint.

.3 Jointing: raked where exposed or where paint or other finish coating is specified.

.2 Special Shapes:

.1 Install special units to form corners, returns, offsets, reveals and indents without cut ends being exposed and without losing bond or module.

.2 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.

.3 End bearing: not less than 200 mm.

.4 Install special site cut shaped units.

3.4 REINFORCEMENT

.1 Install reinforcing in accordance with CAN/CSA-A371.

3.5 CONNECTORS

.1 Install connectors in accordance with CAN/CSA-A370.

3.6 MORTAR
PLACEMENT

.1 Place mortar in accordance with Section 04 05 12.

3.7 GROUT PLACEMENT

.1 Place grout in accordance with Section 04 05 12.

3.8 CONSTRUCTION

.1 Cull out masonry units, in accordance with CAN/CSA-A165 and reviewed range of colour samples, with chips, cracks, broken corners, excessive colour and texture variation.

.2 Build in miscellaneous items such as bearing plates, steel angles, bolts, anchors, inserts, sleeves and conduits.

.3 Construct masonry walls using running bond unless otherwise noted.

.4 Build around frames previously set and braced. Fill behind hollow frames within masonry walls with mortar or grout and embed anchors.

.5 Fit masonry closely against electrical and plumbing outlets so collars, plates and covers overlap and conceal cuts.

- .6 Install movement joints and keep free of mortar where indicated.
- .7 Hollow Units: spread mortar setting bed from outside edge of face shells. Gauge amount of mortar on top and end of unit to create full joints, equivalent to shell thickness. Avoid excess mortar.
- .8 Solid Units: apply mortar over entire vertical and horizontal surfaces. Avoid bridging of airspace between brick veneer and backup wall with mortar.
- .9 Ensure compacted head joints. Use full or face-shell joint as indicated.
- .10 Tamp units firmly into place.
- .11 Do not adjust masonry units after mortar has set. Where resetting of masonry is required, remove, clean and reset units in new mortar.
- .12 Tool exposed joints raked for interior work; strike concealed joints flush.
- .13 After mortar has achieved initial set up, tool joints.
- .14 Do not interrupt bond below or above openings.

3.9
REPAIR/RESTORATION

- .1 Upon completion of masonry, fill holes and cracks, remove loose mortar and repair defective work.

3.10 FIELD QUALITY
CONTROL

- .1 Site Tests, Inspection:
 - .1 Concrete masonry units will be sampled and tested by independent testing agency appointed and paid by Departmental Representative in accordance with CSA S304.1.
 - .2 Noise reduction between two rooms will be tested by independent testing agency appointed and paid by Departmental Representative in accordance with ASTM E336.
 - .3 Notify inspection agency minimum of 24 hours in advance of requirement for tests.
- .2 Manufacturer's Field Services: in accordance with Section 01 45 00.

3.11 CLEANING

- .1 Clean in accordance with Section 01 74 11, supplemented as follows.
 - .1 Progress Cleaning:
 - .1 Standard Concrete Unit Masonry:
 - .1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block. Clean wall surface with suitable brush or burlap.
 - .2 Architectural Concrete Unit Masonry:
 - .1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block. Clean wall surface with suitable brush or burlap.
 - .3 Prefaced Concrete Unit Masonry:
 - .1 Clean masonry as work progresses using soft, clean cloths, within few minutes after laying. Upon completion, when mortar has set so that it will not be damaged by cleaning, clean with soft sponge or clean cloths, brush, and clean water. Polish with soft, clean cloths.
 - .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM):
 - .1 ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A269-13, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .3 ASTM A307-12, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .4 ASTM A666-10, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - .5 ASTM F593-13a, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating
- .3 Canadian Standards Association (CSA):
 - .1 CSA B651-12, Accessible Design for the Built Environment.
 - .2 CSA G40.20-04(2009)/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .3 CAN/CSA-W59-03(R2008), Welded Steel Construction (Metal Arc Welding).
- .4 The Master Painters Institute (MPI) / Architectural Painting Specification Manual - February 2004.
 - .1 MPI #79 - Primer, Alkyd, Anti-Corrosive for Metal.

1.2 DESIGN REQUIREMENTS

- .1 Design steel handrails and railings, in accordance with CSA B651.

1.3 SUBMITTALS

- .1 Submit shop drawings and product data of each item specified in accordance with Sections 01 11 00, 01 33 00 and 01 78 00.
 - .1 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories.

- .2 Indicate each item's conformance with CSA B651.
- .3 Each shop drawing submission shall bear signature and stamp of qualified professional engineer registered or licensed in province of Ontario.

- .2 Submit 300 mm long sample of each finish.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Stainless steel sheet, strip, plate and flat bar: to ASTM A666, type 304, AISI No. 4 finish, minimum 75% recycled content.
- .2 SS bolts, nuts and washers: stainless steel to ASTM F593, minimum 75% recycled content.
- .3 Steel: to CSA G40.20/G40.21, Grade 300W, minimum 30% recycled content.
- .4 Hollow Structural Sections (HSS): to CSA G40.20/G40.21, Grade 350W, Class H, minimum 30% recycled content.
- .5 Alkyd primer: to MPI #79, E3 environmental rating.
- .6 Galvanizing: hot dip, unpassivated, to ASTM A123/A123M, Coating Grade 85, minimum 600 g/m2.
- .7 Zinc rich primer for galvanized surfaces: zinc rich, readymix to CAN/CGSB-1.181, Ecologo certified.
- .8 Grout: non-shrink, non-metallic, flowable, 24 h, 15 MPa, pullout strength 7.9 MPa.
- .9 Bolts and anchor bolts: to ASTM A307.
- .10 Thread lock adhesive: one component, high strength, dimethacrylate ester adhesive for fasteneres subjected to heavy shock/vibration loads/high levels of stress.
 - .1 Braekaway torque: 22N.m to ISO 10964.
 - .2 Prevail torque: 32 N.m to ISO 10964.
 - .3 Breakloose torque: 38 N.m to DIN 54454.
 - .4 Maximum prevail torque: 40 N.m to DIN 54454.
- .11 Welding materials: to CSA W59.

2.2 FABRICATION

- .1 Fit joints in true planes and securely fasten.
- .2 Weld to CSA W59. File or grind welds smooth and flush with adjoining surface.
- .3 Shop assemble work.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Supply other sections with templates, instructions and built-in items.
- .2 Install work straight, plumb and level to a tolerance of 1:600.
- .3 Provide required reinforcing and anchorage.
- .4 Touch-up burnt, scratched or chipped primer.

3.2 LOOSE ANGLE
LINTELS

- .1 Supply masonry section with steel loose angle lintels of sizes required to suit masonry openings.
- .2 Apply alkyd primer to interior lintels. Galvanize exterior lintels.
- .3 Provide 150 mm bearing at ends.
- .4 Weld or bolt together back-to-back angles.

3.3 HSS POSTS AND
BEAMS

- .1 Clean bearing surfaces prior to setting plates.
- .2 Set posts and beams accurately in locations and to elevations indicated.
- .3 Maintain erection tolerances within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- .4 Level and plumb individual members.
- .5 Align and adjust various members that form part of complete frame or structure before permanently fastening or setting in place.

3.4 BRACKETS,
MISCELLANEOUS STEEL

- .1 Supply and install steel brackets, angles, sections and items indicated, detailed or required for completion of the project, and which are not to be supplied under another Section.

3.5 ANCHORS, BOLTS
AND OTHER
ANCHORAGES

- .1 Provide all anchors, bolts and expansion bolts or other means of anchorage required for building into floors, walls, and ceilings, where it is necessary to secure building components or equipment, other than anchorages specified under other Sections. Supply anchor bolts, nuts and similar hardware to the respective Sections for fastenings.

3.6 CORNER GUARDS

- .1 Metal corner guards: 1.5 mm thick, 75 x 75 mm size, 1220 mm long, with 3 mm corner radius, Type 302 satin finished stainless steel, with removable protective paper cover, surface, mechanically mounted.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S101-07, Standard Methods of 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.

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.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets.
- .3 Samples: submit duplicate 300 x 300 mm size sample of exposed fireproofing for approval of texture and colour.
- .4 Quality assurance submittals: submit following in accordance with Section 01 45 00.
 - .1 Test Reports:
 - .1 Submit product data including certified copies of test reports verifying fireproofing applied to substrate as constructed on project will meet or exceed requirements of Specification.
 - .2 Submit test results in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
 - .3 For assemblies not tested and rated, submit proposals based on related designs using accepted fireproofing design criteria.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

.4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company, person specializing in sprayed-on fireproofing with 5 years documented experience and approved by manufacturer.

.2 Mock-ups:

.1 Construct mock-up in accordance with Section 01 45 00.

.2 Apply fireproofing to approximately 10 m2 area of surface to be treated.

.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 fireproofing 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.

.3 Site Meetings:

.1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations, with Contractor's representative and Departmental Representative in accordance with Section 01 31 19 and 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.

.2 Prior to start of Work arrange for site visit with Departmental Representative to examine existing site conditions adjacent to demolition work.

.3 Hold project meetings every week.

.4 Ensure key personnel, site supervisor, project manager, subcontractor representatives attend.

.5 Departmental Representative will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.

- .4 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
- .1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
- .2 Twice during progress of Work at 25% and 60% complete.
- .3 Upon completion of Work, after cleaning is carried out.

1.4 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 packaged materials in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
- .2 Storage and Protection:
- .1 Store materials indoors in dry location.
- .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
- .3 Damaged or opened containers will be rejected.
- .4 Packaging to indicate shelf-life and materials to be applied prior to expiration of shelf-life.
- .5 Provide temporary enclosures to prevent spray from contaminating air beyond application area.
- .6 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of fireproofing materials.
- .3 Waste Management and Disposal:
- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.5 AMBIENT CONDITIONS

- .1 At temperatures less than 5°C, ensure that 5°C air and substrate temperature is maintained during and for 24 hours after application. Ensure that natural ventilation to properly dry the fireproofing during and subsequent to its application is provided. In enclosed areas lacking openings for natural

ventilation, ensure that interior air is circulated and exhausted to the outside.

- .2 Maintain relative humidity within limits recommended fireproofing manufacturer.
- .3 Ensure that natural ventilation to properly dry fireproofing during and subsequent to its application is provided.
- .4 In enclosed areas lacking openings for natural ventilation, provide minimum of 4 air exchanges per hour by forced air circulation.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Sprayed fireproofing: ULC certified cementitious or asbestos-free mineral fibre fireproofing qualified for use in ULC Designs specified and fungus resistant for 28 days.
- .2 Curing compound: type recommended by fireproofing manufacturer, qualified for use in ULC Designs specified.
- .3 Sealer: type recommended by fireproofing manufacturer, qualified for use in ULC Design specified.
 - .1 Colour: as selected by Departmental Representative from manufacturer's standard range.
- .4 Fireproofing: minimum dry density and cohesion/adhesion properties as follows:
 - .1 Fireproofing for structural components concealed above ceiling, or within wall, chase, or furred space: minimum applied dry density of 240 kg per cubic meter and cohesion/adhesion strength of 9.57 kPa.
 - .2 Fireproofing for exposed structural components, except where otherwise specified or indicated: minimum applied dry density of 350 kg per cubic meter and cohesion/adhesion strength of 20.83 kPa.
 - .3 Fireproofing for structural components located in mechanical rooms and storage areas: minimum applied dry density of 640 kg per cubic meter and cohesion/adhesion strength of 350 kPa.
 - .4 Ensure spray-applied fireproofing: does not crack, spall or delaminate under downward deflection conditions over 3 m clear span.

- .5 Minimum compressive strength: 48 kPa.
- .6 Spray-Applied fireproofing material: not contribute to corrosion of test panels.
- .7 Dust removal: not exceed 0.25 gram per square meter.

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 Substrate: free of material, which would impair bond.
- .2 Verify that painted substrates are compatible and have suitable bonding characteristics to receive fireproofing.
- .3 Remove incompatible materials.
- .4 Ensure that items required to penetrate fireproofing are placed before installation of fireproofing.
- .5 Ensure that ducts, piping, equipment, or other items which would interfere with application of fireproofing are not positioned until fireproofing work is completed.

3.3 APPLICATION

- .1 Apply bonding adhesive or primer to substrate if recommended by manufacturer.
- .2 Apply fireproofing to correspond with tested assemblies, or acceptable calculation procedures to provide fire resistance ratings as indicated.
- .3 Apply fireproofing over substrate, building up to required thickness to cover substrate with monolithic blanket of uniform density and texture.
- .4 Apply fireproofing directly to open web joists without use of expanded lath.
- .5 Tamp smooth, surfaces visible in finished work as indicated.

- .6 Apply curing compound to surface of cementitious fireproofing as required by manufacturer.
- .7 Apply sealer to surface of mineral fibre fireproofing as required by manufacturer in ventilation plenums, where fireproofing is to be painted, and as indicated.

3.4 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - 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 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
- .2 Inspection and Site Tests:
 - .1 Inspection and testing of fireproofing will be carried out by Testing Laboratory designated by Departmental Representative.
 - .2 Departmental Representative will pay costs for testing, as specified in Section 01 29 83.

3.5 PATCHING

- .1 Patch damage to fireproofing caused by testing or by other trades before fireproofing is concealed, or if exposed, before final inspection.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 11.
- .2 Clean surfaces not indicated to receive fire- proofing of sprayed material within 24 hours period after application.
- .3 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S101-07, 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 2010, Division B, Subsection 3.1.8 and Article 3.1.9.1, and Subsection 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 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 MSDS - Material Safety Data Sheets.
- .3 Shop Drawings:
 - .1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.
 - .2 Construction details should accurately reflect actual job conditions.
- .4 Samples:
 - .1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.
- .5 Quality assurance submittals: submit following in accordance with Section 01 45 00.
 - .1 Test reports: in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.
 - .4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company, person specializing in fire stopping installations with 5 years documented experience and approved by manufacturer.

-
- .2 All fire stopping material shall be from one manufacturer.
 - .3 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 and 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.
 - .3 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.
- 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, ULC markings.
 - .2 Storage and Protection:
 - .1 Store materials indoors 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.
- .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.

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.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - 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 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 11.
- .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 Edge of floor slabs at curtain wall and precast concrete panels.
 - .3 Top of fire-resistance rated masonry and gypsum board partitions.
 - .4 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .7 Openings and sleeves installed for future use through fire separations.
 - .8 Around mechanical and electrical assemblies penetrating fire separations.

.9 Rigid ducts: greater than 129 cm², when specifically permitted by the fire damper manufacturer's detailed installation instructions, fire stopping to consist of bead of firestopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END OF SECTION

PART 1 - GENERAL

1.1 ENVIRONMENTAL
CHOICE PROGRAM

- .1 Provide sealant products bearing the 'Ecologo' of the Environmental Choice Program, Department of the Environment, Canadian Environmental Protection Act, Environmental Choice Product Guidelines ECP/PCE-45-92 for Sealants and Caulking Compounds, except maximum VOC 60 g/L during application and curing.
- .2 For primers and sealants, indicate VOC in g/L during application and curing.

1.2 PRODUCT DATA

- .1 Submit manufacturer's literature indicating recommended surface preparation, sealant selection and primer for each substrate in accordance with Sections 01 33 00 and 01 78 00.

PART 2 - PRODUCTS

2.1 SEALANTS

- .1 Provide sealant products bearing Ecologo to ECP/PCE-45-92 with maximum VOC 60 g/L.

2.2 SEALANT
MATERIAL
DESIGNATIONS

- .1 Silicones One Part '3'.
 - .1 To ASTM C920-14, primerless, Type S, Grade NS, Class 50, SWRI validated.
- .2 Interior glazing sealant: one part silicone to ASTM C920-14, Type S, Grade NS, Class 25.
- .3 Acrylic Latex One Part '5'.
 - .1 To CAN/CGSB-19.17-M90.
- .4 Acoustical Sealant '6'.
 - .1 One part silicone to ASTM C920-14, primerless, Type S, Grade NS, Class 25, SWRI validated.
- .5 Preformed compressible and non-compressible back-up materials '10', CFC free.
 - .1 Polyethylene, urethane, neoprene or vinyl foam. Extruded open or closed cell foam backer rod. Size: oversize 30 to 50%.
 - .2 Neoprene or butyl rubber. Round solid rod, Shore A hardness 70.

.3 High density foam. Extruded closed cell polyvinyl chloride (PVC) or extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.

.4 Bond breaker tape. Polyethylene bond breaker tape which will not bond to sealant.

2.3 SEALANT SELECTION

- .1 Control and expansion joints on the interior of exterior poured-in place concrete walls: Designation 3.
- .2 Control and expansion joints on the interior of exterior surfaces of unit masonry walls: Designation 3.
- .3 Interior control and expansion joints in floor surfaces: Designation 10.
- .4 Perimeters of interior frames, as detailed: Designation 3.
- .5 Interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls): Designation 3.
- .6 Joints at tops of non-load bearing masonry walls at the underside of poured concrete: Designations 5, 6.
- .7 Exposed interior control joints in gypsum board: Designations 3, 6.

2.4 JOINT CLEANER

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

PART 3 - EXECUTION

3.1 PREPARATION OF JOINT SURFACES

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM C473-12, Standard Test Methods for Physical Testing of Gypsum Panel Products.
 - .2 ASTM C475/C475M-12, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .3 ASTM C840-11, Standard Specification for Application and Finishing of Gypsum Board.
 - .4 ASTM C954-11, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
 - .5 ASTM C1002-07(2013), Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - .6 ASTM C1047-10a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .7 ASTM C1396/C1396M-13, Standard Specification for Gypsum Board.
- .2 Association of the Wall and Ceilings Industries International (AWCI)
 - .1 AWCI Levels of Gypsum Board Finish 101a-97.
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Standard Method of Test of Surface Burning Characteristics of Building Materials and 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 gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Submit duplicate 300 x 300 mm size samples of each type of board.
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- .4 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Low-Emitting Materials:
 - .1 Submit listing of adhesives and sealants and paints and coatings used in building, showing compliance with VOC and chemical component limits or restriction requirements.

1.3 DESIGN REQUIREMENTS

- .1 Partition assembly to be non-combustible construction, fire resistance rated.

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 gypsum board assemblies materials level off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.
 - .3 Protect from weather, elements and damage from construction operations.
 - .4 Handle gypsum boards to prevent damage to edges, ends or surfaces.
 - .6 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

1.5 AMBIENT CONDITIONS

- .1 Maintain temperature 10 degrees C minimum, 21 degrees C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.
- .2 Apply board and joint treatment to dry, frost free surfaces.

- .3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Gypsum board: to ASTM C1396/C1396M, ends square cut.
- .1 Fire rated gypsum board: Gypsum core panel with a solid set, fire-resistive core for use in fire-resistive designs. Thickness 12.7 mm (1/2"), edges tapered, 1200 mm (48") wide x maximum practical length.
- .2 Fire-rated gypsum shaft liner board: Gypsum core shaft wall panel with enhanced fire resistant core, complying with ASTM C1396 Type X. Thickness 25.4 mm (1"), edges double bevelled, 600 mm (24") wide x maximum practical length.
- .2 Non-load bearing channel stud framing: to ASTM C645, 92 mm stud size, roll formed from 0.53 mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres.
- .3 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height.
- .4 Shaft wall studs and runners: Minimum 0.63 mm (25 gauge) thick galvanized steel members, "J Runner", "C-H Stud" and "E-Stud" by Canadian Gypsum Co. Ltd., or other acceptable equivalents.
- .5 Resilient steel furring channels: ASTM C645, 12.7 mm x 65 mm, 0.46 mm (0.018") base metal thickness, hot-dipped galvanized to ASTM A653/A653M G60 (Z180) zinc coating, roll formed; Hat shaped resilient furring channel for direct wall furring where resilient channels are indicated.
- .6 Hangers, tie wires, inserts, anchors: Manufacturer's standard.
- .7 Casing beads, corner beads: 0.48 mm (25 gauge) hot dipped galvanized steel, perforated flanges, designed to be concealed with joint compound; one piece length per location.
- .8 Steel drill screws: to ASTM C1002.
- .9 Sealants: in accordance with Section 07 90 00.
- .10 Joint compound: to ASTM C475/C475M, asbestos-free.

- .11 Joint tape: to ASTM C475/C475M.
 - .1 Paper tape for standard gypsum board.

2.2 FINISHES

- .1 Texture finish: asbestos-free standard white texture coating and primer-sealer, recommended by gypsum board manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies 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 ERECTION

- .1 Do application and finishing of gypsum board to ASTM C840 except where specified otherwise.
- .2 Install work level to tolerance of 1:1200.
- .3 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.
- .4 Place studs vertically at 400 mm on centre and not more than 50 mm from abutting walls, and at each side of openings and corners.
- .5 Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .6 Erect metal studding to tolerance of 1:1000.
- .7 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .8 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .9 Install heavy gauge single jamb studs at openings.

- .10 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .11 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .12 Extend partitions to ceiling height except where noted otherwise on drawings.
- .13 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use double track slip joint as indicated.
- .14 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .15 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.
- .16 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.
- .17 Install wall furring for gypsum board wall finishes to ASTM C840, except where specified otherwise.
- .18 Furr openings and around built-in equipment, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .19 Furr duct shafts, beams, columns, pipes and exposed services where indicated.
- .20 Erect drywall resilient furring transversely across studs, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 25 mm drywall screw.
- .21 Install 150 mm continuous strip of 12.7 mm gypsum board along base of partitions where resilient furring installed.

3.3 APPLICATION

- .1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.
- .2 Apply single or double layer gypsum board to metal furring or framing using screw fasteners for first layer, screw fasteners for second layer. Maximum spacing of screws 300 mm on centre.
 - .1 Single-Layer Application:
 - .1 Apply gypsum board vertically or horizontally, providing sheet lengths that

- will minimize end joints.
- .2 Double-Layer Application:
 - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
 - .2 Apply base layers at right angles to supports unless otherwise indicated.
 - .3 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.
- .3 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, in partitions where perimeter sealed with acoustic sealant.
- .4 Install gypsum board on walls vertically to avoid end-butt joints. At high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.
- .5 Install gypsum board with face side out.
- .6 Do not install damaged or damp boards.
- .7 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 INSTALLATION - GENERAL

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre.
- .2 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .3 Install access doors to electrical and mechanical fixtures specified in respective sections.
 - .1 Rigidly secure frames to furring or framing systems.
- .4 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .5 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with

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AWCI Levels of Gypsum Board Finish:

.1 Levels of finish:

- .1 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
- .6 Finish corner beads, as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .7 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .8 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .9 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
- .10 Mix joint compound slightly thinner than for joint taping.
- .11 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.
- .12 Allow skim coat to dry completely.
- .13 Remove ridges by light sanding or wiping with damp cloth.

3.5 INSTALLATION –
SHAFT WALL

- .1 Securely attach floor and ceiling J-runners with the short leg toward inside side of wall, and fasten to structure at 600 mm (24") o.c.
- .2 Erect liner panel vertically between runners. Where walls exceed maximum available panel height, position panels and joints within upper and lower third points of wall. Stagger joints in adjacent panels and reinforce with horizontal C-H studs.
- .3 Install C-H studs between liner panels with panels inserted in the stud groove.
- .4 Install E-studs or J-runners vertically at intersections, corners and openings.
- .5 Frame openings with E-studs or J-runners horizontally, reinforce as necessary.

- .6 Apply two layers of shaft wall gypsum board to studs and runners on the opposite side of liner panels.
- .7 Fasten base layer vertically to framing with 25 mm (1") screws at 300 mm (12") o.c. Apply face layer vertically over base layer with joints staggered and attached with 41 mm (1-5/8") screws staggered from those on base layer, spaced at 300 mm (12") o.c. and driven into studs and runners.
- .8 Allow for movement of structures so that the wall will not have load imposed.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
- .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.

3.7 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by gypsum board assemblies installation.

END OF SECTION

- .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.

3.2 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.

3.3 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.

3.4 MIXING

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

3.5 APPLICATION

- .1 Ventilate interior spaces during application and curing of sealants to maintain VOCs less than 50 g/l. Coordinate with building manager to ensure existing ventilation system or temporary ventilation supplies sufficient outside air.
- .2 Sealant.
 - .1 Protect installed work of other trades from staining or contamination.
 - .2 Apply sealant in accordance with manufacturer's application manual and written instructions.
 - .3 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint. remove tape after sealant applied.

- .4 Apply sealant in continuous beads.
- .5 Apply sealant using gun with proper size nozzle.
- .6 Use sufficient pressure to fill voids and joints solid.
- .7 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .8 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .3 Curing.
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.
- .4 Clean up.
 - .1 Clean adjacent surfaces immediately and leave work neat and clean.
 - .2 Remove excess and droppings, using recommended cleaners as work progresses.
 - .3 Remove masking tape after initial set of sealant.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 09 23 00: Gypsum plaster.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C841-03(2013), Standard Specification for Installation of Interior Lathing and Furring.
 - .2 ASTM C847-12, Standard Specification for Metal Lath.
 - .3 ASTM C933-13, Standard Specification for Welded Wire Lath.
 - .4 ASTM C1032-06(2011), Standard Specification for Woven Wire Plaster Base.
 - .5 ASTM C1047-10a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .6 ASTM C1063-12c, Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Canadian Standards Association (CSA)
 - .1 CSA 123.3-05(R2010), Asphalt Saturated Organic Roofing Felt.
- .4 Environmental Choice Program (ECP)
 - .1 ECP-69-94, Polyethylene Plastic Film Products.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Divert furring and lathing accessories scraps and cut-offs made from metal, plastic and PVC from landfill by disposal at nearest appropriate recycling facility.
- .2 Divert metal cut-offs from landfill by disposal at nearest metal recycling facility.
- .3 Divert reusable materials for reuse at nearest used building materials facility or similar type facility.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Metal furring (channels, hangers, tie wire, inserts, anchors): to ASTM C841.
 - .1 Steel: minimum 25% recycled content.
- .2 Metal lath: to ASTM C933, of type and weight to suit plaster system and support spacing. Steel: minimum 25% recycled content.
- .3 Polyethylene film: to CAN/CGSB-51.34, Type 2, 0.15 mm thick.
- .4 Metal accessories (corner beads, base screeds, cornerite, casing beads): to ASTM C1047.
 - .1 Steel: minimum 25% recycled content.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Use galvanized supports, members, angles and metal lathing in wet areas, exterior walls and exterior soffits.
- .2 Do not lath over bucks, anchors, blocking, electrical and mechanical work until they are inspected and approved by Engineer.
- .3 Leave finished work rigid, secure, square, level, plumb, and erected to maintain finish plaster line dimensions and contours. Make allowance for thermal movement.
- .4 Provide clearance under beams and structural slabs to prevent transmission of structural loads to vertical furring.

3.2 INSTALLATION

- .1 Furring and lathing work: in accordance with ASTM C841 except as specified otherwise.
- .2 Wall Furring.
 - .1 Install steel furring for walls.

.2 Frame openings and around built-in equipment, access panels, on four sides, with channels. Extend furring into reveals. Check clearances with equipment suppliers.

.3 Construct bulkheads and boxed-in duct shafts, for beams, columns, pipes and around exposed services where indicated. Install 19 mm channels at corners and at 300 mm o.c.

.4 Build in hollow metal frames in plastered furred walls.

.3 Metal Lathing.

.1 Apply metal lath taut. Locate end joints over framing members; stagger end joints on alternate courses; on vertical surfaces lap lower sheet over upper sheet.

.2 Install ribbed lath over chases and openings. Extend 450 mm each side of opening.

3.3 CONSTRUCTION

.1 Install 150 x 450 mm metal lath strips diagonally at each corner of openings exceeding 0.1 m², in masonry, gypsum lath and rigid insulation substrates.

.2 Apply cornerite to internal angles to be plastered except at suspended ceilings. Fasten to retain position during plastering. Do not secure to framing members.

.3 Lath across junctures of dissimilar materials to be plastered with strip of metal lath at least 200 mm wide.

.4 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 220 mm o.c.

.5 Install corner beads on external angles.

.6 Install casing beads at perimeter of suspended plaster ceilings; wherever plaster abuts or joins a dissimilar exposed surface such as masonry, concrete, wood, metal; where edges of plaster are exposed; where plaster on a non-structural member butts plaster on a structural member; and elsewhere as indicated.

.7 Install metal screeds at top of bases and dados.

.8 Construct control joints of two back-to-back casing beads set in plaster or accordion pleated metal accessory supported independently on both sides of joint.

- .9 Provide continuous polyethylene air seal behind and across expansion/contraction joints.
- .10 Locate control joints at butting structural elements, at dissimilar walls and ceilings, at wall juncture with suspended ceilings, at changes in substrate construction, over control joints in block walls, at line of door jambs from top of door frame to ceiling, at approximate 9 m spacing on long corridor runs, at maximum 7.5 m spacing in each direction on ceilings, at building expansion and construction joints.
- .11 Install control joints straight and true.
- .12 Install rings and frames for electrical and mechanical fixtures.
- .13 Rigidly secure rings and frames to furring and lathing systems.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM C28/C28M-10, Standard Specification for Gypsum Plasters.
 - .2 ASTM C35-01(2009), Standard Specification for Inorganic Aggregates for Use in Gypsum Plaster.
 - .3 ASTM C206-03(2009), Standard Specification for Finishing Hydrated Lime.
 - .6 ASTM C631-09, Standard Specification for Bonding Compounds for Interior Gypsum Plastering.
 - .7 ASTM C841-03(2013), Standard Specification for Installation of Interior Lathing and Furring.
 - .8 ASTM C842-05(2010)e1, Standard Specification for Application of Interior Gypsum Plaster.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Environmental Choice Program (ECP)
 - .1 CCD-126-95, Polyethylene Plastic Film Products.
- .4 Health Canada/ Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 Underwriters' Laboratories of Canada (ULC).

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 gypsum plaster materials and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS.
- .3 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Submit duplicate 300 x 300 mm samples of plaster finishes.

- .4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

1.3 QUALITY ASSURANCE

- .1 Certifications: 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.
 - .1 Ensure materials remain in original wrapping and containers until used.
 - .2 Deliver lath and plaster products to job site just prior to application.
 - .3 Deliver fresh plaster as needed to job site.
- .3 Storage and Handling Requirements:
 - .1 Store gypsum plastering materials off ground, indoors, in dry location away from heavy traffic areas and in accordance with manufacturer's recommendations.
 - .2 Store and protect bagged goods from direct contact with rain, snow, splashing water, wet or damp surfaces, condensation and absorption from the atmosphere.
 - .3 Stack plaster bags on planks or platforms away from damp floors and walls.
 - .4 Store gypsum plaster bases flat on clean dry floor.
 - .5 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

1.5 SITE CONDITIONS

- .1 Site Requirements:
 - .1 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of materials.
- .2 Ambient Conditions:
 - .1 Ventilation:
 - .1 Provide free circulation of air to carry off excess moisture.
 - .2 Mechanically remove moisture laden air in areas lacking normal ventilation.
 - .3 Protect plaster from vent drafts, heaters or windows, to avoid uneven drying.
 - .4 Avoid excessive ventilation or air movement to allow plaster to properly set.
 - .5 Screen exterior openings in building.
 - .2 Temperature:
 - .1 Do not apply plaster to surfaces containing frost.
 - .2 Maintain temperature above 13 degrees C for 48 hours prior to erection of gypsum plaster base, prior to and during application of plaster, and for 48 hours following installation of plaster or until plaster is dry.
 - .3 Distribute heat well to areas.
 - .4 Prevent irregular heat on plaster near source by providing deflection or protective screens.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Basecoat plasters:
 - .1 Gypsum mill aggregated plaster: to ASTM C35.
 - .2 Gypsum bonding plaster: to ASTM C28/C28M.
- .2 Finishing plaster:
 - .1 Hydrated finishing lime:
 - .1 Type S: to ASTM C206.
 - .2 Soaked overnight in water above 10 degrees C.
 - .2 Gypsum gauging plaster:
 - .1 To ASTM C28/C28M.
 - .2 Add to lime putty in proportion of 1 part dry gauging plaster by volume to 3 parts lime putty by volume.

- .3 Grounds:
 - .1 Wooden strips, corner beads, metal casing beads applied at perimeter of all openings.
 - .2 Set over metal lath to obtain minimum 15.9 mm plaster thickness from face of lath.
- .4 Screeds: install plumb and level to allow for 2.4 mm finish coat.

- .3 Sand, Perlite, or Vermiculite aggregate for use in basecoat plasters: to ASTM C35.

- .4 Water:
 - .1 Clean, fresh, potable.
 - .2 Free from mineral and organic substances which affect plaster set.
 - .3 Minimum required for plaster of workable consistency.
 - .4 20 degrees C.

- .5 Polyethylene film:
 - .1 CAN/CGSB-51.34, Type 2.
 - .2 EcoLogo certified to CCD-126.

- .6 Bonding agent: to ASTM C631.

2.2 MIXES

- .1 Mix plasters to ASTM C841.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum plastering 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 Prepare surfaces to receive plaster to ASTM C841.
- .2 Ensure grounds, screeds, beads and accessories are in place and conduits, pipes, cables and outlets are properly plugged, capped or covered before starting work.
- .3 Where plaster butts exposed masonry walls, insert 1 m wide strip of polyethylene before applying plaster to protect masonry. Cut polyethylene neatly at junction with plaster when plastering is completed.
- .4 Do not plaster adjacent to aluminum or finished work until such work is masked.
- .5 Apply bonding agent to concrete and bonding plaster to masonry surfaces in accordance with manufacturer's written instructions.

3.3 APPLICATION

- .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 Do plastering work to ASTM C842.
- .3 Apply plaster finish level and plumb to variation of 3 mm maximum in 2.5 m in any plane.
- .4 Use 3 coats plaster.
- .5 Form small vee groove where plaster finish is flush with bases, window frames, glazed wall tiles or similar construction.
- .6 Basecoat Plaster:
 - .1 12.7 mm thick.
 - .2 Mix by hand or with mechanical mixer, following manufacturer's directions.
 - .3 Wet unit masonry surfaces.
 - .4 Treat monolithic concrete with application of plaster bonder before plastering.
 - .5 Fur and lath interior surface of exterior masonry or monolithic concrete walls prior to plastering.
 - .6 Apply scratch (first) coat with sufficient materials and pressure to form good full keys on metal lath, and good bond on other bases.
 - .7 Cross rake.
 - .8 Apply brown (second) coat after first coat has set firm and hard.

- .9 Bring out to grounds and straighten to a true surface with rod and darby without use of additional water.
- .10 Leave surface rough to receive finish (third) coat.
- .11 Cut base coats free of bucks, frames and grounds to allow for movement. Cut plaster free of electrical outlet boxes and other opening.
- .12 Mix fireproofing plaster basecoats using perlite or vermiculite aggregate.

.7 Finishing Plaster:

- .1 Mix in accordance with applicable bag mixing instructions.
- .2 Add 0.014 m3 of perlite fines per 45.4 kg of gauging plaster, or use mill-aggregated "quality" gauging plaster.
- .3 Trowel Finish Coats:
 - .1 Scratch plaster in thoroughly and immediately double back to fill out to smooth, dense surface for decoration, free of surface blemishes and irregularities.
 - .2 Apply 2.4 mm (maximum) finish coat.
 - .3 Trowel plaster after set to achieve dense, hard, smooth surface.
- .4 Float Finish Coats:
 - .1 Scratch plaster in thoroughly and immediately double back to a true, even surface.
 - .2 Float using a wood, sponge, or rubber float to bring aggregate to surface to produce finish of uniform texture free of slick spots, cat faces, and other blemishes.
 - .3 Use water sparingly on natural colour and no water on coloured finishes.
- .5 Machine-Applied Spray Finishes:
 - .1 Apply initial coat of finish by hand.
 - .2 Float to uniform texture surface to provide background.
 - .3 Apply plaster in uniform spray pattern to produce texture approved by Departmental Representative.
- .6 Finish Coat: leave brown coat properly roughened and open as well as partially dry (green state) to receive finish coat.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

- .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.

3.5 PROTECTION

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

3.6 SCHEDULES

- .1 Carry basecoat on fire rated columns and partitions to underside of structure.
- .2 Apply finish coat plaster to exposed plaster surfaces.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Architectural Painting Specifications Manual, Master Painters Institute (MPI), 2010.
- .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).
- .4 National Fire Code of Canada 2010 (NFC).

1.2 QUALITY
ASSURANCE

- .1 Contractor shall have a minimum of five years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .3 Conform to latest MPI requirements for interior painting work including preparation and priming.
- .4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- .5 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.
- .6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.

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

1.3 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

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

1.4 INSPECTION REQUIREMENTS

- .1 Interior painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and local Painting Contractor's Association. Painting contractor shall notify Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.
- .2 Interior surfaces requiring painting shall be inspected by Paint Inspection Agency who shall notify Departmental Representative and General Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.
- .3 Where "special" painting, coating or decorating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating manufacturer shall provide as part of this work, certification of surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Departmental Representative.

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 MSDS - Material Safety Data Sheets in accordance with Section 01 33 00.
- .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 numbers.
 - .4 MPI Environmentally Friendly classification system rating.
 - .5 Manufacturer's Material Safety Data Sheets (MSDS).

1.7 SAMPLES

- .1 Submit full range colour sample chips in accordance with Section 01 33 00. Indicate where colour availability is restricted.
- .2 Submit duplicate 200 x 300 mm sample panels of each paint, stain, clear coating, special 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 3 mm plate steel for finishes over metal surfaces.
 - .2 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
 - .3 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 Provide mock-up in accordance with Section 01 45 00.

- .2 When requested by Departmental Representative Paint Inspection Agency, 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 - litre can of each type and colour of primer, 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 dry chemical 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 Ventilate enclosed spaces in accordance with Section 01 51 00.
 - .2 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.
 - .3 Where required, provide continuous ventilation for seven days after completion of application of paint.
 - .4 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.
 - .5 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.
 - .6 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 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 Separate and recycle waste materials in accordance with Section 01 74 20.
- .2 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.,) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
- .3 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .4 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .5 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).
- .6 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
- .7 Set aside and protect surplus and uncontaminated finish materials. Deliver to or arrange collection by individuals, or organizations for verifiable re-use or re-manufacturing.
- .8 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.
 - .2 be non-flammable.
 - .3 be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
 - .4 be manufactured without compounds which contribute to smog in the lower atmosphere.
 - .5 do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
- .5 Water-borne surface coatings must be manufactured and transported in a manner that steps of process, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).
- .6 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .7 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61.0°C or greater.
- .8 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:
 - .1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
 - .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

- .9 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.
- .10 Recycled water-borne surface coatings must contain 50% post-consumer material by volume.
- .11 Recycled water-borne surface coatings must not contain:
 - .1 Lead in excess of 600.0 ppm weight/weight total solids.
 - .2 Mercury in excess of 50.0 ppm weight/weight total product.
 - .3 Cadmium in excess of 1.0 ppm weight/weight total product.
 - .4 Hexavalent chromium in excess of 3.0 ppm weight/weight total product.
 - .5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.
- .12 The following must be performed on each batch of consolidated post-consumer material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.
 - .1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.
 - .2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.
 - .3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

2.2 COLOURS

- .1 Departmental Representative will provide Colour Schedule after Contract award.
- .2 Selection of colours will be from manufacturers 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:

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 finish	> 85	

- .2 Gloss level ratings of painted surfaces shall be as specified herein and as noted on Finish Schedule.

2.5 INTERIOR
PAINTING SYSTEMS

- .1 Concrete Vertical Surfaces: including horizontal soffits
 - .1 INT 3.1A Latex G5 finish (over sealer).
 - .2 INT 3.1E Latex G5 finish.
- .2 Concrete Horizontal Surfaces: floors and stairs
 - .1 INT 3.2L Waterborne epoxy floor finish.
- .3 Clay Masonry Units: pressed and extruded brick
 - .1 INT 4.1A Latex G5 finish.
- .4 Concrete Masonry Units: smooth and split face block and brick
 - .1 INT 4.2A Latex G5 finish.
- .5 Structural Steel and Metal Fabrications: columns, beams, joists, etc.
 - .1 INT 5.1K Waterborne epoxy finish.
- .6 Galvanized Metal: doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.
 - .1 INT 5.3K Waterborne light industrial coating G5 finish (over waterborne primer).
- .7 Spray Textured Surfaces: ceilings
 - .1 INT 9.1A Latex flat finish spray application only.
- .8 Plaster and Gypsum Board: gypsum wallboard, drywall, "sheet rock type material", etc., and textured finishes
 - .1 INT 9.2B High performance architectural latex G3 finish.

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 and general public 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 General 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 bleach where applicable 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 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 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 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 Field inspection of painting operations to be carried out by independent inspection firm as designated by Departmental Representative.
- .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 Co-operate with inspection firm and provide access to areas of work.

3.8 RESTORATION

- .1 Clean and re-install all hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Departmental Representative. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 BS EN10219-1:1997, Cold formed welded structural hollow sections of non-alloy and fine grain steels.
- .2 BS 476: Part 7: 1997, Method For Classification Of The Surface Spread Of Flame Of Products.

1.2 SUBMITTALS

- .1 Submittals in accordance with Sections 01 33 00 and 01 78 00.
- .2 Product Data: Manufacturer's data sheets on each product to be used, including:
 - .1 Preparation instructions and recommendations.
 - .2 Storage and handling requirements and recommendations.
 - .3 Installation methods.
- .3 Shopping Drawings
 - .1 Indicate tile layout, patterns, color arrangement, perimeter conditions, and junctions with dissimilar materials, thresholds, and setting details.
- .4 Samples
 - .1 For each material specified, two samples, representing all system components and finishes.

1.3 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Manufacturer specializing in the work of this section with minimum five year experience.
- .2 Installer Qualifications: Company specializing in performing similar work to the work of this section with minimum two year experience.
- .3 Roof Walkway Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application/installation workmanship.
 - .1 Provide mock-up in area designated by Departmental Representative.
 - .2 Mock-up shall include representative samples of all components of walkway system.
 - .3 Do not proceed with remaining work until mock-up has been reviewed and approved by Departmental Representative.

.4 Accepted mock-up shall be comparison standard for remaining Work.

1.4 DELIVERY,
STORAGE AND
HANDLING

- .1 Deliver materials in manufacturer's unopened containers, fully identified with name, brand, type, and grade.
- .2 Store products in manufacturer's unopened packaging until ready for installation. Follow manufacturer's written instructions for storage and handling of all products.

1.5 PROJECT
CONDITIONS

- .1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Non-penetrating roof walkway and railing system.
- .2 Metal Framework: Hot-dip galvanized mild steel to BS EN10219-1:1997.
- .3 Grating: Slip and impact resistant; Fire resistant - meets BS 476 Part 7; width as indicated; colour as selected by Departmental Representative from manufacturer's standard range.
- .4 Plastic Foot Support: Nylon 6 B601L 30% Glass Fibre Filled, threaded steel legs for height adjustment, 600 mm square in size.
- .5 Anti Vibration Mat: SBR-Recycled Rubber, bound using a ratio of high quality moisture curing polyurethane pre-Polymer.
- .6 Fastenings: bolts, nuts, washers and hold-down clips per manufacturer's standards.
- .7 Supply and install the system with all sections and components required to construct roof walkway and railing system in layout indicated on the drawings.

PART 3 - EXECUTION

- | | | |
|-------------------------|----|--|
| <u>3.1 EXAMINATION</u> | .1 | Do not begin installation until substrates have been properly prepared. |
| | | |
| <u>3.2 PREPARATION</u> | .1 | Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. |
| | .2 | Establish accurate lines, levels and pattern. |
| | .3 | Confirm that substrate is structurally capable of carrying the dead and live loads anticipated. |
| | .4 | Verify that installation conforms to roofing manufacturer's requirements. Coordinate with roof installation. |
| | | |
| <u>3.3 INSTALLATION</u> | .1 | Install system in accordance with manufacturer's instructions. |
| | .2 | Install deck materials, in accordance with pattern, layout, dimensions and finished elevation as indicated on the Drawings. |
| | | |
| <u>3.4 PROTECTION</u> | .1 | Protect installed products until completion of project. |
| | .2 | Touch-up, repair or replace damaged products. |

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

- .1 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 Submit for approval within 48 hours after Award of Contract.
- .4 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .5 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.
- .6 In addition to transmittal letter referred to in Section 01 33 00: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .7 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.

- .7 Colour coding chart.
- .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93.
- .6 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.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring
 - .2 Transfer information 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.
- .9 As-built drawings and specifications:
 - .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 and specifications.

.5 Submit completed reproducible as-built drawings and specifications with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings and specifications for inclusion in final TAB report.

1.2 HALOCARBONS

- .1 Comply with Federal Halocarbon Regulations 2003 under the Canadian Environmental Protection Act 1999, EPAM and PWGSC Ontario Region Halocarbon Information Sheet dated March 2010.

1.3 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.

1.4 MAINTENANCE

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00.
- .2 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:
.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Complete list of equipment and materials to be used on this project and forming part of bid documents by adding manufacturer's name, model number and details of materials, and submit for approval.

PART 3 - EXECUTION

3.1 REPAIRS/ RESTORATION

- .1 To Section 09 91 23.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged extensively for priming and touch-up.

3.2 CLEANING

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

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 and submit report as described in PART 1 - SUBMITTALS.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - 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 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 DEMONSTRATION

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

- .3 Where specified elsewhere in Division 23 manufacturers to provide demonstrations and instructions.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Departmental Representative will record these demonstrations on video tape for future reference.

3.5 PROTECTION

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

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 National Fire Protection Association (NFPA)
 - .1 NFPA 14-10, Standard for the Installation of Standpipe and Hose Systems.

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 and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Submit complete plans to Authority of Jurisdiction for review and approval before commencement of work.
 - .3 Indicate grooved joint couplings and fittings on drawings.
- .4 Test reports:
 - .1 Submit certified test reports for standpipe and hose assembly from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
- .5 Manufacturers' Instructions:
 - .1 Provide manufacturer's installation instructions.
- .6 Field Quality Control Submittals:
 - .1 Manufacturer's Field Reports: manufacturer's field reports specified.

1.3 CLOSEOUT
SUBMITTALS

- .1 Provide maintenance data for standpipe and hose system for incorporation into manual specified in Section 01 78 00.
-

1.4 QUALITY
ASSURANCE

- .1 Qualifications:
 - .1 Installer: company or person specializing in standpipe and hose assembly with 5 years documented experience or approved by manufacturer.
- .2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

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:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Storage and Protection:
 - .1 Store materials indoors.
 - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
- .4 Packaging Waste Management: remove for reuse of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 SYSTEM
DESCRIPTION

- .1 Design system to NFPA 14 and following parameters:
 - .1 Stand alone: hydraulic or pipe schedule.

2.2 SUSTAINABLE
REQUIREMENTS

- .1 Grooved couplings and fittings made from minimum 90% recycled metal.

2.3 PIPE, FITTINGS
AND VALVES

- .1 Pipe:
 - .1 Ferrous: to NFPA 14.
 - .2 Copper tube: to NFPA 14.
- .2 Fittings and joints to NFPA 14:
 - .1 Ferrous: screwed, welded, flanged or roll grooved.
 - .1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.
 - .2 Copper tube: screwed, soldered, brazed.
- .3 Valves:
 - .1 ULC listed for fire protection service.
 - .2 Up to NPS 2: bronze, screwed ends, grooved, OS&Y gate.
 - .3 NPS 2 1/2 and over: cast or ductile iron, flanged or roll grooved ends, indicating butterfly valve.
 - .4 Check valves: spring actuated swing type, composition disc or seal.
- .4 Pipe hangers:
 - .1 ULC listed for fire protection services.
- .5 Drain valve: NPS 1, complete with hose end, cap and chain.
- .6 Inspector's test connections: NPS 1 gate valve.

2.4 CABINETS

- .1 To NFPA 14 and ULC listed: recessed type as indicated, constructed of 1.6 mm thick steel, 180 degrees opening door of 2.5 mm thick steel with hinge same side as water supply and latching device.
- .2 Cabinets to maintain fire resistive rating of construction in which they occur.
- .3 Cabinet door: style to match existing conditions.
- .4 Large enough to accommodate angle valve, hose rack, fire hose nozzle and spanner, fire extinguisher and NPS 2 1/2 fire department valve. Cabinet to accommodate all accessories found in existing fire hose cabinets.
- .5 Cabinet to fit in the openings provided by architectural.

<u>2.5 HOSE RACK</u>	.1	ULC listed, to match existing. Complete with hose, nozzle and angle valve.
<u>2.6 FIRE HOSE AND NOZZLE</u>	.1	Hose: ULC listed, 38 mm nominal diameter, 23 m long or to match existing conditions (existing conditions prevail), synthetic jacket, synthetic rubber lined.
	.2	Nozzle: ULC listed, 38 mm nominal diameter, forged brass adjustable combination fog-straight stream with shut-off.
<u>2.7 ANGLE VALVES</u>	.1	ULC listed for fire service. NPS 1 1/2 cast or forged brass complete with hand wheel, open or drip connections, or hydrolator valve. Where water pressure exceeds 690 kPa, provide ULC listed pressure reducing device.
<u>2.8 SWINGING HOSE REEL</u>	.1	ULC listed, designed so hose can be removed from reel when water is flowing, and with 20 mm nominal diameter hose 23 m long, and nozzle.
<u>2.9 FIRE DEPARTMENT VALVE</u>	.1	ULC listed, NPS 2 1/2 forged or cast brass angle valve: with thread compatible with local fire department, complete with handwheel, cap and chain. Cap to be part of ULC listing for valve.
<u>2.10 PRESSURE GAUGES</u>	.1	90 mm diameter.
<u>2.11 FINISHES</u>	.1	In finished areas, chrome plate valves, nozzles, fittings.
	.2	Cabinets.
	.1	Tub: prime coated.
	.2	Door and frame: No. 4 satin finish stainless steel.

PART 3 - EXECUTION

3.1 MANUFACTURER'S
INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install and test to acceptance in accordance with NFPA 14.
- .2 Install pipework in accordance with Section 23 05 05, supplemented as specified.
- .3 Run inspectors test connections to sight glass.
- .4 Install drain pipes and valves to drain parts of systems and so arranged that any one standpipe riser can be drained without shutting down any other parts of systems.
- .5 Install 90 mm diameter pressure gauge at top of risers and in accordance with NFPA 14.
- .6 The source of the water supply shall be reliable and capable of providing the required supply for not less than 30 minutes.
- .7 Water supply for standpipe system:
 - .1 Class I Systems:
 - .1 Receive water supply sufficient to provide 1892.50 lpm and 946.25 lpm for each additional standpipe.
 - .2 Total supply not to exceed 9462.5 lpm.
 - .3 Supply system: capable of maintaining residual pressure of 690 kPa at each topmost outlet with 1892.50 lpm flowing from most remote standpipe and 946.25 lpm flowing from each additional standpipe up to maximum of 9462.5 lpm.
 - .2 Class II Systems:
 - .1 Receive water supply sufficient to provide minimum of 378.50 lpm.
 - .2 System: capable of maintaining residual pressure of 414 kPa at topmost outlet with 378.50 lpm flowing.
 - .3 Class III Systems:
 - .1 Receive water supply from source sufficient to provide 1892.50 lpm for single standpipe and 946.25 lpm for each additional standpipe.
 - .2 Total supply not to exceed 9462.5 lpm.

- .3 System: capable of maintaining residual pressure of 690 kPa at each top most outlet with 1892.50 lpm flowing from most remote standpipe and 946.25 lpm flowing from each additional standpipe up to maximum of 9462.5 lpm flowing.
- .4 Water Supply for Combined Standpipe and Sprinkler Risers:
 - .1 Standpipe piping may be used to supply water for automatic fire sprinkler systems.
 - .2 Standpipe systems: hydraulically designed.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports 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 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 SITE TEST

- .1 General:
 - .1 In accordance with NFPA 14, supplemented as specified.
 - .2 In accordance with Section 01 91 13: General Requirements, supplemented as specified.
- .2 Testing witnessed by Fire Commissioner of Canada and authority having jurisdiction.
- .3 Disposal of water used in flushing and testing:
 - .1 Discuss appropriate measures with Departmental Representative.
- .4 Timing:
 - .1 Connect fire hoses when flushing out and pressure tests have been completed.
 - .2 Charge system with water when there is no possibility of freeze-up.
 - .3 Perform tests after pressure booster pumps have been tested.

- .5 Co-ordination:
 - .1 Co-ordinate tests with performance verification of:
 - .1 Standpipe and hose systems Section.
 - .2 All existing systems affected by standpipe work.
- .6 Procedures:
 - .1 Verify that system is complete prior to start-up and testing procedures.
 - .2 Verify that ULC labels are visible.
 - .3 Fill system with water for pressure. Record water supply pressure.
 - .4 Pressure test piping system as required by authority having jurisdiction.
 - .5 Start-up fire pumps and jockey pumps.
 - .6 Verify flow switches are operational.
 - .7 Verify valves in system are visible and monitored.
 - .8 Flushing: fill with water, let stand at operating pressure for 1 week. Drain risers separately, then drain main.
 - .9 Flush buried mains and lead-in connections before making connection to indoor sprinkler system.
 - .10 Perform flow tests, including tests of pre-action systems, as required by:
 - .1 Authority having jurisdiction.
 - .2 Applicable NFPA standards such as 13, 14, 20, 1273.
 - .3 Local building codes.
 - .11 Record incoming pressure to building for 10 days prior to activating system.
 - .12 Adjust PRV on pump discharge to maximum pressure of 620 kPa at top fire hose station.
 - .13 Adjust PRV's at lower fire hose stations to 550 kPa maximum.
 - .14 Fill glycol legs, confirming proper operation of backflow preventers.
 - .15 Adjust pressure switches.
- .7 Sundry checks:
 - .1 Verify that properly sized pressure restricting discs are installed where required.
- .8 Identification:
 - .1 Verify devices are properly labelled, identifying area served, etc.
- .9 Report:
 - .1 Refer to Section 01 91 13, reports supplemented as specified.
 - .2 In addition to reports required by NFPA 14, include the following:
 - .1 Copy of schematic and valve schedule.

- .10 Posted Instructions:
 - .1 Prepare schematic, mount behind glare-free glass and install where directed.
 - .2 Prepare valve schedule, mount behind glare-free glass and install where directed.
- .11 Training:
 - .1 Refer to Section 01 91 13: Training of O&M Personnel.
- .12 Documentation:
 - .1 Provide written certification to Departmental Representative that system was installed, flushed and tested in accordance with appropriate codes, approved plans and calculations.
 - .2 Certificate to include:
 - .1 Contractors name.
 - .2 Contractors address.
 - .3 Contractors license number.
 - .4 List of approved materials and devices installed.
 - .5 Description of system test conducted.
 - .6 Dates of flushing and testing.
 - .7 Certification that connections welding conform to acceptable standards.
 - .8 Certification that system is complete and in service.
 - .9 Approved signage has been provided and attached as appropriate.
 - .10 Hose threads of system and test connections match those of responding fire department.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
.1 CSA-C22.1-2015, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.
- .2 National Electrical Manufacturer's Association (NEMA) Standards.
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).
- .4 The Ontario Electrical Safety Code 2012, and all bulletins (Ontario).
- .5 Hydro requirements and local applicable codes and regulations.
- .6 Other codes and standards as noted herein.

1.2 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.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English and French.
- .4 Use one nameplate or label for each language.

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.
- .2 Product Data: submit WHMIS MSDS.
- .3 Submit for review fire alarm riser diagram, plan and zoning of building.

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- .4 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario within 3 weeks of Award of Contract.
- .5 Quality Control: in accordance with Section 01 45 00.
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract. Pay associated fees. Departmental Representative will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
 - .5 Submit certificate of acceptance from Electrical Inspection Department upon completion of Work to Departmental Representative.

1.4 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians or apprentices.
- .3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.6 SYSTEM STARTUP

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

PART 2 - PRODUCTS

2.1 MATERIALS AND
EQUIPMENT

- .1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - Submittals.
- .2 Factory assemble control panels and component assemblies.

2.2 WIRING
TERMINATIONS

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

2.3 EQUIPMENT
IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
 - .1 Nameplates: plastic laminate 3 mm thick plastic engraving sheet, lettering accurately aligned and engraved into core mechanically attached with self-tapping screws.
 - .2 Colour scheme to match existing in use in building.
 - .3 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 Wording on nameplates to be approved by Departmental Representative prior to manufacture.

- .3 Allow for minimum of twenty-five (25) letters per nameplate.
- .4 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .5 Identify equipment with Size 3 labels engraved "ASSET INVENTORY No. _____ " as directed by Departmental Representative.
- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.

2.4 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to match existing.

2.5 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, to match existing.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Do complete installation in accordance with the OESC except where specified otherwise.

3.2 NAMEPLATES AND LABELS

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

3.3 LOCATION OF
OUTLETS

- .1 Change location of outlets at no extra cost or credit, providing distance does not exceed 3 m, and information is given before installation.

3.4 CO-ORDINATION
OF PROTECTIVE
DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.5 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

PART 1 - GENERAL

1.1 NOT USED .1 Not Used.

PART 2 - PRODUCTS

2.1 MATERIALS .1 Pressure type wire connectors with current carrying parts of copper sized to fit copper conductors as required.
.2 Fixture type splicing connectors with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

PART 3 - EXECUTION

3.1 INSTALLATION .1 Remove insulation carefully from ends of conductors and:
.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
.2 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65.

3.2 CLEANING .1 Progress Cleaning: clean in accordance with Section 01 74 11.
.1 Leave Work area clean at end of each day.
.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 NOT USED .1 Not Used.

PART 2 - PRODUCTS

2.1 CONNECTORS AND
TERMINATIONS .1 Copper compression connectors as required sized for
conductors.

PART 3 - EXECUTION

3.1 INSTALLATION .1 Install terminations in accordance with manufacturer's
instructions.

END OF SECTION

PART 1 - GENERAL

1.1 NOT USED .1 Not Used.

PART 2 - PRODUCTS

<u>2.1 OUTLET AND CONDUIT BOXES GENERAL</u>	.1	Size boxes in accordance with CSA C22.1.
	.2	102 mm square or larger outlet boxes as required.
	.3	Gang boxes where wiring devices are grouped.
	.4	Blank cover plates for boxes without wiring devices.
<u>2.2 GALVANIZED STEEL OUTLET BOXES</u>	.1	One-piece electro-galvanized construction.
	.2	Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
	.3	102 mm square or octagonal outlet boxes for lighting fixture outlets.
<u>2.3 CONDUIT BOXES</u>	.1	Cast FS or FD boxes with factory-threaded hubs and mounting feet for surface wiring of devices where rigid conduit is used.
<u>2.4 FITTINGS - GENERAL</u>	.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 53 mm and pull boxes for larger conduits.
	.4	Double locknuts and insulated bushings on sheet metal boxes.

PWGSC Ontario	OUTLET BOXES, CONDUIT	Section 26 05 32
Region Project	BOXES AND FITTINGS	Page 2
Building Works		
Number R.051251.00B		2015-03-20

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Support boxes independent of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 Provide correct size of openings in boxes for conduit and armoured cable connections. Do not install reducing washers.
- .4 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .5 Identify systems for outlet boxes as required.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED
REQUIREMENTS

- .1 Division 14.

1.2 SCOPE

- .1 All equipment and wiring for intercom system will be supplied under Division 14.
- .2 All intercom devices will be installed and connected under Division 14.
- .3 All intercom wiring shall be installed under this Division.
- .4 All connection to existing equipment will be coordinated between Division 14 and the Departmental Representative's personnel.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install intercom wiring in conduit in conjunction with wiring for CCTV and miscellaneous controls, as described in Division 14.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section includes:
 - .1 Materials and installation for fire alarm systems.
 - .2 Extent of fire alarm work is limited to the relocation of existing devices in a stairwell, as shown.

1.2 SUBMITTALS

- .1 Closeout Submittals:
 - .1 Submit a verification report covering the relocated devices, in accordance with CAN/ULC-S537-04.

1.3 QUALITY
ASSURANCE

- .1 Qualifications:
 - .1 Installer: company or person specializing in fire alarm system installations with 5-year experience.
- .2 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.

1.4 BUILDING SERVICE,
PROVIDER

- .1 The existing fire alarm system is maintained and administered by a specific Building Service Provider (BSP).
- .2 The Departmental Representative will provide contact information for the BSP.

PART 2 - PRODUCTS

2.1 EXISTING SYSTEM

- .1 The building is equipped with a Notifier addressable fire alarm system.

2.2 MATERIALS

- .1 All fire alarm equipment is existing.

2.3 CONDUIT

- .1 Rigid Steel Conduit:
 - .1 Zinc-Coated.
- .2 Electrical Metallic Tubing.

2.4 WIRING

- .1 Wire for 120 V circuits: No. 12 AWG minimum solid copper conductor.
- .2 Wire for low voltage DC circuits: No. 14 AWG minimum solid copper conductor
- .3 Insulation 75 degrees C minimum with nylon jacket.
- .4 Colour code wiring.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install equipment in accordance with CAN/ULC-S524.
- .2 Locate and install devices and connect to relocated wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors.

3.2 FIELD QUALITY CONTROL

- .1 Verification:
 - .1 Verification of new fire alarm work will be carried out by the BSP for fire alarm.
- .2 Cooperate with the BSP, and correct any defects identified in the verification process.
- .3 The BSP will reprogram the main control to accommodate the new devices. Provide direction and assistance as required.

END OF SECTION



November 13, 2013

Tradeworks Interiors Canada Corp.
32 Howden Road - Unit #4
Scarborough, Ontario M1R 3E4

Attention: Mr. Nick Soldatos

Dear Nick:

RE: 25/55 St. Clair Avenue East, Toronto, ON
Elevator Shaft Evaluation

RJC No.: TOR.013762.0012

1.0 Introduction

Read Jones Christoffersen Ltd. was authorized by Mr. Nick on behalf of Tradeworks Interior Canada Corp. to review the condition of the elevator shaft inside the buildings located at the above noted address. In general, the purpose of our review was to document the extent of deterioration, to determine if structural integrity issues exist, to determine where firestopping may be required, and to provide an opinion on any needed remedial work.

As part of this review, the following work was undertaken:

- .1 Review of all available original drawings, documents, and past reports describing the building and elevator shaft's structure and its condition.
- .2 Comprehensive visual review of the interior of the eight (8) elevator shafts to determine the following:
 - .1 The extent of deteriorated clay blocks
 - .2 The location and size of openings where firestopping material is required
 - .3 The extent of damaged/deteriorated firestopping material
 - .4 The inside dimensions of the elevator shafts
- .3 Read Jones Christoffersen Ltd. retained the services of a material testing agency to undertake both carbonation testing and pin testing of the mortar used in the clay block wall assembly.

This report is exclusively for the use and benefit of the client identified on the first page of this report and is not for the use and benefit of, nor may it be relied upon by any other person or entity. The contents of this report may not be quoted in whole or in part or distributed to any person or entity other than the client.

2.0 Brief Description of the Building and History

2.1 Brief Building Description

The building located at 25/55 St. Clair Avenue East in Toronto, Ontario, is a ten (10) story office complex over a single-level underground parking garage. The site is located on the south side of St. Clair Avenue East between Yonge St. and Alvin Avenue (*Refer to Photo #1 in Appendix A*).

The main entrance to 25 St. Clair Avenue is located on the north-west corner of the property and the main entrance to 55 St. Clair Avenue is located on the north-east corner of the property. In total, there are three (3) elevator shafts inside the building, two elevator shafts for passenger elevators and one elevator shaft for a freight elevator. Within the elevator shaft in 25 St. Clair Ave. East, there are a total of 4 elevators which share this shaft. At 55 St. Clair Ave. East, there are 3 elevators which share this shaft. (*Refer to Photos #2-3 in Appendix A*).

2.2 Structure Description

The building structure consists of normally reinforced cast-in-place concrete construction. The structural framing system utilized for building appears to be a two-way normally reinforce flat slab supported by structural steel columns which are encased in concrete.

2.3 Elevator Shaft

The elevator shaft walls consist of exposed concrete beams/slab edges and clay brick/tile along the east and west elevations of elevator shaft (*Refer to Photo #4 in Appendix A*). The north and south elevations consist of exposed concrete beams/slab edges and clay blocks (*Refer to Photos #5-7 in Appendix A*).

The walls of the freight elevator shaft located at the rear building of 55 St. Clair Avenue consists of clay bricks on the first floor with the remaining floors consisting of clay tiles and exposed concrete beams/slab edges (*Refer to Photos #8-9 in Appendix A*).

As part of our review, the inside dimensions of the elevator shafts were measured. The dimensions of the elevator shafts at 25 St. Clair Avenue was approximately 430-inches in the north and south direction and approximately 100-inches in the east and west direction. The

dimensions of the elevator shafts at 55 St. Clair Avenue was approximately 350-inches in the north and south direction and approximately 98-inches in the east and west direction.

3.0 Description and Results of Fieldwork

The fieldwork undertaken as part of this review was conducted on September 23, 2013, and October 9, 2013 by representatives of Read Jones Christoffersen Ltd. (RJC). The following summarizes the field work performed and results obtained:

3.1 Visual Review

Representatives of Read Jones Christoffersen Ltd. (RJC) performed a visual survey of the elevator shaft walls to record areas of visually obvious deterioration, cracks, missing fire stopping materials and to obtain a general understanding of the present condition of the elevator shaft walls.

Our review revealed that the elevator shaft appears to be in fair condition; however, the walls are exhibiting localized signs of deterioration in the form of deteriorated concrete/slab edges, clay bricks and clay blocks, cracking of the mortar joints, and cracking of the brick/clay blocks. (*Refer to Photos #10-12 in Appendix A*). In total, approximately 11 sq.ft. of delaminated concrete was identified in the exposed slab edges within the elevator shafts. A total of approximately 177 sq.ft. of deteriorated (broken, missing piece) clay brick/block was identified in the elevator shaft walls. A total of approximately 384 lin.ft. of cracked mortar joints was identified within the elevator shaft walls. A total of approximately 56 lin.ft. of cracked clay/brick blocks was identified in the elevator shaft walls.

In addition, RJC observed localized areas of missing mortar joints and missing clay brick/blocks throughout the elevator shafts. In total, approximately 295 lin.ft. of missing mortar joints was identified in the elevator shafts (*Refer to Photos #13-15 in Appendix A*). A total of approximately 15 sq.ft. of missing clay brick/blocks was identified within the elevator shafts.

Within the loading freight elevator, observation revealed approximately 8 sq.ft. of clay tiles appears to be loose and on the verge of falling (*Refer to Photo #16 in Appendix A*).

RJC also observed localized areas in various levels of the elevator shafts in locations where the fire stopping material was either missing or not installed (*Refer to Photo #17 in Appendix A*). It was observed that areas where upgrades were made (i.e. new mechanical/elevator service were inspected), no fire stopping was installed at the openings (*Refer to Photos #18-19 in Appendix A*).

3.2 Pin and Carbonation Laboratory Testing

On September 23, 2013, Golder Associates Ltd., under the supervision of representatives of Read Jones Christoffersen Ltd. extracted mortar joint samples from the elevator shaft walls to determine the approximate depth of carbonation. The mortar joint samples were sent to Golder Associates Ltd. Laboratory. In addition, Windsor Pin testing was performed on the mortar joints within the elevator shafts.

.1 **Carbonation Testing**

The purpose of carbonation testing of the mortar is to determine the depth of carbonation. Three samples approximately 3-inches wide and 2.75-inches deep were taken from the mortar joints in the elevator shaft walls. These samples were taken to Golder Associates Laboratory for testing. The results of the testing are shown in Table 3.1 below:

Table 3.1: Depth of Carbonation

Core No.	Depth of Carbonation
Chip 1	Full Depth (> 2.75")
Chip 2	Full Depth (> 2.75")
Chip 3	Full Depth (> 2.75")

The depth of carbonation of the mortar joints was greater than the depth of the samples (*Refer to Appendix B for Golder's Report*).

.2 **Pin Testing**

The purpose of Windsor pin testing of the mortar joints is to determine the approximate in situ strength of the mortar. Three (3) tests were completed to obtain a general indications of the strength of the mortar. The results of the testing are shown in Table 3.2 below:

Table 3.2: Pin Testing

Test No.	Elevator No. and Floor for Test	Penetration Depth (Average Resistance Penetration (mm))	Relative Strength
1	Between level 1 st and 2 nd	4.5	25MPa
2	2 nd	4.3	25MPa
3	1 st	5.5	21MPa

The windsor pin test results suggest that, in general, the mortar has a compressive strength around 20 to 25MPa, which would be considered strong enough for this application. It should be noted that the windsor pin test only provides approximate strength indications and the actual compressive strength may be higher or lower (*Refer to Appendix B for Golders Report*).

4.0 Conclusions/Discussion

Base on the findings of this review, the elevator shaft walls are generally in fair condition, exhibiting signs of localized deterioration in the form of concrete delaminations, brick/clay deterioration, crack mortar joints, and missing fireproofing. Further, the Windsor pin testing revealed that the in situ mortar joints appear to have sufficient strength. The carbonation testing revealed that the depth of carbonation to be at least 2.75" and given the age of the mortar joints in the elevator shafts this does not appear to be an unexpected result.

At this time, the primary concern for the elevator shaft walls relates to the localized areas of deterioration and locations of damaged/missing fireproofing. Repairs are required to repair the distress noted to date and to correct the deficiencies with the elevator shaft wall fireproofing.

5.0 Recommendation

Based on the results obtained from our review with respect to the condition of the elevator shaft walls, we recommend the following repairs as the most cost-effective solution to address the deterioration noted to date:

- Localized repair of all concrete slab edge/beam delamiantions (approximate quantity of 25 sq.ft.)

- Localized repair of all deteriorated/spalled/damaged clay brick and clay block (approximate quantity of 180 blocks and 30 bricks)
- Localized repointing of deteriorated mortar joints (approximate quantity of 450 lin.ft.)
- Installation of new spray on fireproofing in all locations where a 2-hour fire separation (approximate quantity of 50 sq.ft.)
- Installation of new fireproofing sealant at all locations where clay bricks/block meet the concrete slab edges/beams (approximate quantity of 3,300 lin.ft.)

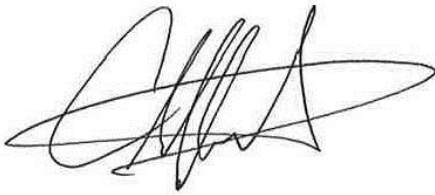
6.0 Closing Remarks

In closing, Read Jones Christoffersen Ltd. would like to thank you for selecting us for this project. RJC would be pleased to assist you with the implementation of our recommendations. Should you want to discuss our recommendations or have any questions or concerns, please do not hesitate to contact our office.

Yours truly,

Read Jones Christoffersen Ltd.

Reviewed by:



Cliff Louis Li, EIT, B.A.Sc.
Building Science and Restoration



James Cooper, P.Eng., LEED AP O+M
Project Engineer
Building Science and Restoration

*Encl: Appendix A: Photographs
Appendix B: Laboratory Testing Results*

Appendix A

Photographs

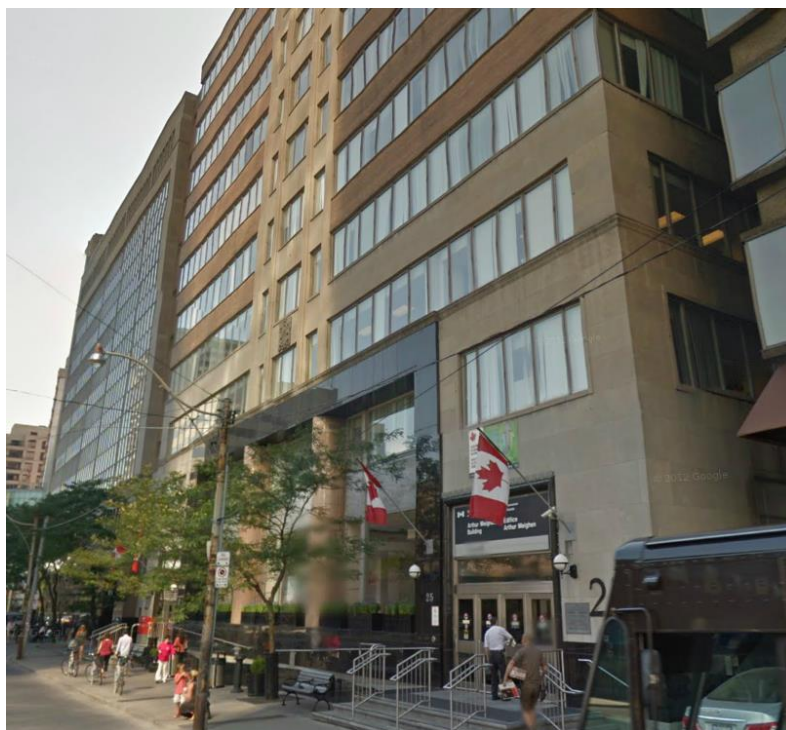


Photo 1: Overview of the building of 25/55 St. Clair Ave. E



Photo 2: Overview of elevators at 25 St Clair Ave E



Photo 3: Overview of elevators at 55 St. Clair Ave E

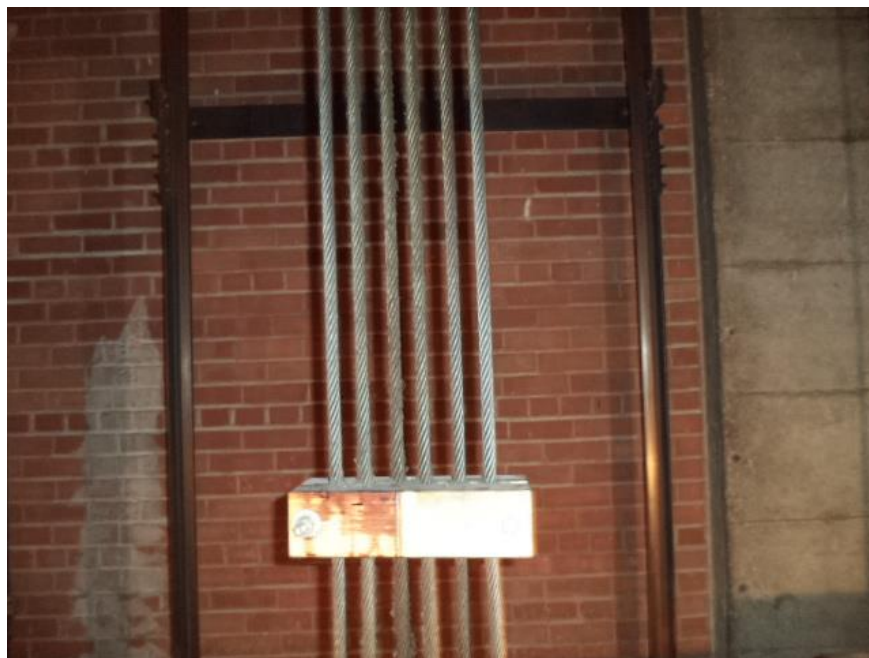


Photo 4: Overview of East and West walls inside elevator shaft at 25 St. Clair Ave E



Photo 5: Overview of North and South walls inside elevator shaft at 25 St. Clair Ave E



Photo 6: Overview of East and West walls inside elevator shaft at 55 St. Clair Ave E



Photo 7: Overview of North and South walls inside elevator shaft at 55 St. Clair Ave E

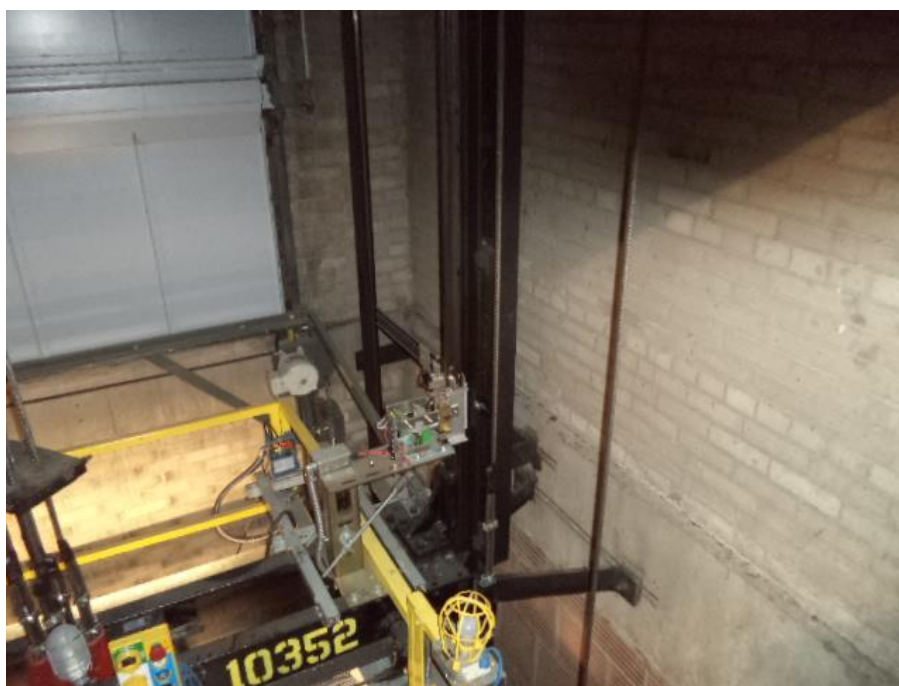


Photo 8: Overview of first floor elevator shaft inside loading freight elevator

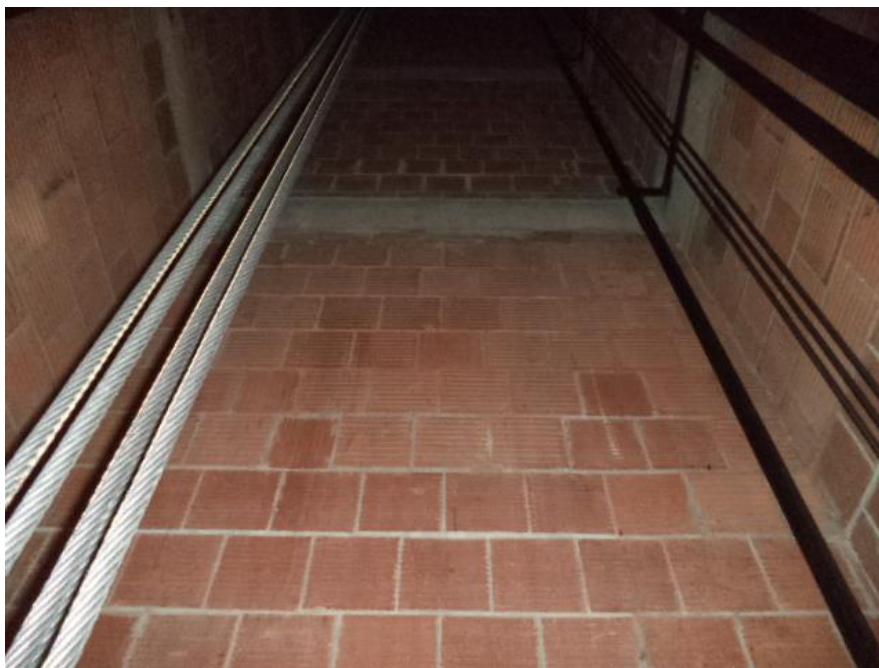


Photo 9: Overview of elevator shaft inside loading freight elevator



Photo 10: Overview of broken/deteriorated clay block above 10th level.



Photo 11: Overview of cracked mortar joints between clay tiles.



Photo 12: Overview of cracked concrete blocks.

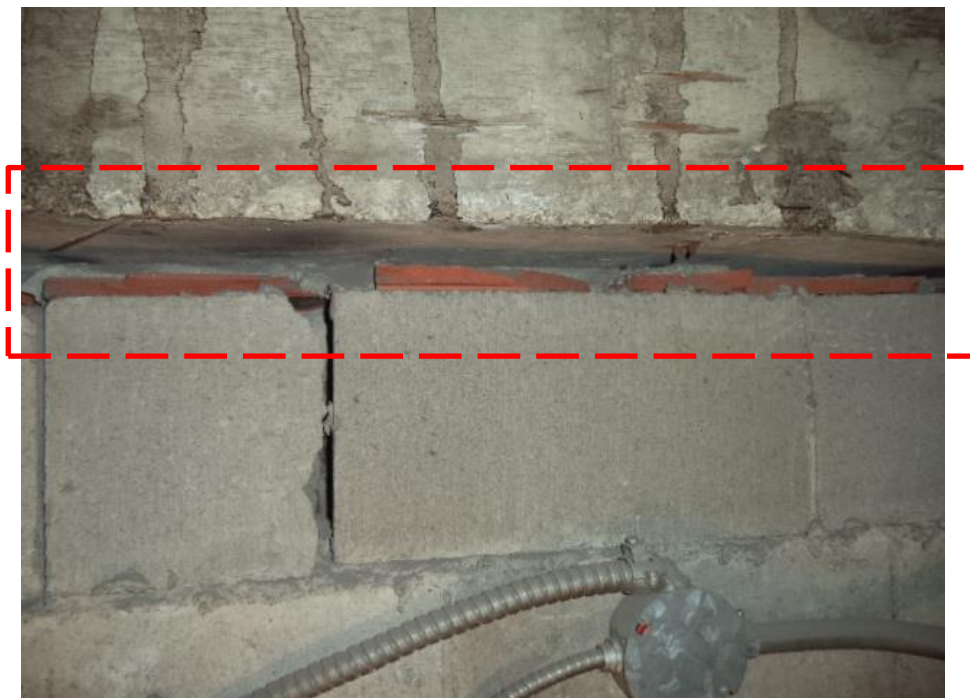


Photo 13: Overview of opening gaps of missing mortar joints.

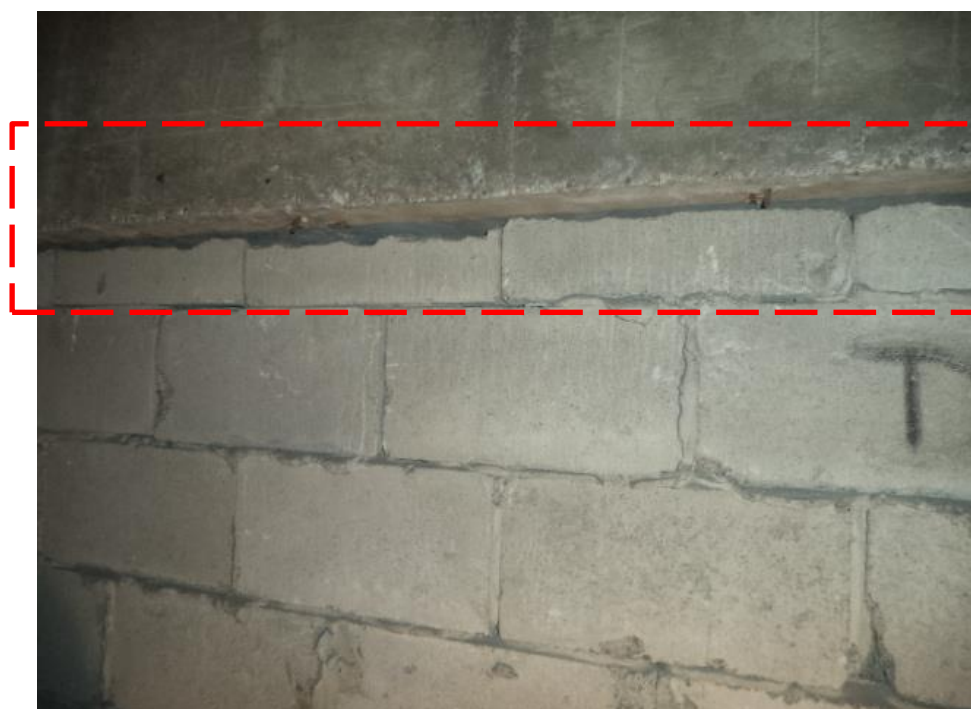


Photo 14: Overview of opening gaps of missing mortar joints.



Photo 15: Overview of missing clay tiles throughout the elevator shafts.



Photo 16: Level 3 loading freight elevator shaft loose clay tiles.

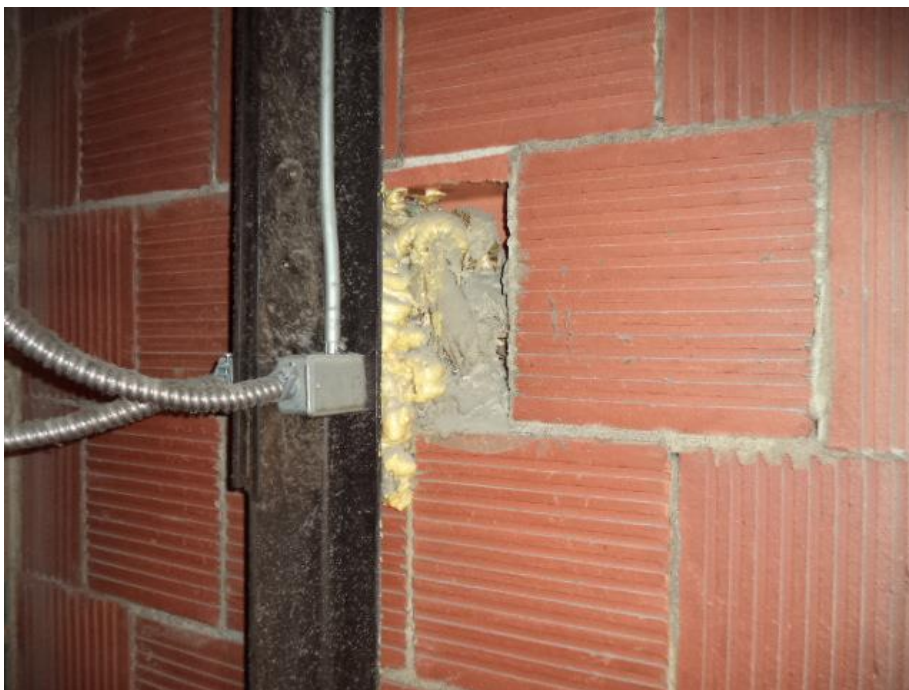


Photo 17: Overview of deteriorated firestopping material.



Photo 18: Previous openings filled with firestopping material.



Photo 19: Overview of an area where no fire stopping material was placed.

Appendix B

Laboratory Test Results

FIELD MONITORING REPORT

TO: Read Jones Christoffersen
25-55 St. Clair Avenue East
Toronto, Ontario

Date of Site Visit: September 23, 2013
Weather: Indoor
Present at Site: Rav Singh – Golder
James Cooper & Cliff Li - RJC

ATTENTION: Mr. James Cooper

Distributed By: Sent by Email

THE FOLLOWING HAS BEEN NOTED:

On site as requested to perform in-situ Windsor Pin testing at the mortar joints and to saw-cut and remove mortar joint sample from the elevator pit at the above noted site.

The Windsor pin test result are as follow:

Test	Average Resistive Penetration Readings (inches)	Average Resistive Penetration Readings (mm)	Locations
1	0.179	4.5	Elevator no. 1 – Northeast corner of the of the elevator shaft between ground floor level and 2 nd floor level.
2	0.168	4.3	Elevator no. 4 – Southeast former of the elevator shaft at 2 nd floor level.
3	0.218	5.5	Elevator no. 7 – Southeast corner of the elevator shaft at ground floor level.

One sample of the mortar was taken from each of the test location.

Concrete Type: Mortar Joint

Driver Type: NDT Instruments Model WP2000

Client: Read Jones Christoffersen
Owner: -
Contractor: Alltrades

Job Number: 13 1186 0089 (9030)
Project: 25 – 55 St. Clair Avenue East
Location: Toronto, Ontario

Name: Ravindra Singh, C.E.T.

Checked by: *As, z*

Signed: *[Signature]*

Date: *SEPTEMBER 27, 2013*



DEPTH OF CARBONATION

September 25, 2013

Golder Project Number: 13-1186-0089-9030

Read Jones Christoffersen Ltd.
500-144 Front Street West
Toronto, ON M5J 2L7

Attention: Mr. James Cooper

Project Number:	N/A
Project Name:	55 St. Clair, Toronto

Date Cast: N/A

Date Tested: September 25, 2013

Date Received: September 24, 2013

Tested By: L. Atkinson

Core Number:	Golder Lab Number:	Depth of Carbonation (mm)
Chip 1	C-13-1538	Full Depth
Chip 2	C-13-1539	Full Depth
Chip 3	C-13-1540	Full Depth
Remarks:		

Reviewed by: 
Jeremy Rose, Laboratory Manager



Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods.
This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

GOLDER ASSOCIATES LTD., 100 Scotia Court Whitby, Ontario, Canada L1N 8Y6 Tel: 905-723-2727 Fax: 905-723-2182

DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS ASSESSMENT SPECIFIC TO STAIRWAY FIRE SEPARATION PROJECT

Stairways #1-5
25-55 St. Clair Avenue East
Toronto, Ontario

Prepared for:

Mr. Ilke Ayan
Project Manager

Public Works & Government Services Canada
Real Property Branch, Professional & Technical Programs
4900 Yonge Street
Toronto, Ontario
M2N 6A6

Prepared by:

Safetech Environmental Limited

A handwritten signature in black ink, appearing to read 'P. Valenti'.

Paul Valenti, B.ES., AMRT
OH&S Technician

A handwritten signature in black ink, appearing to read 'D. Glenn Smith'.

D. Glenn Smith, B.Sc. (HE), AMRT, CRSP
Senior Project Manager

SEL Project Number 181813

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Appendix F – Background Information on Designated Substances and Other Hazardous Materials

EXECUTIVE SUMMARY

Safetech Environmental Limited (SEL) was commissioned by the Real Property Branch of the Public Works & Government Services of Canada to conduct a designated substances and hazardous materials assessment within Stairways #1-5 located at 25-55 St. Clair Avenue East, Toronto, Ontario.

The objective of our assessment was to determine the presence, location, condition and quantities of designated substances and other hazardous materials within the stairways that have the potential to be disturbed as part of planned renovation activities (i.e. the Fire Separation Project) so that appropriate control measures can be implemented to protect workers during the renovation.

A summary of our assessment results and general recommendations based on our findings are provided in the following Table. This Table should be considered a summary only. Please refer to the Results (Section 3) and Conclusions and Recommendations (Section 4) of our report for additional details.

Summary of Asbestos-Containing Materials Stairway Fire Separation Project 25-55 St. Clair Avenue East, Toronto, Ontario November 2013

Location Description	Material	Quantity	Type of Asbestos	Condition	Photograph	Friable
Stairway #1 Shaft Ground Floor to 10 th Floor	Mechanical Pipe Straight Insulation	~800 ft	<i>Chrysotile</i>	Good-Fair		Y
	Mechanical Pipe Fitting Insulation	~50 units	<i>Chrysotile</i>	Good-Fair		Y
Stairway #2 Shaft Above Storage Closets 2 nd Floor to 9 th Floor	Mechanical Pipe Straight Insulation	~200 ft	<i>Chrysotile</i>	Fair- Poor (debris seen on top of some ceilings)		Y
Stairway #2 Shaft behind wall of Storage Closets 2 nd Floor to 9 th Floor	Mechanical Pipe Straight Insulation	~800 ft	<i>Chrysotile</i>	Good		Y
Stairway #3 Ground Floor to 10 th Floor within Shaft	Mechanical Pipe Straight Insulation	~800 ft	<i>Chrysotile</i>	Fair- Poor (some debris in shaft)		Y

Location Description	Material	Quantity	Type of Asbestos	Condition	Photograph	Friable
	Seam Tape on Round HVAC and Possibly Two Black Foil Paper Insulated Pipes	~800 ft	<i>Chrysotile</i>	Poor (debris in shaft)		Y
	Mechanical Pipe Fitting Insulation	~30 units	<i>Chrysotile</i>	Good		Y
Stairway #3 Garage Levels	Mechanical Pipe Straight Insulation*	~100 ft	<i>Chrysotile</i>	Good		Y
	Slightly Textured Plaster Walls	~300 ft ² per Level	<i>Chrysotile</i>	Good		Y
10 th Floor Shaft Behind Men's Washroom Sink Adjacent to Stairway #4	Mechanical Pipe Straight Insulation	~50 ft	<i>Chrysotile</i>	Good		Y
9 th Floor Shaft Behind Men's Washroom Sink Adjacent to Stairway #4	Mechanical Pipe Straight Insulation Debris	-	<i>Chrysotile</i>	Poor		Y
Garage Levels at Stairway #4 within Ceiling & Concrete Block Wall Pipe Chase	Mechanical Pipe Straight Insulation	~ 100 ft per Level	<i>Chrysotile</i>	Good-Fair		Y
	Seam Tape on Fibreglass Duct Insulation	~ 100 ft per Level	<i>Chrysotile</i>	Fair		Y
Garage Entrance Vestibules at Stairway #4	Mechanical Pipe Straight Insulation Above Ceiling	~20 ft per Level	<i>Chrysotile</i>	Good		Y
	Duct Seam Tape on Fibreglass Duct Insulation Inside Bulkhead	~10 ft per level	<i>Chrysotile</i>	Good		Y
Stairway #5 Ground Floor to 10th Floor within Shaft	Duct Seam Tape on Fibreglass Duct Insulation Inside Bulkhead	~100 ft ² per level	<i>Chrysotile</i>	Good		Y
	Seam Tape on Black Foil Paper Insulation	~500 ft	<i>Chrysotile</i>	Good		Y
Stairway #5 Ground Floor to Mezzanine Level	Mechanical Pipe Straight Insulation*	~100 ft	<i>Chrysotile</i>	Good		Y

*Material may be present within inaccessible concrete/block walls

Designated Substance	Findings	Recommendations
Lead	Varying concentrations of lead were identified in paints tested. Other paints not are also suspected to contain varying quantities of lead.	Work involving the disturbance of a lead-containing paint should follow the procedures outlined in the Ministry of Labour “ <i>Lead on Construction Projects</i> ” guideline. Lead-containing wastes should be recycled if practicable or handled and disposed of according to O.Reg. 347.
	Lead may be a component of solder in pipe fittings and electrical equipment but is not expected to be a hazard as a result of the planned construction project.	No action required.
Mercury	Mercury vapour is expected to be present within fluorescent lamp light fixtures.	Handle lamps with care and keep intact. All waste lamps are recommended to be sent to a lamp recycling facility.
Silica	Building materials identified that are suspected to contain crystalline silica and may be disturbed as part of the planned construction project include drywall surfaces, plaster surfaces, and concrete/block surfaces. Several other building materials were also identified that are suspected to contain silica.	Any work involving the disturbance of silica-containing materials should follow the procedures outlined in the Ministry of Labour “ <i>Silica on Construction Projects</i> ” guideline.
Other Designated Substances	No other designated substances are expected to be present in any significant quantities or in a form that would represent an exposure concern.	No protective measures or procedures specific to acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride are considered necessary.

Other Hazardous Materials	Findings	Recommendations
Urea Formaldehyde Foam Insulation	No UFFI was identified or is suspected within the areas assessed.	No action required.
Mould Contamination	No obvious visible mould growth was observed within the areas assessed.	No action required.
Polychlorinated Biphenyls	No equipment suspected of containing PCB's was observed within the areas assessed.	No action required.
Ozone Depleting and Global Warming Substances	No equipment suspected of containing ozone depleting or global warming substances was observed within the areas assessed.	No action required.

This assessment satisfies the Owner's requirements under Section 30 of the Ontario Occupational Health and Safety Act (OHSA), Revised Statutes of Ontario 1990, as amended.

Should you have any questions regarding the information contained in the report, please contact our office.

Safetech Environmental Limited



Paul Valenti, B.ES., AMRT
OH&S Technician



D. Glenn Smith, B.Sc. (HE), AMRT, CRSP
Senior Project Manager

December 2nd, 2013

Public Works & Government Services of Canada
Real Property Branch, Professional & Technical Programs
4900 Yonge Street
Toronto, Ontario M2N 6A6

Attention: Mr. Ilke Ayan
Project Manager

**RE: Designated Substances and Hazardous Materials Assessment
Specific to Stairway Fire Separation Project
25-55 St. Clair Avenue East, Toronto, Ontario**

1.0 INTRODUCTION

1.1 Background and Objectives

Safetech Environmental Limited (SEL) was commissioned by the Real Property Branch of the Public Works & Government Services of Canada to conduct a designated substances and hazardous materials assessment within Stairways #1-5 located at 25-55 St. Clair Avenue East, Toronto, Ontario. The objective of our assessment was to determine the presence, location, condition and quantities of designated substances and other hazardous materials within the stairways that have the potential to be disturbed as part of planned renovation activities (i.e. the Stairway Fire Separation Project) so that appropriate control measures can be implemented to protect workers during the renovation.

This assessment satisfies the Owner's requirements under Section 30 of the Ontario Occupational Health and Safety Act (OHSA), Revised Statutes of Ontario 1990, as amended. Section 30(1) requires a building owner to determine if there are any designated substances present at a project site prior to construction or demolition activity. Sections 30(2), (3) and (4) require the Owner and constructors for a project to provide the findings in this report as part of the tendering information for any tendered project or to prospective contractors (and subcontractors) of a project before entering into a binding contract.

This report documents findings of our on-site inspection that was conducted from November 7th to 18th and provides conclusions and recommendations based on our findings and knowledge of the planned construction project.

1.2 Scope of Work

In accordance with our fee proposal document our scope of work included the following activities:

- A review of existing documents, including renovation documents and drawings, floor plans and existing environmental assessment reports, etc., where available.
- A visual assessment of the accessible area(s) specific to the renovation project to identify the presence, location, condition and quantities of designated substances and other hazardous materials.
- Collection, analysis and interpretation of representative bulk samples of suspect asbestos-containing building materials for the determination of asbestos content and material classification.
- Collection, analysis and interpretation of representative paint chip samples for the determination of lead content.
- Preparation of a report to document findings and provide recommendations regarding control measures and/or special handling procedures for designated substances or specific hazardous materials that may be disturbed as part of planned renovation activities.

Documents reviewed to aid in our assessment included the following:

- Stairway Fire Separation Improvements drawings as produced by Public Works & Government Services Canada. Included was drawing sets A1, A2, M0, M2, and E2.
-

This assessment only identified designated substances and hazardous materials that were deemed to be part of the building or somehow otherwise incorporated into the building structure and its finishes. Assessing occupant items such as stored products, furnishings, items and materials used or produced as part of a manufacturing process, etc. were beyond the scope of this assessment. In addition, our assessment did not include an investigation for underground materials or equipment (vessels, drums, underground storage tanks, pipes, cables, etc.). Furthermore, this assessment was limited to the areas investigated, and more specifically, to those materials that may be disturbed as part of the planned renovation work, as described in Section 1.3.

1.3 Description of Area(s) Assessed

The area investigated included all accessible locations of the Stairways #1 to 5, including the accessed shafts. The elevator shaft within Stairway #4 was not accessed so as not to damage the elevator or compromise the integrity of the elevator system.

2.0 METHODOLOGY

The presence of hazardous materials was assessed by visual inspection. For the purpose of this assessment and this document, hazardous materials include designated substances as well as other chemical, biological and environmental hazards as defined below:

- **Designated Substances (as prescribed by Ontario Regulation 490/09):**
 - Acrylonitrile, Arsenic, Asbestos, Benzene, Coke Oven Emissions, Ethylene Oxide, Isocyanates, Lead, Mercury, Silica and Vinyl Chloride.
- **Other Hazardous Materials:**
 - **Chemical Hazards** – Urea Formaldehyde Foam Insulation (UFFI)
 - **Biological Hazards** – Mould Contamination and Pest Infestation
 - **Environmental Hazards** – Polychlorinated Biphenyls (PCBs) and Ozone Depleting & Global Warming Substances

For background information regarding the above hazardous materials, please refer to Appendix F.

Destructive testing was not conducted as part of this assessment. Concealed locations such as above solid plaster or drywall ceilings, within plaster or drywall wall cavities, enclosed mechanical/pipe shafts and bulkheads, etc. were not investigated. Similarly, motors, blowers, electrical panels, etc., were not de-energized or disassembled to examine concealed conditions. Building materials that are not detailed within this assessment due to inaccessibility at the time of our site visit and/or uncovered during renovation/demolition activities should be assessed by a qualified person prior to their disturbance.

Bulk sampling followed by laboratory analysis was also conducted to confirm the presence/absence of selected hazardous materials. Bulk sampling was limited to asbestos in building materials and lead in paint on building finishes. All other hazardous materials were identified by visual inspection only. Where possible, observations regarding the location, quantity and condition of the hazardous materials identified were made in order to determine the potential for exposure and provide appropriate recommendations for remedial action, if necessary. Specific methodology for each individual hazardous material assessed is further detailed below.

2.1 Designated Substances

2.1.1 Asbestos

A visual inspection for the presence of both friable and non-friable asbestos-containing material (ACM) was performed within the assessment area(s). The condition of ACM was rated as Good, Fair or Poor based on our assessment criteria provided in Appendix A.

Although destructive testing was not conducted, details regarding the possible presence of ACM in enclosed locations were provided on a case-by-case basis where our visual inspection indicated this possibility. Materials that may be present in the surveyed area(s) that were not tested intrusively should be considered asbestos-containing until proven otherwise. This includes materials such as refractory brick in boilers and incinerators, fire door cores, elevator brakes, roofing felts, mastics, high voltage wiring, mechanical packing and gaskets, vermiculite inside wall cavities or inaccessible ceiling spaces and underground services or piping. These materials are recommended to be sampled immediately prior to renovation or demolition work if they are to be removed or have a potential to be disturbed.

If an existing asbestos survey was available for review, SEL relied on the information present. Building materials that were visually similar to materials previously tested and that were confirmed to be either ACM or non-ACM were considered to have consistent content and were not re-sampled. Additional sampling was only conducted where the investigator believed a need existed.

Bulk samples of building materials suspected to contain asbestos were retrieved by SEL only for materials that were deemed to have a potential to be disturbed as part of the Stairway Fire Separation Project. Other suspect materials were noted but were not sampled. Bulk samples were retrieved in accordance with Section 3 and Table 1 of Ontario Regulation 278/05, *“Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations”*. The number of samples collected for each material was based on the type and quantity of the material present within the area(s) investigated. Each individual sample was placed in a labeled zip-lock bag for transportation to an independent laboratory (EMSL). EMSL is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) for bulk asbestos fiber analysis.

Analysis for asbestos content was performed by the independent laboratory in accordance with the U.S. Environmental Protection Agency (EPA) Test Method EPA/600/R-93-116: Method for the Determination of Asbestos in Bulk Building Materials. June 1993. This method identifies the asbestos fibre content of building materials using polarized light microscopy (PLM) analytical techniques, with confirmation of presence and type of asbestos made by dispersion staining optical microscopy. This analytical method meets the requirements set forth in Section 3 of O.Reg. 278/05.

In accordance with O. Reg. 278/05, an asbestos-containing material is defined as material that contains 0.5 per cent or more asbestos by dry weight. The laboratory was instructed to conduct “stop-positive” analysis for all materials. If a sample was found to be asbestos-containing no further analysis was conducted for samples taken from the same homogeneous material. The Laboratory Certificate of Analysis is included in Appendix C.

Locations where ACM have been identified are detailed in this report. Recommendations pertaining to ACM were made based on the friability, accessibility and condition of the material in conjunction with the potential for the planned renovation work to disturb the ACM.

2.1.2 Lead

An assessment for lead in paint was conducted by retrieving paint chip samples from representative surfaces within the area(s) assessed that were deemed to have a potential to be disturbed as part of the planned renovation activities. The condition of painted surfaces from which samples were taken were also visually assessed for signs of deterioration such as cracking, chipping, flaking, bubbling and deterioration due to friction. The condition of these surfaces was assessed as good, fair or poor based on the degree and extent of deterioration.

The number of paint chip samples retrieved for analysis was based on the number of surface colours observed and the approximate surface area of the paint. Samples were not retrieved from paint finishes with limited application while additional samples were retrieved for paints covering greater surface areas to better account for possible variances in lead concentration due to underlying paints (if present). All paint chip samples were retrieved by scraping the paint down to the base material substrate to ensure collection of all layers of paint. Care was taken to avoid collection of the underlying substrate to reduce analytical substrate matrix interference.

Upon completion of our assessment, paint chip samples were submitted to an independent laboratory (EMSL) for the determination of lead content. This laboratory participates in and is accredited by the EPA (U.S. Environmental Protection Agency) for analysis of lead in paint chips through the American Industrial Hygiene Association (AIHA) Environmental Lead Laboratory Accreditation Program (ELLAP). Analysis was conducted by the laboratory following the EPA “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods” (SW-846), Method 7000B “Flame Atomic Absorption Spectrophotometry”. Results of analysis were reported by the laboratory as the percentage of lead by weight of the total sample (% by wt.). The Laboratory Certificate of Analysis is included in Appendix D.

The presence of lead in other materials, such as lead sheeting, pigmented mortar, lead piping, lead solder, etc. were noted where observed but were not sampled to verify lead content. Lead can be present in these materials to varying degrees, depending on their

age of application (refer to Appendix F for additional details) and should be considered lead-containing until proven otherwise.

2.1.3 Mercury

The type, quantity and location of mercury-containing equipment and devices within the area(s) assessed were determined by visual inspection based on appearance, age and knowledge of historical uses. Sampling for mercury-containing building materials and dismantling of suspect mercury-containing equipment was not performed. Where possible, attempts were made to verify the presence/absence of mercury by gathering additional information such as equipment model number, serial number, etc.

2.1.4 Silica

The presence of crystalline silica in building materials was determined through visual inspection of building materials only, based on knowledge of the historic use of silica-containing materials in certain building materials. Sampling to verify the presence/absence of silica in building materials was not performed.

2.1.5 Other Designated Substances

Other designated substances (i.e. acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride) are typically not expected to be encountered in building materials as significant constituents or in a form that would represent an exposure concern. These substances were not included in our assessment unless specific information regarding their use (e.g. in a manufacturing process) was provided to us. Please refer to Appendix F for information regarding where these designated substances are typically found or used. No sampling for these designated substances was performed.

2.2 Other Hazardous Materials

2.2.1 Chemical Hazards

Urea Formaldehyde Foam Insulation (UFFI)

A visual inspection to evaluate the possible presence of Urea Formaldehyde Foam Insulation (UFFI) was conducted within the area(s) assessed. Our visual inspection was limited to looking for evidence of possible UFFI installation (i.e. repaired nozzle holes in walls) and overspray at wall/ceiling joints, etc. No destructive testing or material sampling was conducted as part of our assessment.

2.2.2 Biological Hazards

Mould Contamination

A visual inspection to determine the possibility of mould growth was conducted within the area(s) assessed. Our assessment was limited to looking for evidence of mould growth and water damage (staining, material deterioration, efflorescence, etc.) on the surface of building materials, which may be an indicator of hidden mould growth. No moisture content readings of building materials were taken to determine their current condition. Additionally, destructive testing to confirm the presence/absence of hidden mould growth and material sampling to verify the presence/absence of mould on suspect surfaces was beyond the scope of this assessment.

Pest Infestation

The presence and extent of pest infestation within the area(s) assessed was based on visually inspecting for evidence of significant pest activity, including signs of nesting, droppings/fecal accumulation, dead insects/carcass accumulation, etc. Evidence of minor pest presence was not considered to be indicative of pest infestation.

2.2.3 Environmental Hazards

Polychlorinated Biphenyls (PCBs)

The presence of PCB-containing electrical equipment within the area(s) assessed was identified through visual inspection and knowledge of the timeline of historical use.

For stand-alone transformers and capacitors, information from the manufacturer nameplate (such as the date of manufacture, dielectric fluid trade name or "Type Number", etc.) was gathered, where possible, to further evaluate if the equipment may contain PCBs. This information was then compared to the information provided in the Environment Canada document entitled "*Handbook on PCB's in Electrical Equipment*" (Third Edition, April 1988) to aid in identification. Transformers and capacitors confirmed to be manufactured after 1979 were assumed to not contain PCBs. If appropriate information could not be obtained it was assumed that the transformer or capacitor contained PCBs.

For fluorescent light ballasts, a representative number of fixtures were inspected, if possible, for assessment areas that were constructed prior to 1980 and where there was no history or evidence of a complete lighting retrofit. The light fixtures were examined by removing any lenses and ballast covers to expose the ballast and identify information such as ballast make, model number, serial number, and date code. This information was then compared to the information provided in the Environment Canada document entitled "*Identification of Lamp Ballasts Containing PCBs*" (Report EPS 2/CC/2 (revised) August 1991) to aid in identification. Ballasts that could not be

confirmed Non-PCB-containing were assumed to contain PCBs. The light fixtures were not de-energized and ballasts were not removed to obtain manufacturer information that may be on the back of the ballast. If visual confirmation of ballast type could not be made it was assumed that light fixtures in areas constructed prior to 1980 that have not undergone a complete lighting retrofit have PCB-containing ballasts until proven otherwise.

No sampling of materials or fluids within equipment was conducted to verify the presence/absence of PCBs. Inspection and testing of other materials for PCB content, including (but not limited to) caulking, asphalt, oil-based paint, plastics, switches, electric cables and hydraulic fluids was beyond the scope of our assessment.

Ozone Depleting and Global Warming Substances

The presence of fixed equipment likely to contain ozone-depleting substances (ODS) and/or global-warming substances (GWS) was identified through visual inspection and knowledge of the timeline of historical use. This included equipment such as chillers, air-conditioners, walk-in refrigeration and freezer units and fixed dry-chemical fire extinguishers, where chemicals such as hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs) or halons may be present. Where possible, information regarding the type and quantity of refrigerant present was obtained from the manufacturer nameplate. Our visual assessment was limited to fixed equipment within the area(s) assessed and did not include portable equipment such as stand-alone refrigerators, freezers, water coolers, air-conditioners and fire extinguishers, etc.

3.0 RESULTS

Results of our visual assessment and bulk sample analytical findings are summarized in the sections below.

3.1 Designated Substances

3.1.1 Asbestos

Results of bulk sample analysis for the determination of asbestos content are summarized in Table 1. Materials have been classified as “ACM”, “Non-ACM”, “Suspected ACM” or “Presumed Non-ACM” based on analytical results. Materials classified as Suspected ACM or Presumed Non-ACM may require further analysis (depending on site-specific conditions) to verify whether the material should be classified as ACM or Non-ACM. Please refer to the Limitations section of this report (Section 5.0) for additional details. The Laboratory Certificate of Analysis is included in Appendix C.

TABLE 1
Bulk Sample Analytical Results for Determination of Asbestos Content
Stairway Fire Separation Project
25-55 St. Clair Avenue East, Toronto, Ontario
Sample Collection Date: November 7-18th, 2013

Sample No.	Material Description	Sample Location	Asbestos Content	Material Classification
1a	Drywall Joint Compound	10 th Floor Washroom	None Detected	Non-ACM
1b		5 th Floor Washroom		
1c		Garage Ceiling at Stairway #4		
2a	Black Paper on HVAC	9 th Floor Shaft Stairway #3	None Detected	Non-ACM
2b		7 th Floor Shaft Stairway #3		
2c		4 th Floor Shaft Stairway #3		
3a	Tar on Fibreglass Insulation	Basement Bulkhead at Stairway #4	None Detected	Non-ACM
3b				
3c				
4a	Tile Mortar	6 th Floor Washroom	None Detected	Non-ACM
4b		10 th Floor Washroom		
4c		2 nd Floor Washroom		
5a	Plaster	10 th Floor Stairway #1	None Detected	Non-ACM
5b		9 th Floor Stairway #2		
5c		Ground Floor Stairway #3		
5d		6 th Floor Stairway #3		
5e		4 th Floor Stairway #4		
5f		Basement Stairway #4		
5g		Ground Floor Stairway #5		
6a	Slightly Textured Plaster	Garage at Stairway #3	1% Chrysotile	ACM
6b			Not Analyzed	
6c				

As per O.Reg. 278/05, ACM contains $\geq 0.5\%$ asbestos by dry weight.

Materials assessed for asbestos content are summarized in Table 2 based on the type/use of the material. The condition and friability of materials confirmed or suspected to be asbestos-containing (based on our visual assessment, results of bulk sample analysis or from a review of previous analytical results) is provided. Condition (Cond.) ratings are provided as Good (G), Fair (F) or Poor (P) based on our Assessment Criteria provided in Appendix A. Estimates of quantity have only been provided for confirmed or suspected asbestos-containing materials that were deemed to have a potential to be disturbed as part of the Stairway Fire Separation Project. Any quantities provided

should be considered rough estimates only and should not be relied upon for bidding purposes. It is the responsibility of the selected Contractor to obtain actual quantities.

TABLE 2
Results of Assessment for Asbestos-Containing Materials
Stairway Fire Separation Project
25-55 St. Clair Avenue East, Toronto, Ontario

Sprayed and Loose Fill Insulating Materials	Location/Description	Cond.	Est. Quantity	Friability
Sprayed Fireproofing	None identified in area(s) assessed.	N/A	N/A	N/A
Sprayed Insulation	None identified in area(s) assessed.	N/A	N/A	N/A
Loose Fill / Vermiculite Insulation	None identified in area(s) assessed.	N/A	N/A	N/A
Thermal System Insulation	Location/Description	Cond.	Est. Quantity	Friability
Mechanical Pipe Insulation – Straights	Mechanical pipe straights were observed to be insulated with known asbestos-containing insulation within various surveyed areas (refer to Executive Summary for exact locations and quantities).	Good-Poor	-	Friable
	Remaining mechanical pipe straights were observed to be insulated with fiberglass.	N/A	N/A	N/A
Mechanical Pipe Insulation – Fittings (elbows, valves, tees, hangars, etc.)	Mechanical pipe fittings were observed to be insulated within known asbestos-containing insulation within various surveyed areas (refer to Executive Summary for exact locations and quantities).	Good-Fair	-	Friable
	Remaining mechanical pipe fittings were observed to be insulated with fiberglass.	N/A	N/A	N/A
HVAC Duct Insulation	HVAC ductwork within the Stairway #3 shaft was observed to be insulated with a black paper material which was sampled (Sample Set 2) and analyzed for asbestos content using the PLM method of detection. The paper material was found not to contain asbestos, however known asbestos-containing seam tape was observed on the seams of the paper. The seam tape was observed to be in Poor condition with debris present within the shaft.	Poor	-	Friable
	HVAC ductwork within the shaft of Stairway #5 and basement garage ceiling at Stairway #4 was observed to be fiberglass with known asbestos-containing seam tape.	Good-Poor	-	Friable

	Tar material on fiberglass duct insulation within the basement bulkhead of Stairway #4 was sampled (Sample Set 3) and analyzed for asbestos content using the PLM method of detection. The samples were found not to contain asbestos.	N/A	N/A	N/A
Breeching / Exhaust Insulation	None identified in area(s) assessed.	N/A	N/A	N/A
Tank Insulation	None identified in area(s) assessed.	N/A	N/A	N/A
Boiler Insulation	None identified in area(s) assessed.	N/A	N/A	N/A
Other Mechanical Equipment Insulation	Remaining mechanical equipment was either uninsulated or insulated with fiberglass insulation.	N/A	N/A	N/A
Architectural Finishes & Finishing Materials	Location/Description	Cond.	Est. Quantity	Friability
Sprayed Texture / Stucco Finishes	None identified in area(s) assessed.	N/A	N/A	N/A
Plaster Finishes	Plaster finishes observed throughout the stairways was sampled (Sample Set 5) and analyzed for asbestos content using the PLM method of detection. The samples were found not to contain asbestos.	N/A	N/A	N/A
	Slightly textured plaster walls observed within the garage at stairway #3 were sampled (Sample Set 6) and analyzed for asbestos content using the PLM method of detection. The samples were found to contain 1% Chrysotile asbestos.	Good	-	Friable
Drywall Joint Compound	Drywall joint compound observed on drywall surfaces within various areas was sampled (Sample Set 1) and analyzed for asbestos content using the PLM method of detection. The samples were found not to contain asbestos.	N/A	N/A	N/A
Ceiling Tiles	Location/Description	Cond.	Est. Quantity	Friability
Lay-in Acoustic Ceiling Tiles	None identified in area(s) assessed.	N/A	N/A	N/A
Glued-on Acoustic Ceiling Tiles	None identified in area(s) assessed.	N/A	N/A	N/A
Transite Ceiling Panels	None identified in area(s) assessed.	N/A	N/A	N/A
Flooring	Location/Description	Cond.	Est. Quantity	Friability
Vinyl Floor Tiles	None identified in area(s) assessed.	N/A	N/A	N/A

Vinyl Sheet Flooring	None identified in area(s) assessed.	N/A	N/A	N/A
Asbestos Cement Products	Location/Description	Cond.	Est. Quantity	Friability
Piping	None identified in area(s) assessed.	N/A	N/A	N/A
Roofing, Siding, Wallboard	None identified in area(s) assessed.	N/A	N/A	N/A
Other Cement Products	None identified in area(s) assessed.	N/A	N/A	N/A
Misc. Materials	Location/Description	Cond.	Est. Quantity	Friability
Tile Mortar	Tile mortar observed on walls and ceilings within the stairway adjacent to Stairway #4 was sampled (Sample Set 4) and analyzed for asbestos-content using the PLM method of detection. The samples were found not to contain asbestos.	N/A	N/A	N/A

Notes: N/A=Not Applicable; N/D=Not Determined

3.1.2 Lead

Laboratory analytical results for paints tested to determine lead content are summarized below in Table 3. The Laboratory Certificate of Analysis is included in Appendix D. Refer to Section 4.1.2 of this report for recommended lead abatement procedures (if any) that correspond to the type of proposed construction, renovation, or demolition work.

TABLE 3
Results of Paint Condition and Lead Content Assessment
Stairway Fire Separation Project
25-55 St. Clair Avenue East, Toronto, Ontario
Sample Collection Date: November 7-18th, 2013

Sample No.	Location	Surface	Paint Colour	Condition	Lead Conc. (% by wt.)
L1	Stairway 2	Plaster	Beige	Good-Fair	0.69
L2	Stairway 3	Plaster	Beige	Good-Fair	0.081
L3	Stairway 4	Plaster	Beige	Good-Fair	0.075
L4	Stairway 1	Plaster	Beige	Good-Fair	0.57

Paints sampled were found to have lead content greater than 0.009% by weight which is considered to be lead containing. Lead may also be a component of solder in pipe fittings and electrical equipment.

3.1.3 Mercury

Mercury is present within the area(s) assessed in the form of vapour within fluorescent lamp light fixtures.

3.1.4 Silica

A number of building materials were identified within the surveyed area(s) that are suspected to contain crystalline silica. This includes the following materials:

- Concrete/concrete block walls
- Plaster finishes
- Drywall finishes

3.1.5 Other Designated Substances

Acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride were not included in our assessment as these substances are not expected to be a significant component of building materials or present in a form that would represent an exposure concern. Additionally, no specific information regarding their use was provided to us.

3.2 Other Hazardous Materials

3.2.1 Chemical Hazards

No visible evidence of UFFI installation (i.e. injection openings) or overspray of foam insulation at wall/ceiling joints was identified. In addition, due to the age of construction and use of the building the presence of UFFI insulation within wall cavities is not suspected.

3.2.2 Biological Hazards

Mould Contamination

There was no visible evidence of obvious mould growth on building finishes within the surveyed area(s) at the time of our assessment. In addition, there was no visible evidence of any significant water staining or discolouration to building finishes within the surveyed area(s) that would suggest the potential for hidden mould growth behind these finishes.

Pest Infestation

There was no visible evidence of any significant pest infestation within the surveyed area(s).

3.2.3 Environmental Hazards

Polychlorinated Biphenyls (PCBs)

No equipment suspected of containing PCBs was observed within the areas assessed. Internal light ballasts were observed to be non-PCB containing.

Ozone Depleting and Global Warming Substances

No fixed equipment suspected to contain ODS/GWS were observed in the area(s) assessed.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Designated Substances

4.1.1 Asbestos

Results of our assessment indicated that the following asbestos-containing materials are present within the stairways that are likely to be disturbed as part of the Stairway Fire Separation Project:

- Mechanical pipe insulation
- Mechanical pipe fitting insulation
- HVAC ductwork seam tape
- Seam tape on black foil paper pipe insulation
- Slightly textured plaster
- Debris within the shafts on vertical and horizontal surfaces

As per O.Reg. 278/05, removal or disturbance of greater than 1 square metre of friable ACM is classified as a Type 3 operation; unless the material is removed using a glove bag, in which case Type 2 operations are applicable. Please note that Type 2 procedures may be required to enter mechanical shafts whereby asbestos-containing debris is present. The following two options are presented in order to address the presence of asbestos-containing materials in locations identified in this report and regarding this project:

Option # 1 - Full Removal Following Type 3 Procedures

Based on the scope of work for the fire separation project, we understand the existing plaster and terra cotta walls along the stairwells where the mechanical shafts are located will be demolished and re-built to meet fire code requirements. The procedure to demolish the walls surrounding the shafts will likely disturb the existing asbestos - containing material present on piping, pipe fittings, duct work and the debris present. Therefore, engineering controls will need to be implemented prior to this operation being conducted. The most obvious and most appropriate long-term solution would be to access the mechanical shafts and remove all asbestos - containing materials present as part of the fire separation project. This would include constructing a Type 3 work area in each stairwell and/or at each level followed by removal of the shaft walls to access the asbestos - containing materials. All of the asbestos-containing materials would be removed and cleaned-up and upon completion the remaining scope of work within the fire separation project could proceed freely. Besides the costs associated with the asbestos removal, the mechanical systems would also need to be re-insulated. Other challenges exist regarding the height of the stairwells, space to gain access to the material and the shafts floors are open to floors above and below creating an additional hazard for workers.

Option # 2 - Repair and Clean-Up Following Type 2 Procedures

Based on the scope of work for the fire separation project, we understand the existing plaster and terra cotta walls along the stairwells where the mechanical shafts are located will be demolished and re-built to meet fire code requirements. The procedure to demolish the walls surround the shafts will likely disturb the existing asbestos - containing material present on piping, pipe fittings, duct work and the debris present. Therefore, engineering controls will need to be implemented prior to this operation being conducted. A suitable engineering control for the fire separation project would be to access the mechanical shafts and repair and clean-up the asbestos - containing materials present as part of the fire separation project. This would include constructing a Type 2 work area in each stairwell and/or at each level followed by removal of the shaft walls to access the asbestos - containing materials for repair and clean-up. The existing damaged and exposed asbestos - containing materials that are considered in poor condition would be repaired by applying a new canvas jacketing over the asbestos - containing materials. This would seal the exposed asbestos - containing materials rendering the work area safe to work in close proximity to the asbestos - containing materials. The vertical and horizontal surfaces within the shaft would be HEPA vacuumed clean during this operation. This option is far more cost effective than full removal with the only drawback being that the asbestos-containing materials will remain for the duration of the project. In addition, past experience has shown that tradesmen are often concerned about working in close-proximity to these materials and any physical damage caused after the Type 2 repair would need to be handled on a case by case basis meaning the work would stop and the abatement contractor would need to

be engaged for a localized repair and clean-up. In addition, the asbestos-containing materials will remain and would need to be addressed on future projects in this area.

The removal or disturbance of ACM must follow the measures and procedures indicated in O.Reg. 278/05. This work should be conducted by workers who have received proper training by a “competent person” in the hazards of asbestos exposure, personal hygiene and work practices, and the use and care of respirators and protective clothing. Any worker/supervisor who works in a Type 3 operation must successfully complete the Asbestos Abatement Worker or Supervisor Training Program approved by the Ministry of Training, Colleges and Universities.

It is recommended that all work involving the removal or disturbance of ACM be subject to inspection and testing to document conformance with O.Reg. 278/05 requirements. The degree of inspection and testing is dependent on site-specific conditions such as the type, duration, size and location of the work. In most circumstances Type 3 operations require a visual inspection and clearance air testing to be conducted by a competent worker on completion of the work. The inspection should be conducted to ensure that the enclosure and the work area inside the enclosure are free from visible dust, debris or residue that may contain asbestos. Clearance air testing for Type 3 operations requires a minimum number of air samples to be taken (depending on the size of the work area) following specific sampling and analytical procedures and all samples taken must meet the clearance criteria set out in O.Reg. 278/05.

4.1.2 Lead

Results of paint chip analysis for the determination of lead content indicated that varying concentrations of lead were identified in all of the paints sampled. As current studies have shown a poor correlation between paint lead concentrations and worker exposures the Ontario Ministry of Labour (MOL) has not established a threshold concentration or action level for lead in paint below which worker protection and/or control measures during the disturbance of lead-containing paints are considered unnecessary. The type of work being conducted and the method/degree of disturbance of the paint appear to play a larger role in worker exposure than the concentration of lead in the paint.

Given the poor correlation between lead paint concentrations and worker exposure it is recommended that any work involving the disturbance of a lead-containing paint follow the procedures outlined in the MOL “*Lead on Construction Projects*” guideline (April 2011). The extent of procedures (or Type of operation) necessary depends on the type of work to be conducted.

If practicable, all bulk lead waste materials should be separated from other wastes and sent to a recycling facility. If not practicable, lead-containing waste should be handled and disposed of according to Ontario Regulation 347 (O.Reg. 347), “*General – Waste Management*”, made under the Environmental Protection Act. Under this regulation (and depending on the quantity of waste generated) the waste may be subject to

analysis following the Toxicity Characteristic Leaching Procedure (TCLP) to determine if it is a “leachate toxic waste” based on the leachate quality criteria provided in Schedule 4 of the regulation. Such wastes must meet specific treatment requirements (Schedule 5) or undergo alternative treatment for hazardous debris (Schedule 8) prior to land disposal.

4.1.3 Mercury

Fluorescent and HID lamps that require removal should be handled with care and kept intact to avoid potential exposure to mercury vapour present within the lamps. Under O.Reg. 347, waste mercury produced in amounts less than 5 kilograms (kg) in any month or otherwise accumulated in an amount less than 5 kg are exempt from hazardous waste registration, treatment and disposal requirements and can be disposed of in landfill as regular waste. Larger quantities of waste mercury must be treated and disposed of in accordance with the requirements of O.Reg. 347. To prevent the release of mercury into the environment it is recommended that all waste lamps are sent to a lamp recycling facility and are not disposed of in landfill.

Although no mercury was visibly identified in other equipment, dismantling of equipment was not conducted to verify the presence/absence of mercury. It is cautioned that thermometers, barometers and other measuring devices (pressure gauges/sensors, vacuum gauges, manometers, etc.), thermostats and a variety of other electrical switches (temperature sensitive, tilt switches, float switches, etc.) may contain mercury that may not be visible without dismantling the equipment. Such devices should be assumed to contain mercury until proven otherwise and similar precautions to those outlined above should be taken if any of these items are to be disturbed or taken out of service in the future.

4.1.4 Silica

Suspect silica-containing materials were identified to be present within the project-specific work area. In their current state, building materials containing silica do not represent a risk to building occupants or construction workers. Risks associated with exposure to silica arise during demolition activities that cause silica dust to be created (particularly grinding, drilling or cutting operations and during major demolition), resulting in a crystalline silica inhalation hazard.

If any materials suspected to contain silica are to be removed or otherwise disturbed as a result of renovation/demolition activities it is recommended that procedures be put in place to control the generation of dust (such as routine water misting) and thus reduce the potential for worker exposure. Workers that have the potential to be exposed to airborne silica should also wear appropriate protective clothing and respiratory protection.

Any work involving the disturbance of silica-containing materials should follow the procedures outlined in the MOL “*Silica on Construction Projects*” guideline (April 2011). The appropriate engineering controls, work practices, hygiene practices, personal protective measures and training necessary to conduct the work in a safe manner are provided in this guideline. The general measures and procedures (or Type of operation) necessary depends on the type of work to be conducted.

4.1.5 Other Designated Substances

No other designated substances are expected to be a component of building materials within the surveyed area(s) in a form that would represent an exposure concern. Therefore, no protective measures or procedures specific to acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride are considered necessary.

4.2 Other Hazardous Materials

4.2.1 Chemical Hazards

As no UFFI was identified or is suspected to be present within the surveyed area(s) no further action is required. However, given that no destructive testing was conducted, there is a remote possibility that UFFI could be hidden within locations such as exterior wall cavities. If suspect foam insulation is identified during renovation/demolition activities work should be stopped and the area should be re-assessed to evaluate conditions and determine appropriate control measures and worker protection, if necessary.

4.2.2 Biological Hazards

Mould Contamination

No mould contamination was identified in the surveyed area(s) and therefore no further action is required at this time. Although no obvious mould contamination or evidence to suggest possible hidden mould contamination was visibly identified within the surveyed area(s) there is still a potential for hidden mould growth to exist behind or underneath building finishes. Should suspect mould growth be discovered during the course of renovation or demolition work it is recommended that all work stop so that the area can be assessed to evaluate proper control measures and remediation protocols in order to avoid worker exposure to mould and possible contamination of adjacent areas.

Pest Infestation

No visual evidence of any significant pest infestation was observed within the area(s) assessed. Therefore, no additional precautionary measures are deemed necessary for protection against biological contaminants potentially associated with pest infestation.

4.2.3 Environmental Hazards

Polychlorinated Biphenyls (PCBs)

No equipment was identified within the surveyed area(s) that is expected to be PCB-containing.

Ozone Depleting and Global Warming Substances

No fixed equipment suspected to contain ODS/GWS were observed in the area(s) assessed.

5.0 LIMITATIONS

The information and recommendations detailed in this report were carried out by trained professional and technical staff in accordance with generally accepted environmental and industrial hygiene work practices and procedures. Recommendations provided in this report have been generated in accordance with accepted industry guidelines and practices. These guidelines and practices are considered acceptable as of the date of this report.

In preparation of this report, Safetech Environmental Limited (SEL) relied on information supplied by others, including without limitation, information pertaining to the history and operation of the site, test results and reports of other consultants and testing services provided by independent laboratories. Except as expressly set out in this report, SEL has not made any independent verification of information provided by independent entities.

The collection of samples at the location noted was consistent with the scope of work agreed-upon with the person or entity to whom this report is addressed and the information obtained concerning prior site investigations. As conditions between samples may vary, the potential remains for the presence of unknown additional contaminants for which there were no known indicators.

The analytical method used for determination of asbestos content meets the requirements of O.Reg. 278/05. However, small asbestos fibres may be missed by PLM due to resolution limitations of the optical microscope. Interfering binder/matrix and/or low asbestos content may also hinder positive identification by PLM. These conditions are common for vermiculite attic insulation (VAI) and non-friable organically bound (NOB) materials such as vinyl floor tiles, roofing materials, mastics and caulking and can lead to “false negative” results. If PLM analytical results for these types of

materials indicate no asbestos detected they have been reported as “Presumed Non-ACM”. Due to limitations of the analytical method we cannot confirm that low quantities of asbestos are not present in these samples using solely PLM analysis. Additional analytical procedures should be considered for such materials to rule out false negative results.

Conclusions are based on site conditions at the time of inspection and can only be extrapolated to an undefined limited area around inspected locations. The extent of the limited area depends on building construction and conditions. Building materials that are not detailed within this survey due to inaccessibility during the time of survey and/or are uncovered during renovation/demolition activities should be properly assessed by a qualified person prior to their disturbance. SEL cannot warrant against undiscovered environmental liabilities. If any information becomes available that differs from the findings in this report, we request that we be notified immediately to reassess the conclusions provided herein.

No other person or entity is entitled to use or rely upon this report without the express written consent of Safetech Environmental Limited and the person or entity to who it is addressed. Any use that a third party makes of this report, or any reliance based on conclusions and recommendations made, are the responsibility of such third parties. SEL accepts no responsibility for damages suffered by third parties as a result of actions based on this report.

Appendix A

Condition Assessment Criteria for Asbestos-Containing Materials

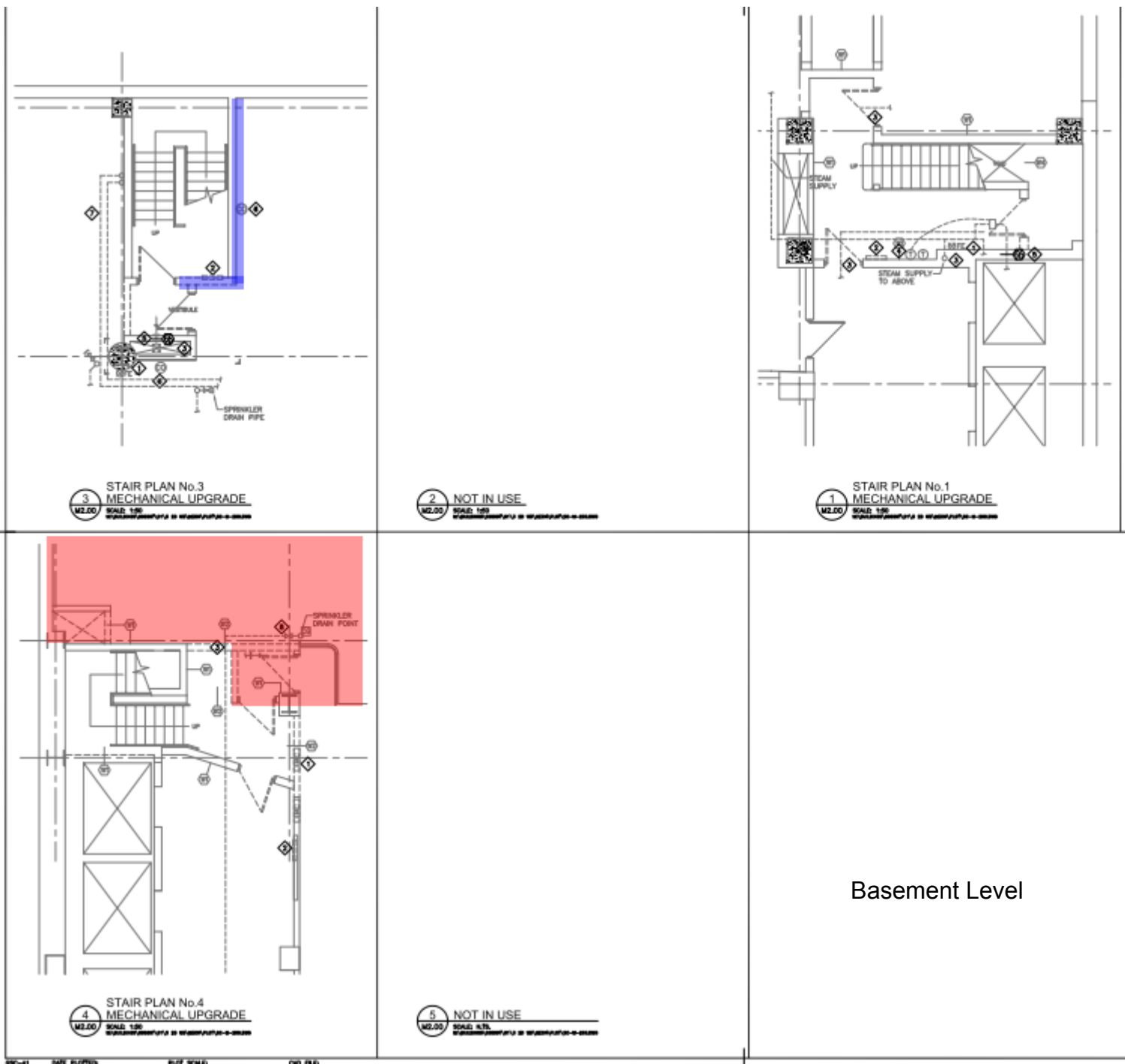
The condition of asbestos-containing materials identified within the surveyed area(s) was assessed as Good (G), Fair (F) or Poor (P). The assessment criteria used to determine condition is dependent on material characteristics, such as friability. The following Table summarizes the criteria used by SEL to evaluate the condition of ACM.

Condition Assessment Criteria for Asbestos-Containing Materials

Sprayed Fireproofing, Sprayed Insulation and Sprayed Texture Finishes	
Good	<ul style="list-style-type: none"> • Surface shows no significant signs of damage, deterioration, or delamination (i.e. <1%). • Unencapsulated or unpainted fireproofing or texture finishes, where no delamination or damage is observed. • Encapsulated fireproofing or texture finishes where encapsulation applied after damage or fallout.
Fair	• Not utilized as part of condition assessment for these materials.
Poor	• Greater than 1% damage, delamination, or deterioration to surface.
In areas where damage exists in isolated locations, both Good and Poor may be applicable.	
Mechanical Insulation (boilers, breeching, ductwork, piping, tanks, equipment, etc.)	
Good	<ul style="list-style-type: none"> • Insulation completely covered in jacketing and exhibits no evidence of damage or deterioration. • Jacketing may have minor damage (i.e. scuffs or stains), but is not penetrated.
Fair	<ul style="list-style-type: none"> • Minor penetrating damage to jacketed insulation (cuts, tears, nicks, deterioration or delamination). • Undamaged insulation that had never been jacketed. • Insulation is exposed but not showing surface disintegration. • Extent of missing insulation ranges from minor to none. • Damage that can be repaired.
Poor	<ul style="list-style-type: none"> • Original insulation jacket is missing, damaged, deteriorated, or delaminated. • Insulation is exposed and significant areas have been dislodged. • Damage that cannot be easily repaired.
Non-Friable and Potentially Friable Materials (includes materials such as plaster finishes, drywall compound, ceiling tiles, asbestos cement products, vinyl asbestos tile and asbestos paper backed vinyl sheet flooring, etc., which have the potential to become friable when handled)	
Good	<ul style="list-style-type: none"> • No significant damage. • Material may be cracked or broken but is stable and not likely to become friable upon casual contact. • No friable debris present
Fair	• Not utilized as part of condition assessment for these materials.
Poor	<ul style="list-style-type: none"> • Material is severely damaged. • Debris is present or binder has disintegrated to the point where the material has become friable.
Asbestos-Containing Debris (noted separately from the presumed source material)	
Poor	• Debris is always considered to be in Poor condition.

Appendix B

Floor Plans and Sample Locations for Areas Assessed



Legend:

- ACM Slight Texture Plaster
- ACM pipe insulation & duct seam tape

Project:
Stairway Fire Separation Project

Location:
25-55 St. Clair Avenue East
Toronto, Ontario

Project #: 181813



Safetech Environmental Ltd.
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7

Legend:

- ACM pipe/fitting insulation
- ACM pipe insulation & duct seam tape

Project:
Stairway Fire Separation Project

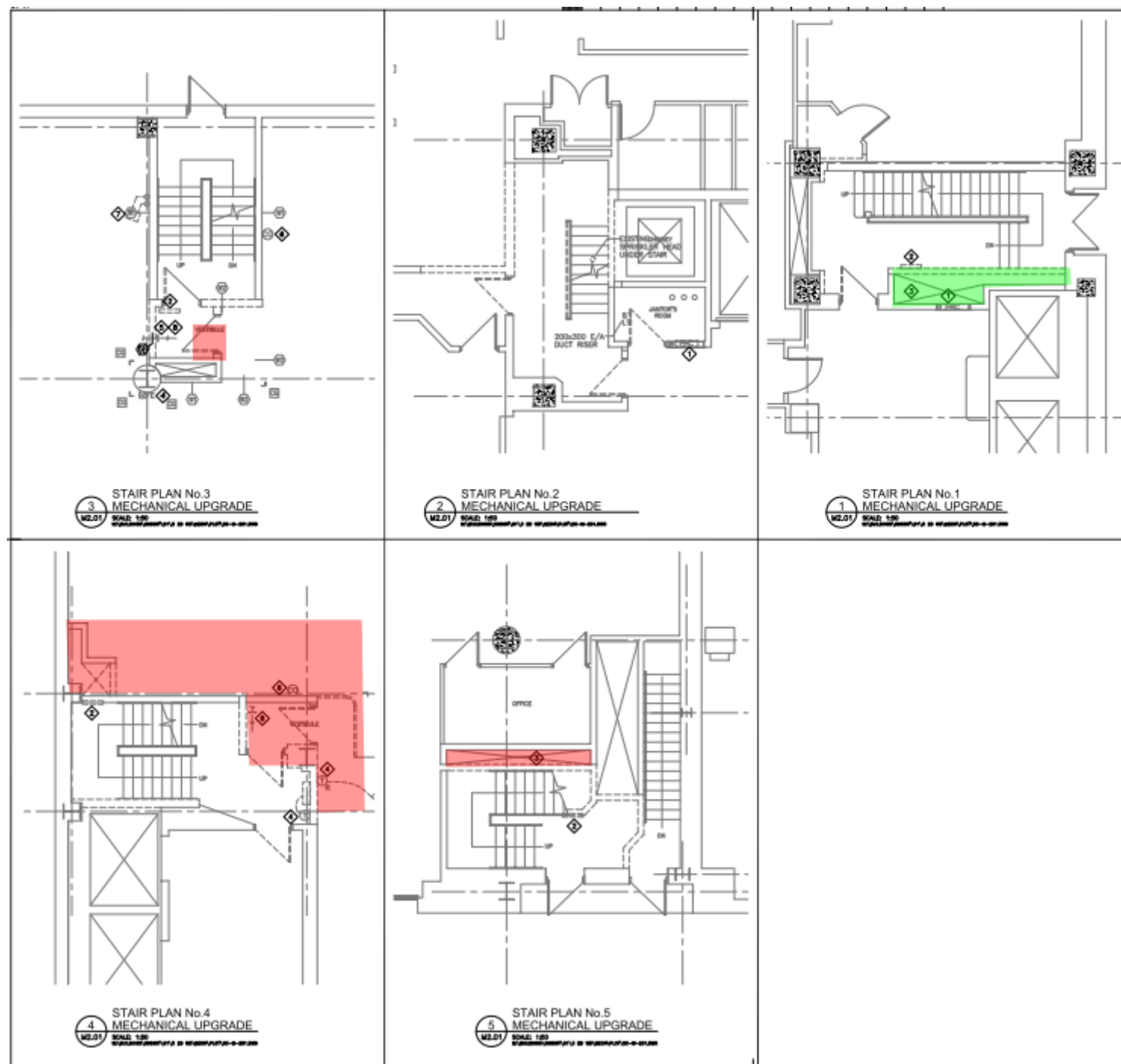
Location:
25-55 St. Clair Avenue East
Toronto, Ontario

Project #: 181813

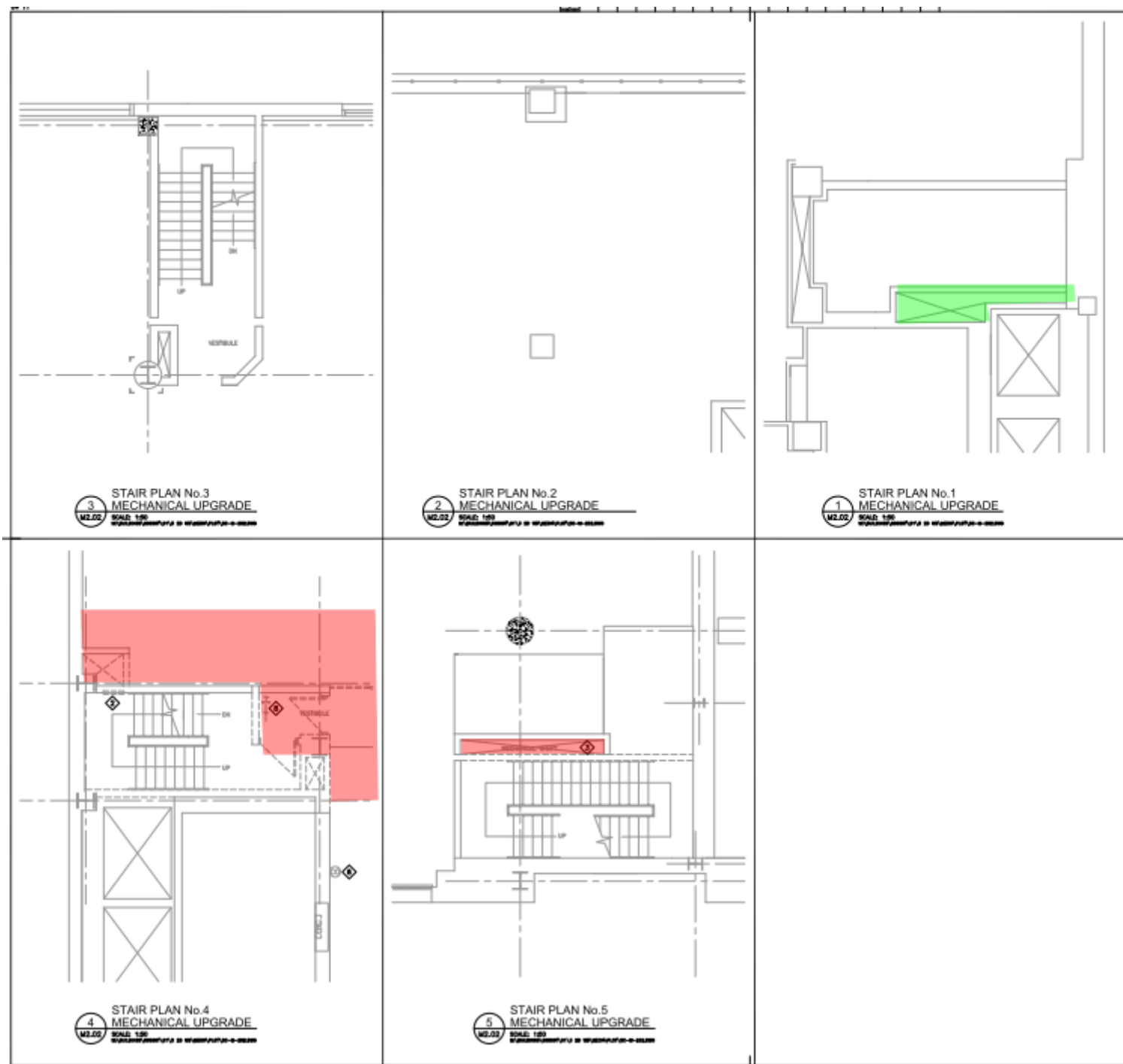
Date: 12/3/13



Safetech Environmental Ltd.
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7



Ground Level



Mezzanine Level

Legend:

- ACM pipe/fitting insulation
- ACM pipe insulation & duct seam tape

Project:
Stairway Fire Separation Project

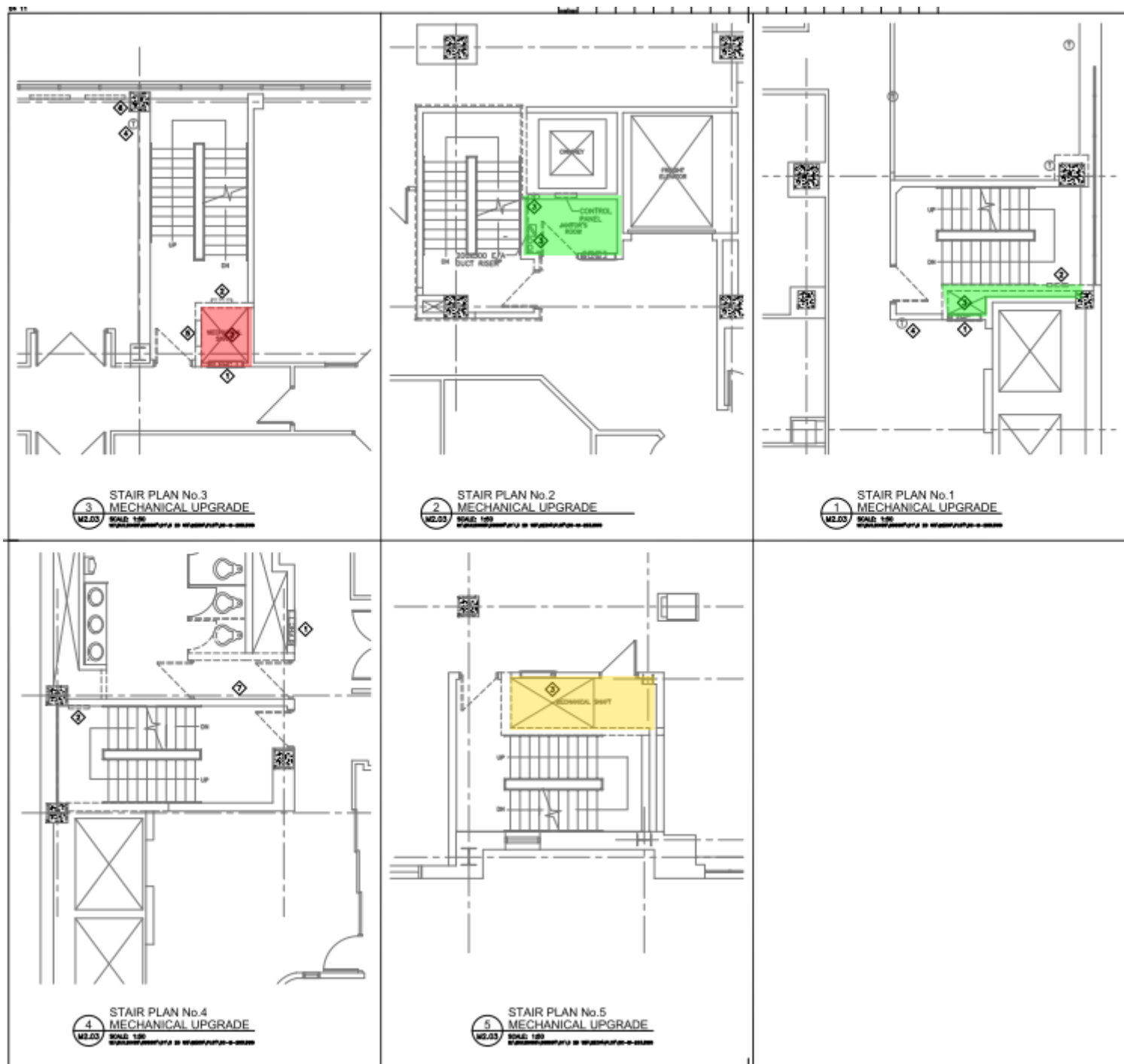
Location:
25-55 St. Clair Avenue East
Toronto, Ontario

Project #: 181813

Date: 12/3/13



Safetech Environmental Ltd.
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7



Legend:

- ACM pipe/fitting insulation
- ACM pipe insulation & duct seam tape
- ACM duct seam tape

Project:
Stairway Fire Separation Project

Location:
25-55 St. Clair Avenue East
Toronto, Ontario

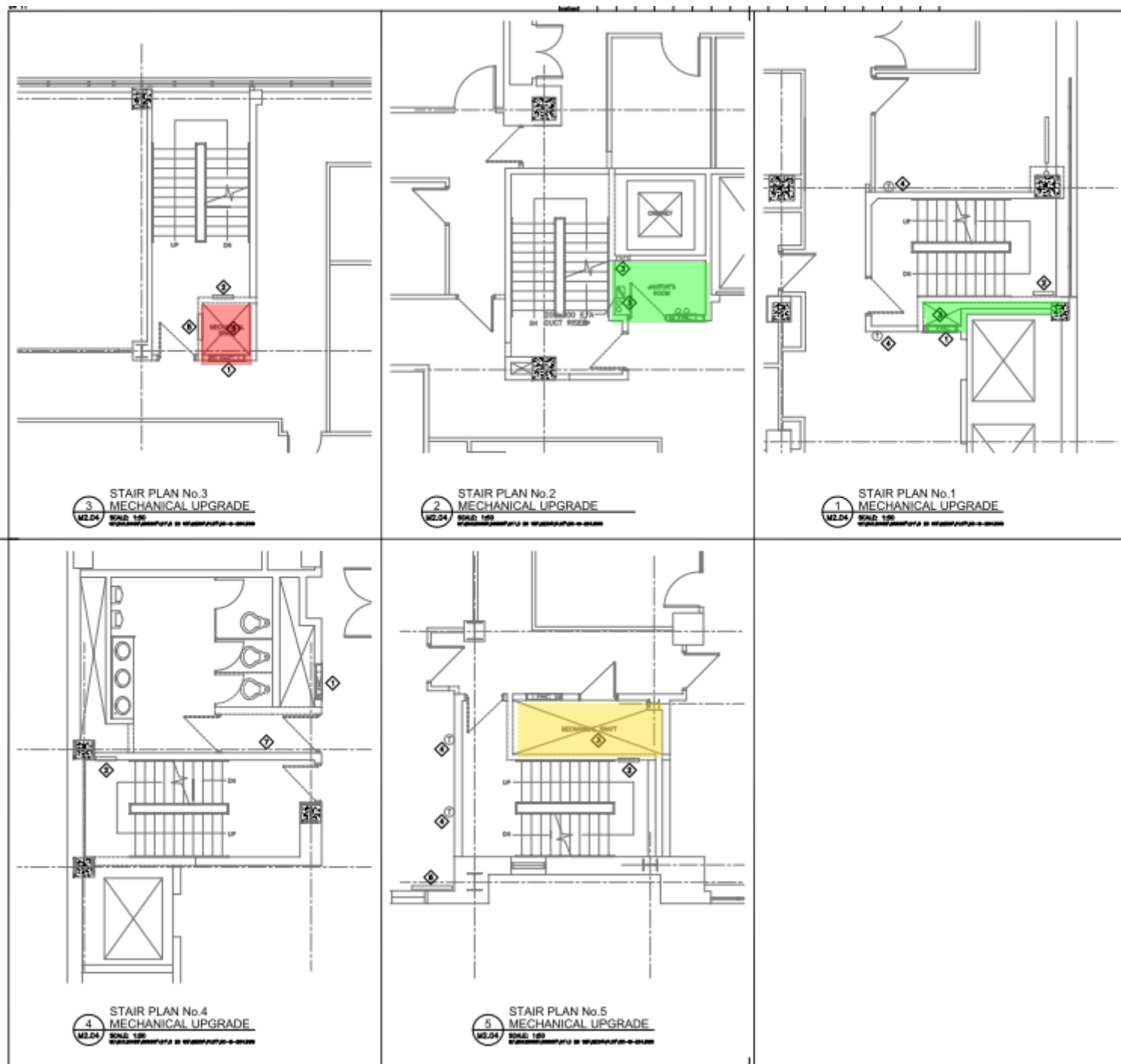
Project #: 181813

Date: 12/3/13



Safetech Environmental Ltd.
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7

Second Floor



Legend:

- ACM pipe/fitting insulation
- ACM pipe insulation & duct seam tape
- ACM duct seam tape

Project:
Stairway Fire Separation Project

Location:
25-55 St. Clair Avenue East
Toronto, Ontario

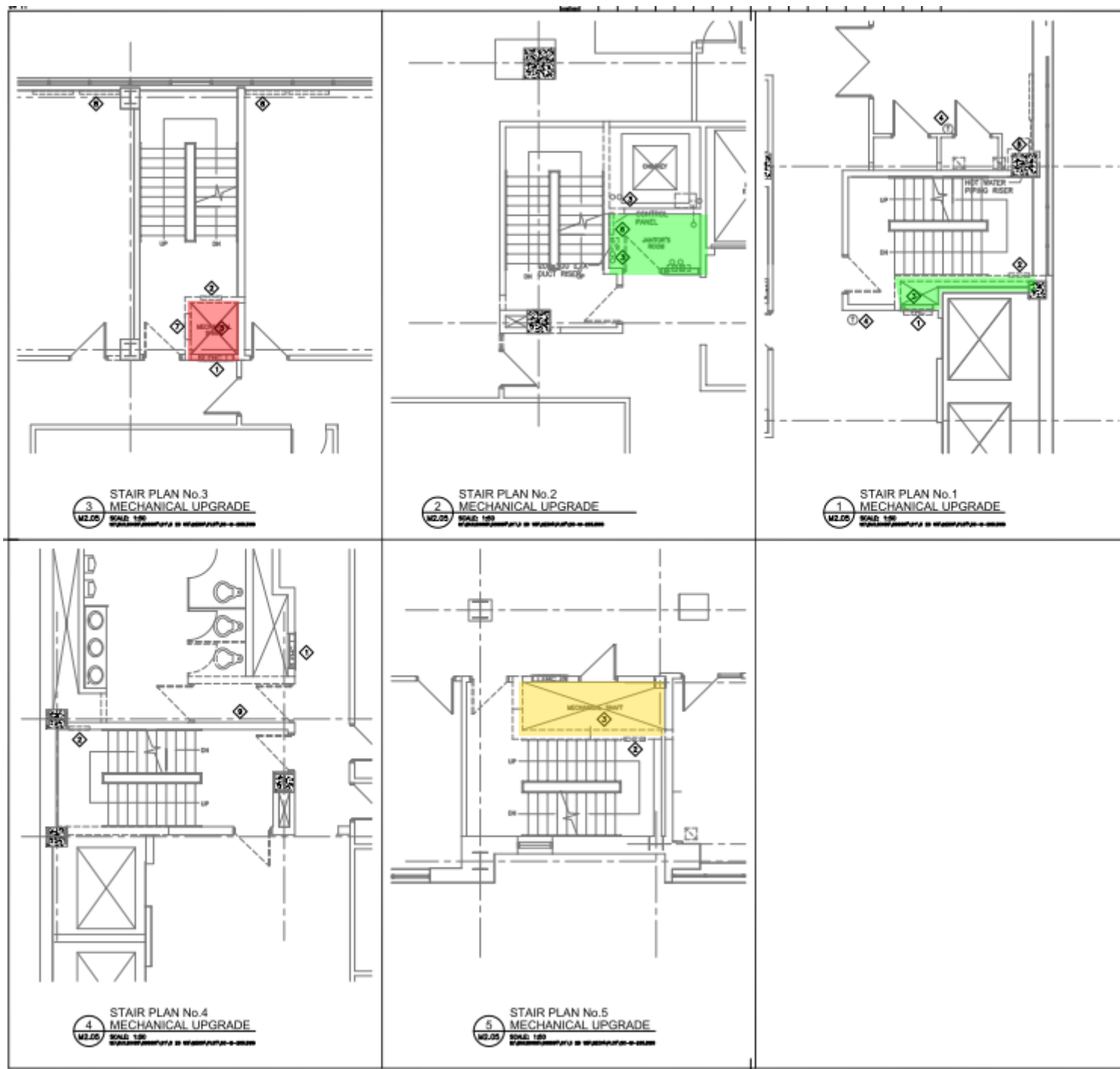
Project #: 181813

Date: 12/3/13



Safetech Environmental Ltd.
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7

Third Floor



Legend:

- ACM pipe/fitting insulation
- ACM pipe insulation & duct seam tape
- ACM duct seam tape

Project:
Stairway Fire Separation Project

Location:
25-55 St. Clair Avenue East
Toronto, Ontario

Project #: 181813




Date: 12/3/13



Safetech Environmental Ltd.
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7

Fourth Floor

Legend:

-  ACM pipe/fitting insulation
-  ACM pipe insulation & duct seam tape
-  ACM duct seam tape

Project:
Stairway Fire Separation Project

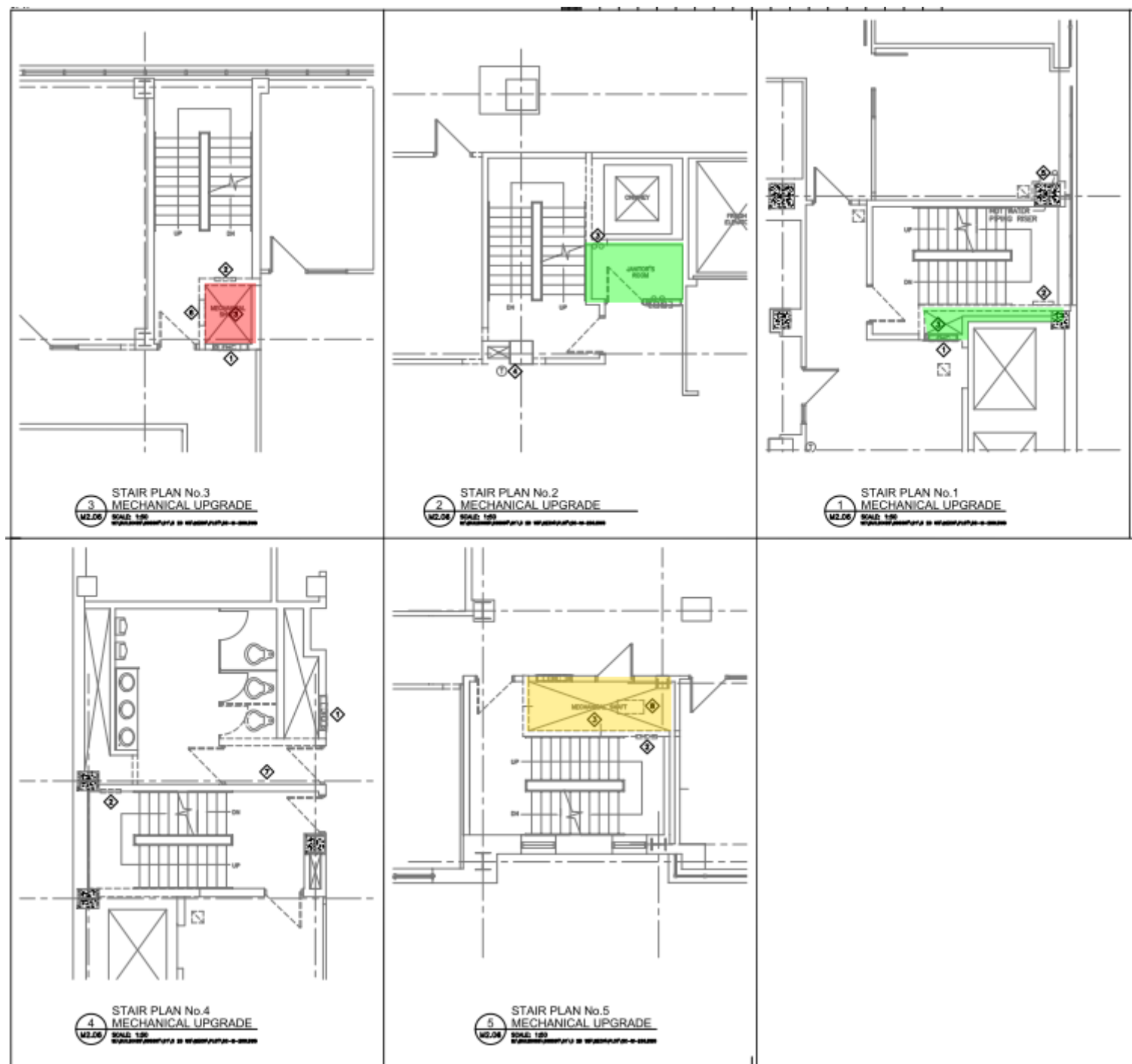
Location:
25-55 St. Clair Avenue East
Toronto, Ontario

Project #: 181813

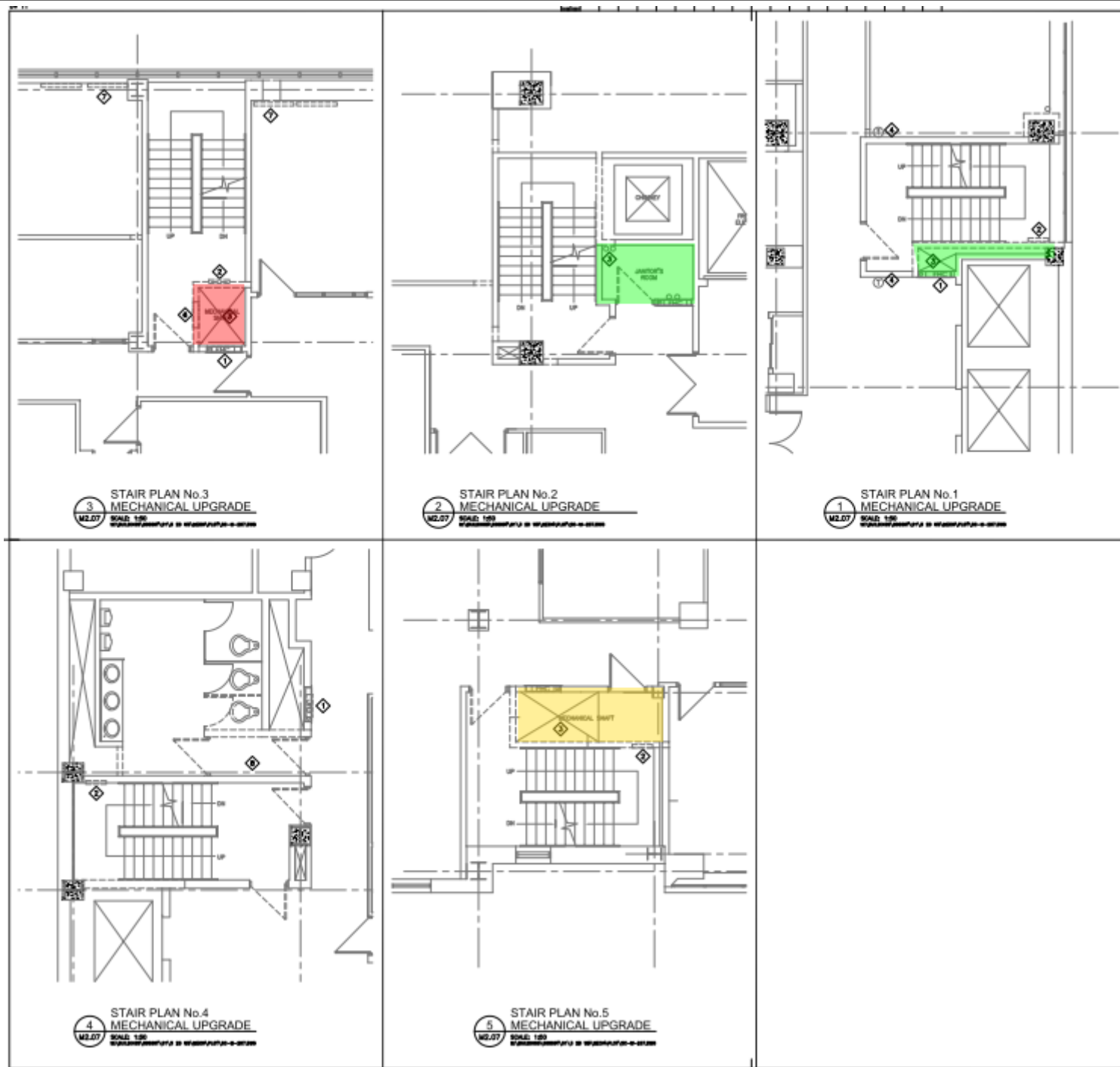
Date: 12/3/13



Safetech Environmental Ltd.
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7



Fifth Floor



Legend:

- ACM pipe/fitting insulation
- ACM pipe insulation & duct seam tape
- ACM duct seam tape

Project:
Stairway Fire Separation Project

Location:
25-55 St. Clair Avenue East
Toronto, Ontario

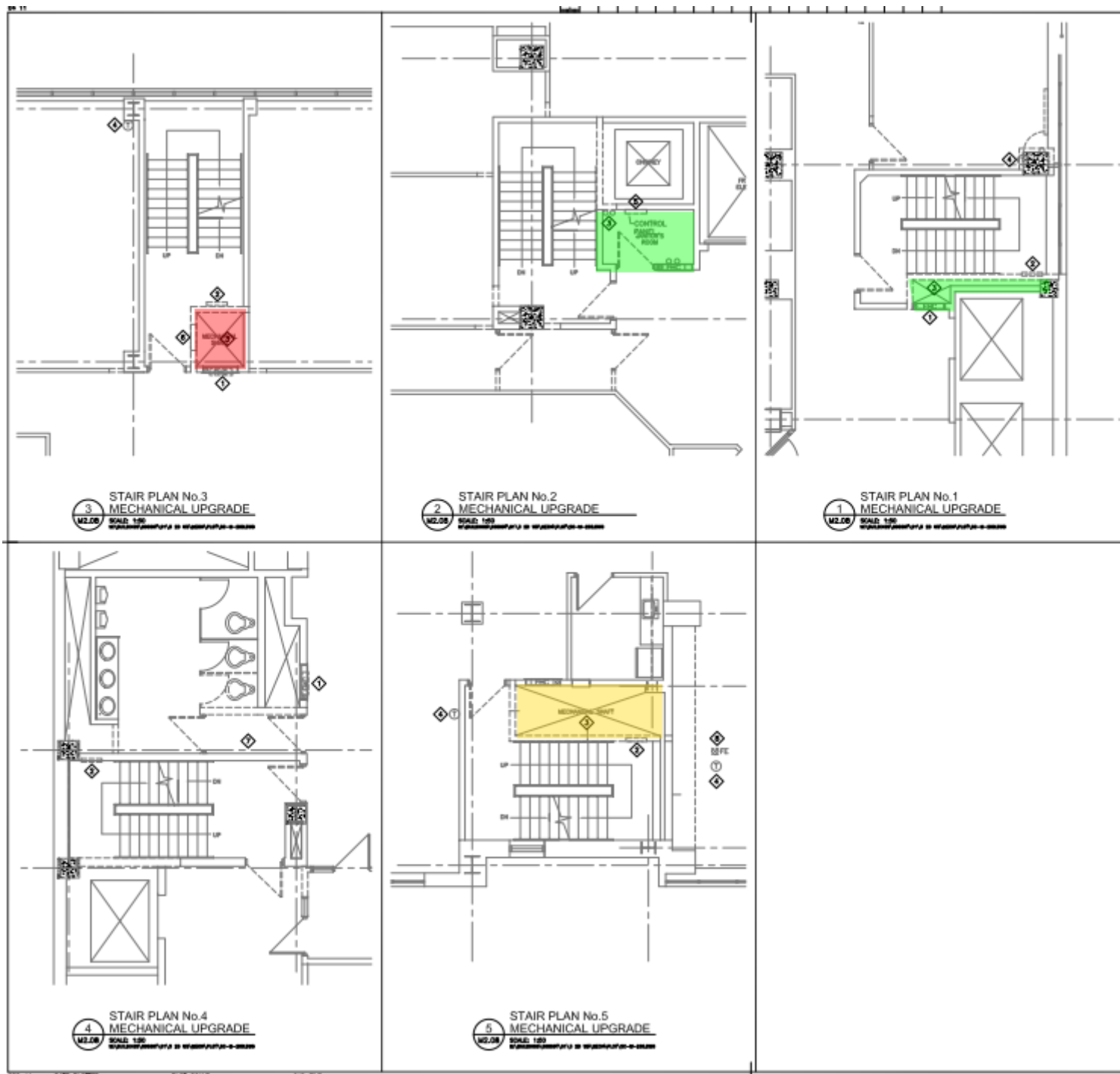
Project #: 181813

Date: 12/3/13



Safetech Environmental Ltd.
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7

Sixth Floor



Legend:

- ACM pipe/fitting insulation
- ACM pipe insulation & duct seam tape
- ACM duct seam tape

Project:
Stairway Fire Separation Project

Location:
25-55 St. Clair Avenue East
Toronto, Ontario

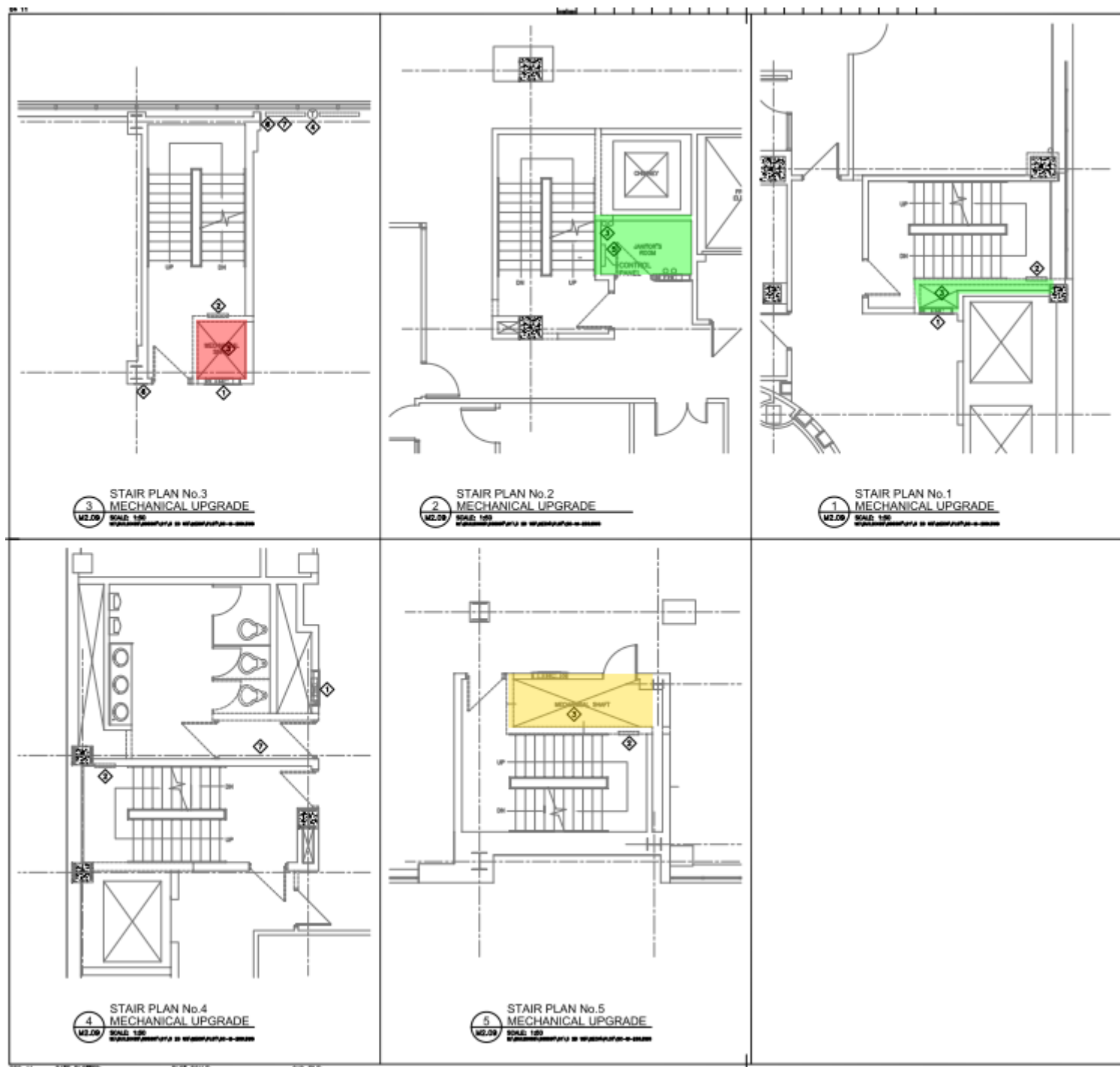
Project #: 181813

Date: 12/3/13



Safetech Environmental Ltd.
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7

Seventh Floor



Legend:

- ACM pipe/fitting insulation
- ACM pipe insulation & duct seam tape
- ACM duct seam tape

Project:
Stairway Fire Separation Project

Location:
25-55 St. Clair Avenue East
Toronto, Ontario

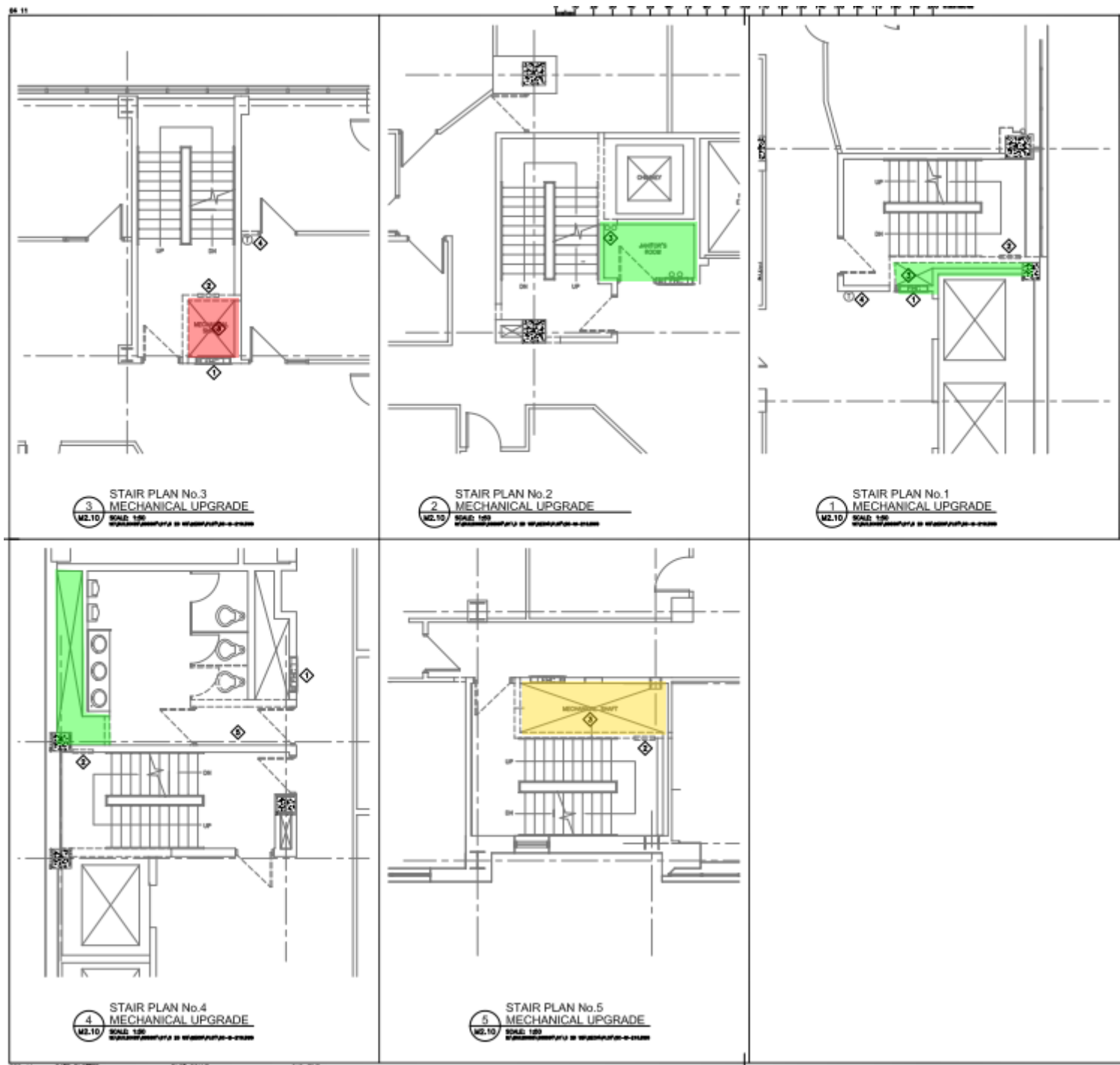
Project #: 181813

Date: 12/3/13



Safetech Environmental Ltd.
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7

Eight Floor



Legend:

- ACM pipe/fitting insulation
- ACM pipe insulation & duct seam tape
- ACM duct seam tape

Project:
Stairway Fire Separation Project

Location:
25-55 St. Clair Avenue East
Toronto, Ontario

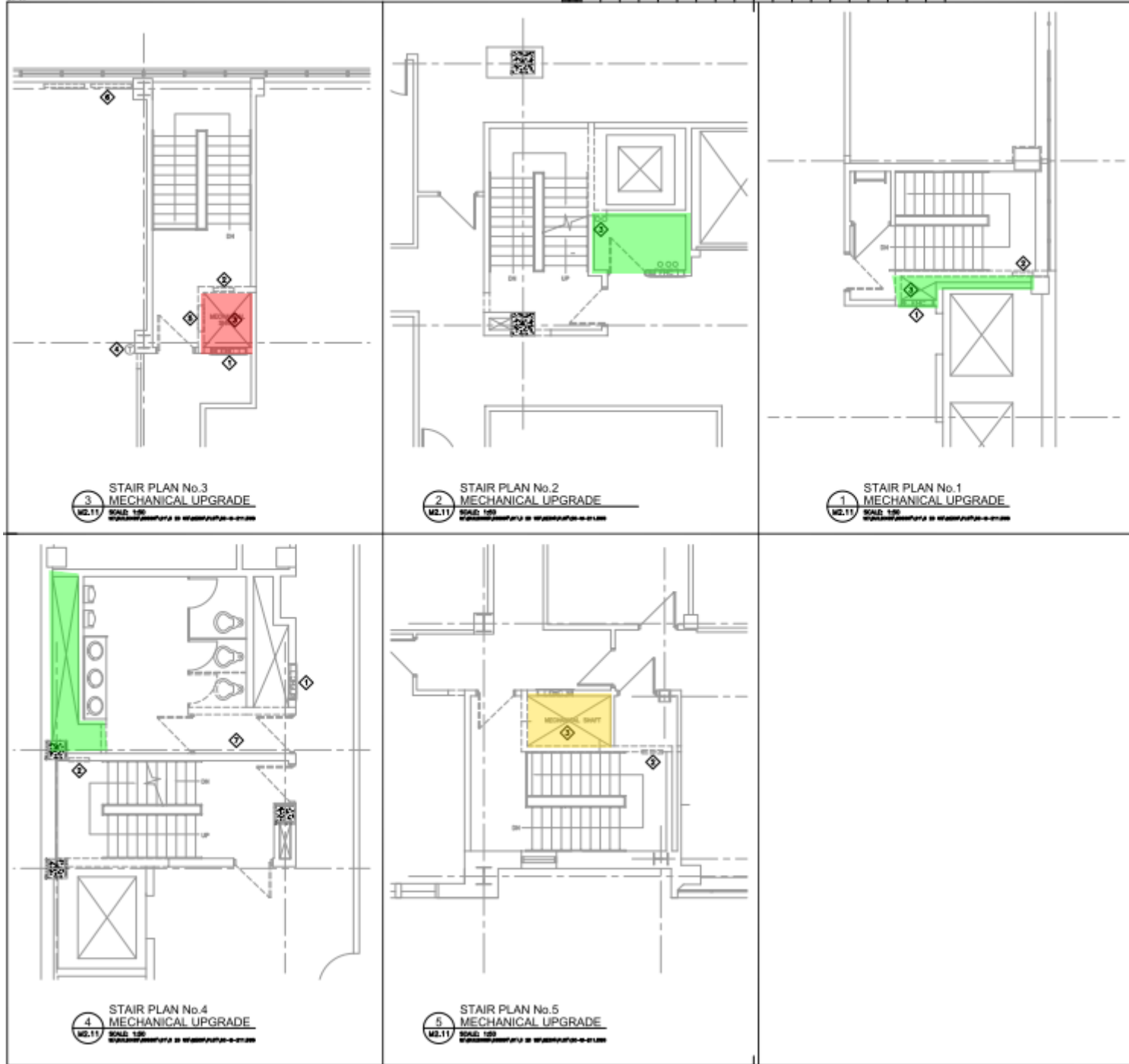
Project #: 181813

Date: 12/3/13



Safetech Environmental Ltd.
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7

Ninth Floor



Legend:

- ACM pipe/fitting insulation
- ACM pipe insulation & duct seam tape
- ACM duct seam tape

Project:
Stairway Fire Separation Project

Location:
25-55 St. Clair Avenue East
Toronto, Ontario

Project #: 181813

Date: 12/3/13



Safetech Environmental Ltd.
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7

Tenth Floor

Appendix C

Laboratory Certificate of Analysis - Asbestos



EMSL Canada Inc.

10 Falconer Drive, Unit #3 Mississauga, ON L5N 3L8
Phone/Fax: 289-997-4602 / (289) 997-4607
<http://www.EMSL.com> / torontolab@emsl.com

EMSL Canada Order 551308169
Customer ID: 55SELI62
Customer PO:
Project ID:

Attn: Paul Valenti
Safetech Environmental
3045 Southcreek Road
Unit 14
Mississauga, ON L4X 2X7

Phone: (905) 624-2722
Fax: (905) 624-4306
Collected:
Received: 11/20/2013
Analyzed: 11/20/2013

Proj: 25 ST CLAIRE AVE E

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: 1A **Lab Sample ID:** 551308169-0001
Sample Description: 10TH FLOOR WASHROOM/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	White	0%	100%	None Detected	

Client Sample ID: 1B **Lab Sample ID:** 551308169-0002
Sample Description: 5TH FLOOR WASHROOM/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	White	0%	100%	None Detected	

Client Sample ID: 1C **Lab Sample ID:** 551308169-0003
Sample Description: STAIRWAY 4 GARAGE/DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	White	0%	100%	None Detected	

Client Sample ID: 2A **Lab Sample ID:** 551308169-0004
Sample Description: STAIRWAY 3 9TH GARAGE/BLACK PAPER ON HVAC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	Black	30%	70%	None Detected	

Client Sample ID: 2B **Lab Sample ID:** 551308169-0005
Sample Description: STAIRWAY 3 7TH FLOOR/BLACK PAPER ON HVAC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	Black	30%	70%	None Detected	

Client Sample ID: 2C **Lab Sample ID:** 551308169-0006
Sample Description: STAIRWAY 3 4TH FLOOR/BLACK PAPER ON HVAC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	Black	30%	70%	None Detected	

Client Sample ID: 3A **Lab Sample ID:** 551308169-0007
Sample Description: STAIRWAY 4 BASEMENT/TAR ON HVAC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	White/Black	20%	80%	None Detected	



EMSL Canada Inc.

10 Falconer Drive, Unit #3 Mississauga, ON L5N 3L8
Phone/Fax: 289-997-4602 / (289) 997-4607
<http://www.EMSL.com> / torontolab@emsl.com

EMSL Canada Order 551308169
Customer ID: 55SELI62
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: 3B **Lab Sample ID:** 551308169-0008
Sample Description: STAIRWAY 4 BASEMENT/TAR ON HVAC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	Tan/White/Black	20%	80%	None Detected	

Client Sample ID: 3C **Lab Sample ID:** 551308169-0009
Sample Description: STAIRWAY 4 BASEMENT/TAR ON HVAC

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	Black	30%	70%	None Detected	

Client Sample ID: 4A **Lab Sample ID:** 551308169-0010
Sample Description: 6TH FLOOR WASHROOM/TILE MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	White	0%	100%	None Detected	

Client Sample ID: 4B **Lab Sample ID:** 551308169-0011
Sample Description: 10TH FLOOR WASHROOM/TILE MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	White	0%	100%	None Detected	

Client Sample ID: 4C **Lab Sample ID:** 551308169-0012
Sample Description: 2ND FLOOR WASHROOM/TILE MORTAR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	White	0%	100%	None Detected	

Client Sample ID: 5A **Lab Sample ID:** 551308169-0013
Sample Description: 10TH FLOOR STAIRWAY 1/PLASTER WALL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	Gray/White	0%	100%	None Detected	

Client Sample ID: 5B **Lab Sample ID:** 551308169-0014
Sample Description: 9TH FLOOR STAIRWAY 2/PLASTER WALL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	Gray/White	0%	100%	None Detected	

Client Sample ID: 5C **Lab Sample ID:** 551308169-0015
Sample Description: GROUND FLOOR STAIRWAY 3/PLASTER WALL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	Gray/White	0%	100%	None Detected	



EMSL Canada Inc.

10 Falconer Drive, Unit #3 Mississauga, ON L5N 3L8
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EMSL Canada Order 551308169
Customer ID: 55SELI62
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: 5D **Lab Sample ID:** 551308169-0016
Sample Description: 6TH FLOOR STAIRWAY 3/PLASTER WALL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	Gray/White	0%	100%	None Detected	

Client Sample ID: 5E **Lab Sample ID:** 551308169-0017
Sample Description: 4TH FLOOR STAIRWAY 4/PLASTER WALL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	Gray/White	0%	100%	None Detected	

Client Sample ID: 5F **Lab Sample ID:** 551308169-0018
Sample Description: BASEMENT STAIRWAY 4/PLASTER WALL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	Gray/White	0%	100%	None Detected	

Client Sample ID: 5G **Lab Sample ID:** 551308169-0019
Sample Description: GROUND FLOOR STAIRWAY 5/PLASTER WALL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	Gray/White	0%	100%	None Detected	

Client Sample ID: 6A **Lab Sample ID:** 551308169-0020
Sample Description: STAIRWAY 3/GARAGE PLASTER

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013	Gray/White	0%	99%	1% Chrysotile	

Client Sample ID: 6B **Lab Sample ID:** 551308169-0021
Sample Description: STAIRWAY 3/GARAGE PLASTER

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013				Stop Positive (Not Analyzed)	

Client Sample ID: 6C **Lab Sample ID:** 551308169-0022
Sample Description: STAIRWAY 3/GARAGE PLASTER

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	11/20/2013				Stop Positive (Not Analyzed)	



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EMSL Canada Order 551308169
Customer ID: 55SELI62
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Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Analyst(s)

Arabee Sathiaselvan	PLM	(6)
Jon Delos Santos	PLM	(4)
Matthew Davis	PLM	(10)

Kevin Pang
or other Approved Signatory

Any questions please contact Kevin Pang.

None Detected = <0.5%. 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: 11/21/2013 11:33:23

Appendix D

Laboratory Certificate of Analysis - Lead

**EMSL Canada Inc.**

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EMSL Canada Or 551308171
CustomerID: 55SELI62
CustomerPO: 25 ST. CLAIRE
ProjectID:

Attn: **Paul Valenti**
Safetech Environmental
3045 Southcreek Road
Unit 14
Mississauga, ON L4X 2X7

Phone: (905) 624-2722
Fax: (905) 624-4306
Received: 11/20/13 5:18 PM
Collected:

Project: **25 ST. CLAIRE AVENUE EAST****Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B*/7000B)**

<i>Client Sample Description</i>	<i>Lab ID</i>	<i>Collected</i>	<i>Analyzed</i>	<i>Lead Concentration</i>
L1	0001	11/21/2013		0.69 % wt
Site: BEIGE PAINT - STAIRWAY 2				
L2	0002	11/21/2013		0.081 % wt
Site: BEIGE PAINT - STAIRWAY 3				
L3	0003	11/21/2013		0.075 % wt
Site: BEIGE PAINT - STAIRWAY 4				
L4	0004	11/21/2013		0.57 % wt
Site: BEIGE PAINT - STAIRWAY 1				

Kevin Pang
or other approved signatory

Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. The QC data associated with these results included in this report meet the method QC requirements, unless specifically indicated otherwise. Unless noted, results in this report are not blank corrected. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. * slight modifications to methods applied. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 11/22/2013 09:56:35

Appendix E

Site Photographs



P1 –

View of asbestos-containing mechanical pipe insulation within the mechanical shaft of Stairway #1.



P2 –

Typical view of asbestos-containing mechanical pipe insulation within the shaft present above the Storage Room adjacent to Stairway #2.



P3 –

View of asbestos-containing mechanical pipe insulation debris within the shaft above the Storage Room ceiling adjacent to Stairway #2.



P4 –

Typical view of asbestos-containing mechanical pipe insulation within the shaft present behind the rear wall of the Storage Room adjacent to Stairway #2.



P5 –

Typical view of asbestos-containing mechanical pipe insulation within the mechanical shaft of Stairway #3.



P6 –

Typical view of asbestos-containing mechanical pipefitting insulation within the shaft of Stairway #3.



P7 –

Typical view of round HVAC ductwork and black foil paper insulation whereby asbestos-containing seam tape was observed within the mechanical shaft of Stairway #3.



P8 –

Typical view of asbestos-containing seam tape debris within the mechanical shaft of Stairway #3.



P9 –

Typical view of asbestos-containing mechanical pipe insulation within the mechanical shaft present behind the sinks within the 10th Floor Men's Washroom adjacent to Stairway #4.



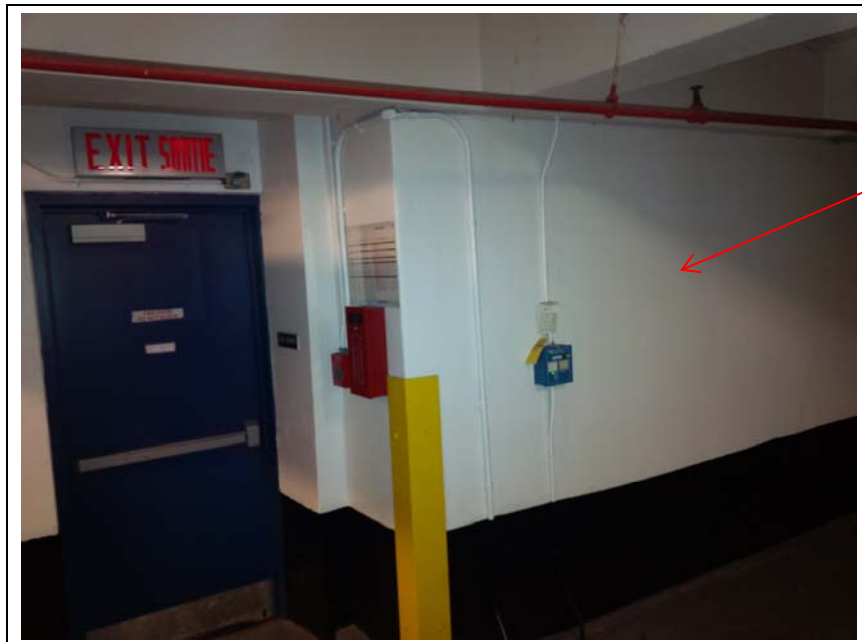
P10 –

Typical view of asbestos-containing duct seam tape within the basement garage ceiling at Stairway #4.



P11 –

Typical view of asbestos-containing mechanical pipe/ pipe fitting insulation within the garage ceiling space at Stairway #4.



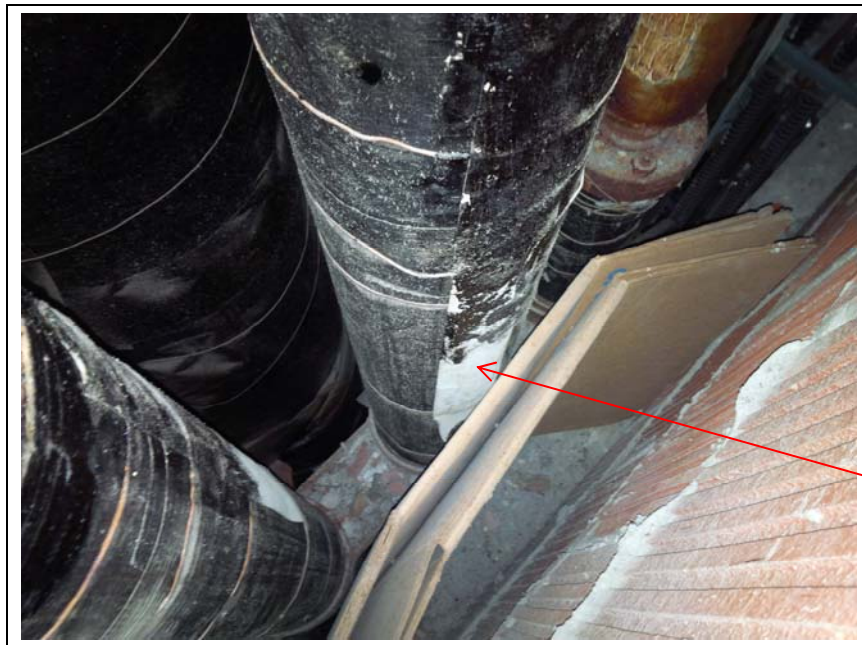
P12 – Location

Typical view of asbestos-containing slightly textured plaster wall within the garage at Stairway #3.



P13 –

Typical view of HVAC ductwork with asbestos-containing seam tape within the shaft at Stairway #5.



P14 – Location

Typical view of asbestos-containing seam tape on black foil paper pipe insulation within the shaft at Stairway #5.

Appendix F

Background Information on Designated Substances and Other Hazardous Materials

DESIGNATED SUBSTANCES

The Occupational Health and Safety Act of Ontario (OHSA) allows for certain toxic substances to be especially designated. The OHSA defines a designated substance as “a biological, chemical or physical agent or combination thereof prescribed as a designated substance to which the exposure of a worker is prohibited, regulated, restricted, limited or controlled.” Ontario Regulation 490/09 - Designated Substances (O.Reg. 490/09), made under the Occupational Health and Safety Act outlines required steps to control exposure of workers to designated substances. Under O.Reg. 490/09 there are eleven (11) designated substances; acrylonitrile, arsenic, asbestos, benzene, coke oven emissions, ethylene oxide, isocyanates, lead, mercury, silica and vinyl chloride. This regulation applies to every employer and worker at a workplace where the designated substances are present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to the designated substance.

Section 14 of O.Reg. 490/09 exempts an employer and the workers of an employer who engage in construction from the requirements of the regulation. However, designated substances are still required to be identified prior to the beginning of a demolition or renovation project to ensure that construction workers (and potentially building occupants) are adequately protected from the hazards posed by the presence of these materials if the planned work may cause them to be disturbed. Accordingly, under Section 30 of the OHSA building owners are required to perform an assessment to determine whether any designated substances are present at the project site before the beginning of the project. The owner is also required to prepare a list of designated substances that are present at the site and provide this list to prospective constructors before entering into a binding contract with the constructor. This way, contractors and construction workers are made aware of designated substances present within the work area so that appropriate measures can be taken during the work to limit exposure to these substances.

Designated Substances and Hazardous Materials Assessments are conducted to conform to the requirements of Section 30 of the OHSA. The assessments are performed to identify designated substances (and other hazardous materials) within the work area that may present a hazard to workers if disturbed. These substances are commonly a component of building materials or equipment found in buildings. Additional information regarding the eleven designated substances including their properties, uses and health effects are provided below.

Acrylonitrile

Acrylonitrile (ACN) is a clear, colourless or pale yellow liquid with a pungent onion- or garlic-like, irritating odour. It is highly flammable and as such is a severe fire and explosion hazard.

Acrylonitrile is used mainly as a monomer or comonomer in the production of acrylic fibres, plastics, resins and nitrile rubbers. Historically, a mixture of acrylonitrile and carbon tetrachloride was used as a pesticide; however, all pesticide uses have stopped. Based on its use as a chemical intermediate, exposure to acrylonitrile is primarily occupational, via inhalation during its manufacture and use. Therefore, this designated substance is not expected to be encountered in buildings where it is not either produced or used in a manufacturing process.

Acute (short-term) exposure of workers to acrylonitrile has been observed to cause mucous membrane irritation, headaches, dizziness, and nausea. More significant exposures may lead to symptoms such as limb weakness, labored and irregular breathing, impaired judgment, cyanosis, collapse, and convulsions. Exposure of the skin to high concentrations of acrylonitrile in the air may irritate the skin and cause it to turn red while direct skin contact with acrylonitrile may cause the skin to blister and peel. The International Agency for Research on Cancer (IARC) concluded that there is inadequate evidence in humans for the carcinogenicity of acrylonitrile, but has classified it as possibly carcinogenic to humans (Group 2B).

Arsenic

Arsenic is a naturally occurring mineral, widely distributed in the earth's crust. Elemental arsenic (sometimes referred to as metallic arsenic) is a silver-gray or white brittle metal. However, arsenic is usually found in the environment combined with other elements such as oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic has no odor and is almost tasteless.

Arsenic and its compounds have a variety of commercial uses. Inorganic arsenic compounds are mainly used as a wood preservative. Copper chromated arsenic (CCA) is used to make "pressure-treated" lumber. CCA-treated wood is no longer used for residential applications but may still be used in industrial applications. Arsenic is also used in metallurgy for hardening copper, lead and certain metal alloys, in pigment production, in the manufacture of certain types of glass, and in semiconductors and light-emitting diodes. Inorganic arsenic compounds are no longer used as pesticides in agriculture; however, organic arsenic compounds, namely cacodylic acid, disodium methylarsenate (DSMA), and monosodium methylarsenate (MSMA), are used, as yet, as pesticides – principally on cotton.

Today, workplace exposure to arsenic may still occur in some occupations that use arsenic, such as copper or lead smelting, wood treating, or pesticide application. Exposure to arsenic within buildings other than where it is used as part of the manufacturing process is unlikely and therefore arsenic is not expected to be encountered as part of a routine hazardous building materials assessment.

Human exposure to arsenic can cause both short and long term health effects. Short-term or acute effects can occur within hours or days of exposure. If you breathe high levels of inorganic arsenic, then you are likely to experience a sore throat and irritated lungs. Longer exposure at lower concentrations can lead to skin effects (such as darkened patches of skin and areas of thickened skin), and also to circulatory and peripheral nervous disorders. An important concern is the ability of inhaled inorganic arsenic to increase the risk of cancer. Long term exposure to arsenic has been linked to cancer of the bladder, lungs, skin, kidneys, nasal passages, liver and prostate. The IARC classifies arsenic and arsenic compounds as "carcinogenic to humans" (Group 1).

Asbestos

Asbestos is the name given to a number of naturally occurring fibrous minerals found in the environment. Ontario Regulation 490/09 (Designated Substances) defines asbestos as any one of the following fibrous silicates: actinolite; amosite; anthophyllite; chrysotile; crocidolite; and tremolite. Asbestos fibres have several desirable characteristics such as high textile strength, the ability to be spun and woven, and resistance to heat and most chemicals. These characteristics have resulted in the historical use of asbestos in a wide variety of building materials and other manufactured goods. Examples of products where asbestos has been used include roofing shingles, ceiling and floor tiles, insulation, sprayed fireproofing, gaskets, and friction products such as automotive brakes and clutches.

The peak years for asbestos use were in the 1960s and early 1970s. Therefore, asbestos is commonly found in building materials of this era. The use of asbestos in building materials and other products has decreased significantly since this time. Friable asbestos-containing materials (material that when dry can be crumbled, pulverized or powdered by hand pressure), such as sprayed fireproofing and sprayed insulation, ceased use circa 1973. Mechanical thermal system insulation ceased use circa 1981 while sprayed acoustic texture coat finishes ceased use circa 1982. Non-friable asbestos-containing materials were generally manufactured for a longer period of time (with the exception of plaster finishes which ceased use circa 1960's). Asbestos-containing drywall joint compound ceased use circa 1980. Vinyl floor tiles, vinyl sheet flooring and acoustic ceiling tile ceased use 1982. Other non-friable materials continued to be produced into the 1990's, including roofing materials (ceased use circa 1991) and floor adhesives (ceased use circa 1992). Today, asbestos is a controlled substance, and is banned for use in most products sold in Canada under the Hazardous

Products Act (with the exception of certain roof shingles, clutch facings and brake linings).

Potentially harmful exposure to asbestos occurs through inhalation of air containing asbestos fibres. The greatest risk for workplace exposure to airborne asbestos is in occupations that produce and use asbestos, such as in mining and milling operations or in the manufacture of products containing asbestos. Exposure to airborne asbestos fibres may also occur to construction workers, trades people, maintenance workers and other building occupants in buildings constructed with asbestos-containing materials; especially during building renovations or repairs or if the materials are in poor condition or are otherwise disturbed.

Health risks associated with asbestos exposure are dependent on several factors such as the type and airborne concentration of asbestos, and period of exposure. In general, the greater the exposure to asbestos, the greater the chance of developing harmful health effects. Typically, chronic, daily exposure to elevated airborne concentrations of asbestos over a period of years is required for health effects to eventually manifest themselves. Health effects associated with exposure to asbestos can result in asbestosis (a scarring of the lungs which makes breathing difficult), mesothelioma (a rare cancer of the lining of the chest or abdominal cavity) and lung cancer. The link between exposure to asbestos and other types of cancers and health effects is less clear.

Benzene

Benzene is a clear, colourless liquid with a characteristic, sweet or aromatic hydrocarbon odour. It is a liquid at room temperature but evaporates into the air very quickly, making it a highly flammable vapour as well as an extremely flammable liquid.

Benzene is formed from both natural processes and human activities. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke. It is produced from petroleum and coal sources and is used mainly in the manufacture of other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides.

Exposure to pure benzene within buildings other than where it is produced or used as part of a manufacturing process is unlikely. Therefore benzene is not expected to be encountered as part of a routine hazardous building materials assessment.

Exposure to benzene primarily occurs through inhalation of airborne vapours. Short-term (acute) health effects associated with overexposure to benzene vapours can result in symptoms such as headache, nausea, dizziness, drowsiness and confusion, with unconsciousness or even death at very high levels. Long-term (chronic) exposure to

Benzene may cause blood and bone marrow effects which can lead to anemia and leukemia (cancer of the blood-forming organs) as well as cause damage to the immune system, increasing the chance for infection. The IARC classifies benzene as "carcinogenic to humans" (Group 1).

Coke Oven Emissions

Coke Oven Emissions refers to the benzene soluble fraction of total particulate matter emitted during the destructive distillation or carbonization of coal for the production of coke (pure carbon). These emissions are a mixture of coal tar, coal tar pitch, volatiles (including benzene, toluene and xylene), creosote, polycyclic aromatic hydrocarbons (PAHs – including benzo(a)pyrene, benzanthracene, chrysene and phenanthrene), and metals (including cadmium, arsenic, beryllium and chromium). Condensed coke oven emissions are a brownish, thick liquid or semisolid with a naphthalene-like odor, while uncondensed coke oven emissions are vapors that escape when the ovens are changed and emptied and are a component of fugitive emissions.

The coke produced is used as a component in the manufacturing of iron and steel. Coke is also used to synthesize calcium carbide and to manufacture graphite and electrodes. Additional chemicals recovered from the coke oven emissions (such as benzene, toluene, naphthalene, sulfur, and ammonium sulfate) are used as raw materials for plastics, solvents, dyes, drugs, waterproofing, paints, pipecoating, roads, roofing, insulation, and as pesticides and sealants.

Coke oven emissions would only be present within facilities producing or using coke as part of the manufacturing process and thus occupational exposure is limited to those workers in the aluminum, steel, graphite, electrical, and construction industries. Therefore, coke oven emissions are not a contaminant of concern during a routine hazardous building materials assessment.

Chronic (long-term) exposure to coke oven emissions can result in chronic bronchitis (particularly those who smoke) and additional health effects such as conjunctivitis, severe dermatitis, and lesions of the respiratory system and digestive system. However, the greatest concern regarding chronic exposure to coke oven emissions is the increased risk of cancer. The IARC classifies coke production as "carcinogenic to humans" (Group 1). The site at which excess cancer rates have been identified most commonly among workers in coke production is the lung. Excess risk for kidney cancer has also been associated with work in coke plants. Additional studies have also reported excess risks for other types of cancers such as cancer of the large intestine and pancreas.

Ethylene Oxide

Ethylene oxide is colourless gas with a somewhat sweet odour. It is extremely flammable and also dangerously reactive. Ethylene oxide exists as a compressed gas that has been produced since the early 1900s. It is used primarily as a chemical intermediate in the production of ethylene glycol, glycol ethers, nonionic surfactants and other industrial chemicals. Much smaller amounts are used as a non-explosive mixture with nitrogen or carbon dioxide for sterilizing medical instruments and supplies in hospitals and industrially for the fumigation of spices.

Most people are not likely to be exposed to ethylene oxide because it is not commonly found in the environment. Exposure to ethylene oxide is generally limited to those facilities where it is made or used. Therefore, ethylene oxide is not a contaminant of concern during a routine hazardous building materials assessment, although the presence of it should be determined in buildings such as hospitals if construction activities are to occur in or adjacent to areas where it is used or stored.

Exposure to ethylene oxide can result in irritation to the skin or eyes; however, the greatest risk for health effects is through inhalation. This can result in irritation to the nose, throat and respiratory tract, with damage to the central nervous system at higher concentrations. Exposure to high concentrations may cause headache, nausea, dizziness, drowsiness, and incoordination. Exposure to ethylene oxide is also a cancer hazard and possible reproductive hazard. In epidemiological studies of exposure to ethylene oxide, the most frequently reported association has been with lymphatic and haematopoietic cancer. The IARC has concluded that there is limited evidence for the carcinogenicity of ethylene oxide in humans and sufficient evidence for carcinogenicity in experimental animals, classifying ethylene oxide as “carcinogenic to humans” (Group 1).

Isocyanates

Isocyanates are a family of highly reactive, low molecular weight, manufactured chemicals containing one or more isocyanate groups (-NCO). An isocyanate that has two isocyanate groups is known as a diisocyanate, which are the most common type of isocyanates used for manufacturing other products. The most commonly used diisocyanates include methylene diphenyl diisocyanate (MDI), toluene diisocyanate (TDI), and hexamethylene diisocyanate (HDI).

When isocyanates are combined with other compounds that contain free hydroxyl functional groups (i.e. -OH) they react and begin to form polyurethane polymers. These polyurethanes find significant application in the manufacture of rigid and flexible foams. Flexible foam is primarily used for cushioning, while rigid foam is used mainly for insulation. Polyurethanes are also used in the production of adhesives, elastomers, and

coatings and are increasingly used in the automobile industry, autobody repair, and building insulation materials.

This diversity of applications means that exposures to isocyanates can occur in a broad range of production facilities from small workshops to automated production lines. Jobs that may involve exposure to isocyanates include painting, foam-blowing, and the manufacture of many polyurethane products. Exposure to isocyanates within buildings where it is not produced or used as part of manufacturing is unlikely, as products such as rigid foam insulation that may be used in buildings has already undergone the curing process. Completely cured products are fully reacted and therefore are considered to be inert and non-toxic. However, some products such as spray foams, coatings, sealants and adhesives may be sold and used in an uncured form. An example would be an adhesive, which is sold to be initially applied in an uncured form and as it cures (hardens), bonds two pieces of wood together. Such products can provide potential exposure to building occupants and construction workers during the application and use of these products. However, for the purposes of a routine hazardous building materials assessment, products that may have contained isocyanate as part of the manufacturing process (e.g. rigid foam) or during the application/installation process (e.g. spray foam, adhesives and sealants) are assumed to be fully cured and would no longer contain free isocyanate.

Direct skin contact with isocyanates can cause marked skin irritation, resulting in reddening, swelling and blistering. However the greatest route of exposure to isocyanates is through inhalation of fine vapours or droplets. Airborne exposure to isocyanates can result in irritation to the mucous membranes of the eyes and respiratory tracts. This results in symptoms such as excessive tear secretion, dry throat, dry cough, chest pains and difficulty in breathing. Isocyanates are also a major cause of work-related asthma worldwide. Increased exposure to isocyanates can lead to sensitization. Once sensitized, individuals are subject to severe asthma attacks (which in some cases has been reported to result in death) if they are re-exposed.

Lead

Lead is a naturally occurring metal found in small amounts in the earth's crust. It is usually found in ore with zinc, silver and (most abundantly) copper, and is extracted together with these metals. Metallic lead is bluish-white in colour but soon tarnishes to a dull grey when exposed to air. When melted into liquid form it has a shiny chrome-silver appearance.

Lead is soft, dense, highly malleable and resistant to corrosion, with poor electrical conductivity as compared to most other metals. Such properties have resulted in lead being used in many applications, including products and materials commonly found in buildings. It is present as a component of lead-acid batteries, ammunition, PVC plastics, and older brass and chrome-plated brass faucets. As a building component,

lead has been used in water distribution piping, as an alloy in solder, in electrical conduits, roofs and roofing details, and as an additive to paints, ceramic glazes and mortars as pigments or for anti-corrosion properties. Lead has also used as sheeting inside buildings for shielding X-rays and for sound attenuation.

Exposure to lead can occur for workers in workplaces that produce the above materials but also to construction workers, building maintenance personnel and the general population due to the widespread historical use of lead in building materials and consumer products. Most exposure to lead occurs through ingestion or inhalation, with the health effects being the same. Overexposure to lead can result in damage to nervous connections and can cause blood and brain disorders, severe damage to the kidneys and ultimately death. Infants and young children are especially vulnerable to the health effects of lead, as overexposure has been proven to result in the permanent reduction in cognitive capacity. In pregnant women, high levels of exposure to lead may cause miscarriage. The IARC has concluded that lead and inorganic lead compounds are “possibly carcinogenic to humans” (Group 2B).

The known serious health effects associated with lead exposure has brought about widespread reduction in its use. The use of lead in building materials and consumer products has decreased substantially since the 1970s to where lead is no longer being used in building materials and consumer products or is present at significantly lower concentrations. For example, unleaded gasoline was introduced in Canada in 1975, after which leaded gasoline was phased out and banned in 1990. Lead-based solder has been banned since the 1980s and most solder used today is either lead-free or has very low lead concentrations. Up until the 1960s, lead was added to paints in significant quantities. Since that time, the concentration of lead in paint has decreased. The federal government began reducing the amount of lead allowed in interior paint in 1976 (to 0.5% by weight). By 1991, paint manufacturers in Canada and the U.S. voluntarily stopped adding lead to paint, reducing lead concentrations to background levels. In 2005 the *Surface Coating Materials Regulations* came into effect to limit the concentration of lead in paint (to 0.06% by weight) for both interior and exterior paints sold to consumers. This was since amended in 2011 to further reduce the allowable lead limit (to 0.009% by weight) and extended to include all consumer paints and coatings.

Mercury

Mercury is a naturally occurring element found in the earth's crust, with natural deposits generally found as a vermilion red ore called cinnabar. Mercury can exist as metallic mercury, organic mercury or inorganic mercury. Metallic or elemental mercury has unique properties as compared to other metals. It is the only pure metal that is a liquid at room temperature, having a silvery-white, shiny appearance. Mercury is the densest liquid known, which produces a colourless, odourless vapour at room temperature.

The unique properties of mercury have resulted in it being used in a wide variety of applications. Properties such as its coefficient of expansion and ability to conduct electricity has resulted in mercury being used in thermometers, barometers and other measuring devices (blood pressure gauges, vacuum gauges, manometers, etc.), thermostats and a variety of other electrical switches (temperature sensitive, tilt switches, float switches, etc.). Mercury is also used in antifouling paints, dry cell or button batteries and numerous lighting products, including fluorescent lamps and a variety of High Intensity Discharge (HID) lamps such as mercury vapor, metal halide and high pressure sodium lamps. HID lamps are used for street lights, floodlights and industrial lighting applications. Because of the wide variety of uses mercury can be found as a component of machinery, equipment and lighting within buildings; although many of its uses have been phased out over the years.

The health effects of mercury exposure depend on its chemical form (elemental, inorganic or organic), the route of exposure (inhalation, ingestion or skin contact), and the level of exposure. Vapours from liquid elemental mercury and methyl mercury are more easily absorbed than inorganic mercury salts and can, therefore, cause more harm. Exposure to mercury occurs mainly from breathing contaminated air or ingesting contaminated water and food. Mercury is a neurotoxin, which means it can adversely affect the central nervous system. Upon exposure, mercury tends to accumulate quickly in the brain where it tightly binds with the tissue and is released at a very slow rate. The nervous system effects of mercury toxicity are sometimes referred to as "Mad Hatter's Disease" since mercurous nitrate was used in making felt hats. High levels of exposure to mercury can also lead to harmful effects on the digestive and respiratory systems, and the kidneys. Many mercury compounds may also be teratogenic or capable of causing birth defects.

Mercury compounds can also be toxic at low levels in the environment. The characteristics of mercury that make it an environmental problem are its toxicity and persistence in the environment, and its ability to accumulate and bioconcentrate as methyl mercury in fish and fish-eating predators such as large fish or loons. Therefore, proper disposal of mercury-containing materials is essential. The improper disposal of mercury-containing products such as fluorescent light bulb tubes, high intensity discharge lamps, mercury vapour lamps, mercury thermometers and thermostats can lead to the release of mercury from municipal landfills. Used fluorescent and HID lamps may be classified as hazardous waste due to their mercury content and should be recycled if possible rather than being disposed of in landfill.

Silica

Silica (silicon dioxide) is the name of a group of minerals that contain silicon and oxygen in a chemical combination and have the general formula SiO_2 . It is one of the most common minerals in the earth's crust. Silica can be present as crystalline silica (free silica) or amorphous silica (combined silica), and exists in many forms. The three most

common crystalline forms of silica encountered in the workplace environment are quartz, tridymite, and cristobalite. Quartz is by far the most common crystalline silica found in nature, being abundant in most rock types, notably granites, sandstones, quartzites and in sands and soils. Cristobalite and tridymite are found in volcanic rocks. Amorphous silica is found in nature as biogenic silica and as silica glass of volcanic origin. One form of biogenic silica, diatomaceous earth, originates from the skeletons of diatoms deposited on sea floors. From a health perspective it is the crystalline silica forms that raise the biggest concerns.

Silica is present in numerous building materials and products, including concrete, brick, stone, terrazzo, refractory brick, etc. Low concentrations of silica are also possible in plaster, drywall, acoustical ceiling tiles, drywall joint compound, mortars and adhesives. Because of the wide usage of quartz-containing materials, workers may be exposed to crystalline silica in a large variety of industries and occupations. Occupational exposure to silica dust occurs in cement and brick manufacturing, asphalt pavement manufacturing, china and ceramic manufacturing and the tool and die, steel and foundry industries. Exposure to silica also occurs during many different construction and maintenance activities. The most severe exposures to crystalline silica result from abrasive blasting activities using silica sand. Other activities that may produce crystalline silica dust include jack hammering, rock/well drilling, concrete mixing, concrete drilling, tuck pointing, and brick and concrete block cutting and sawing. Additionally, crystalline silica exposures occur in the maintenance, repair and replacement of refractory brick furnace linings.

Adverse health effects associated with silica exposure result from inhalation of the respirable fraction of crystalline silica, which can arise from many of the activities outlined above. The main health effects associated with silica exposure are lung cancer and silicosis. The IARC has concluded that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is “carcinogenic to Humans” (Group 1). Silicosis is caused by scarring of the lung tissue from breathing in silica dust. This scarring is permanent and causes a reduction in the lungs’ ability to take in oxygen, making it difficult to breathe and in severe cases can be disabling, or even fatal. Since silicosis affects lung function, it also makes one more susceptible to lung infections like tuberculosis.

Vinyl Chloride

Vinyl chloride is a manufactured substance that does not occur naturally. It is used as a chemical intermediate and not an end product. Vinyl chloride exists in liquid form if kept under high pressure or at low temperatures. At room temperature, it is a colourless gas. It burns easily and is not stable at high temperatures.

Most of the vinyl chloride produced is used to make a polymer called polyvinyl chloride (PVC). PVC is used to make a variety of plastic products including pipes, wire and cable coatings, vinyl flooring, vinyl wallpaper and window frames. It is also used to make furniture, upholstery and packaging materials. One of the concerns regarding PVC is that upon burning it will emit toxic fumes. Contaminants emitted when PVC is burned include hydrochloric acid, carbon monoxide and carbon dioxide, along with lesser amounts of dioxin and furan.

Vinyl chloride is reported to be slightly irritating to the eyes and respiratory tract in humans. Central nervous system effects (including dizziness, drowsiness, fatigue, headache, visual and/or hearing disturbances, memory loss, and sleep disturbances) as well as peripheral nervous system symptoms (peripheral neuropathy, tingling, numbness, weakness, and pain in fingers) have been reported in workers exposed to vinyl chloride. Short-term (acute) exposure to extremely high levels of vinyl chloride has also reportedly caused loss of consciousness, lung and kidney irritation, and inhibition of blood clotting in humans. The most significant health effect associated with exposure to vinyl chloride is that it is a known human carcinogen that causes a rare cancer of the liver. It has been classified by the IARC as "carcinogenic to humans" (Group 1). Brain cancer, lung cancer, and some cancers of the blood also may be connected with breathing vinyl chloride over long periods.

OTHER HAZARDOUS MATERIALS

CHEMICAL HAZARDS

Urea Formaldehyde Foam Insulation

Urea-formaldehyde foam insulation (UFFI) was developed in as an improved means of insulating difficult-to-reach cavities. It was typically made at the construction site from a mixture of urea-formaldehyde resin, a foaming agent and compressed air. When the mixture is injected into the wall, urea and formaldehyde unite and "cure" into an insulating foam plastic. Its appearance is like ordinary shaving cream. Dry, it can be a white or tan colour, and fluffy like styrofoam. Over time UFFI shrinks significantly and may begin to degrade due to its crumbly texture.

UFFI was installed primarily in wall cavities during the 1970's as an energy conservation measure. The insulation was used most extensively from 1975 to 1978, during the period of the Canadian Home Insulation Program (CHIP), when financial incentives were offered by the government to upgrade home insulation levels. In addition to detached homes it can be found in common areas and walls of semi-detached homes, apartment buildings and condominiums. UFFI was also used to a lesser degree in some commercial and industrial buildings.

UFFI installation has been banned in Canada under the Hazardous Products Act (HPA) since December, 1980 due to concerns regarding the health effects of exposure to formaldehyde. Formaldehyde is a colourless, pungent-smelling gas. Health effects include eye, nose, and throat irritation; wheezing and coughing; fatigue; skin rash; nausea; headache; dizziness; and severe allergic reactions.

Sometimes, a slight excess of formaldehyde was often added to ensure complete "curing" with the urea to produce the urea-formaldehyde foam. The excess formaldehyde was given off after installation during the initial curing process, which typically took a few days to a week to complete. UFFI was sometimes improperly installed or used in locations where it should not have been, resulting in continued off-gassing of formaldehyde past the initial curing stage. Since UFFI was last installed in 1980, it should have little effect on indoor formaldehyde levels today. However, if UFFI comes in contact with water or moisture, it could begin to break down. Due to the age of the insulation UFFI may also begin to degrade and crumble into a fine powder. Under these conditions UFFI may release more formaldehyde and consideration should be given to removing the material using properly trained remediation personnel.

BIOLOGICAL HAZARDS

Mould

Mould is part of the fungi kingdom, which also includes mushrooms and yeasts. They are a naturally occurring and essential part of our environment since they break down dead organic material in the outdoor environment (such as leaves, wood and other plant debris), which they use as a food source.

Mould reproduces by means of tiny spores that are so small they can't be seen by the naked eye. Because of their small size mould spores easily become airborne and can travel long distances, entering indoor environments through ventilation systems, open windows or doors, or tracked in on footwear. Therefore, mould spores are a commonly detected in indoor air and as a component of settled dust.

Under normal conditions, the presence of indoor mould is not an issue. However, if conditions exist that allow it to grow and multiply indoors it can become a potential hazard. Several factors will affect what moulds will grow within a building and how fast they will grow. This includes parameters such as temperature, airflow, and the pH (i.e. acidity/alkalinity) of the food substrate. However, the most important parameter affecting mould growth is water availability, as all moulds need some amount of moisture for them to be able to grow. Buildings that have had a history of water damage are at greater risk of indoor mould growth.

Indoor mould growth may present a risk to the building structure itself through decomposition of building materials. Health risks to building occupants may also occur as a result of indoor mould growth. Construction or renovation work which disturbs mould-contaminated materials increases this risk of exposure to building occupants and the construction workers themselves. Health effects associated with exposure to mould most commonly results in allergic type reactions such as runny nose, cough, congestion, eye irritation and aggravation of asthma, headache and fatigue. Exposure to very high concentrations of airborne mould spores (such as those that may be observed during disturbance of mould-contaminated building materials) can result in more serious health effects such as Organic Dust Toxic Syndrome (ODTS) or Hypersensitivity Pneumonitis (HP), where flu-like symptoms (fever, chills, cough, fatigue, shortness of breath, body aches, etc.) are exhibited. The chronic form of HP may occur from long-term exposure to lower levels of mould and results in a continued worsening in shortness of breath or cough. A variety of species of mould have also been documented to cause serious invasive infections, which are generally limited to individuals whose immune systems are already somehow compromised.

Pest Infestation

Areas currently or previously infested by pests (including birds, bats, rodents, raccoons, cockroaches, etc.) can result in potential exposure to numerous biological hazards that can be viral, bacterial, fungal or parasitic in nature. This can occur through exposure to their droppings, urine or saliva.

Bird and bat droppings should be presumed to be contaminated with the fungi *Histoplasma capsulatum* and/or *Cryptococcus neoformans*. These fungi grow well in the high nutrient content of accumulated bird and bat excrement and can cause respiratory infections in workers exposed during construction or maintenance activities that cause the droppings to be disturbed and the fungi to become airborne.

Histoplasmosis is an infectious disease caused by inhaling the spores of *Histoplasma capsulatum*. After an exposure, how ill a person becomes varies greatly and most likely depends on the number of spores inhaled and a person's age and susceptibility to the disease. The mildest form of histoplasmosis produces no signs or symptoms, but severe infections can cause serious problems throughout your body as well as in your lungs. Otherwise healthy people who've had intense exposure to *H. capsulatum* may experience a form of the disease known as acute symptomatic pulmonary histoplasmosis. Typical symptoms include fever, muscle aches, headache, dry cough, chest pain, sweating and loss of appetite.

Cryptococcosis is an infectious disease caused by inhaling the spores of *Cryptococcus neoformans*. Once inhaled, infection with cryptococcosis may go away on its own, remain in the lungs only, or spread throughout the body. Most cases occur to people with a weakened immune system, such as those with HIV infection, taking high doses of

corticosteroid medications, cancer chemotherapy, or who have Hodgkin's disease. In people with a normal immune system, the lung (pulmonary) form of the infection may have no symptoms. In people with weakened immune systems, the cryptococcus organism may spread to the brain. Most people with this infection have meningoencephalitis (swelling and irritation of the brain and spinal cord) when they are diagnosed.

Rodents such as deer mice may be infected with Hantavirus, which can be shed in their urine, saliva and droppings. Exposure to Hantavirus can result in a serious respiratory illness called hantavirus pulmonary syndrome (HPS). Initially, infected individuals exhibit flu-like symptoms, including fever and body aches which progresses to shortness of breath and coughing which rapidly becomes more severe. Exposure to Hantavirus in Canada is rare and Health Canada has only found the virus in a very small percentage of deer mice tested in Northern Ontario.

A raccoon latrine (i.e. an area where they repeatedly deposit fresh feces on top of old feces) may contain microscopic roundworm (*Baylisascaris procyonis*) eggs that can potentially be hazardous to human health. Once deposited in the environment, the eggs develop into an infectious form; and if inadvertently ingested by humans, the larvae hatch out of the eggs and may penetrate the body's organs. Larvae travel through the body and may cause serious eye disease, spinal cord or brain damage or death. Raccoon roundworm disease is not contracted by inhalation nor has any case of inhalation of roundworm eggs been documented.

Exposure to animal dander, scales, fur, urine, feces and saliva can also result in exposure to certain proteins that can act as allergens and can also cause asthmatic reactions. Some common sources of pest-related allergens include cockroaches, dust mites and rodents. The protein in urine from rats and mice is a potent allergen. Cockroach allergens are also potent and are derived from several sources, such as saliva, fecal material, secretions, cast skins, debris, and dead bodies. Allergic reactions occur when sensitized persons inhale, swallow or touch traces of the allergen, resulting in an exaggerated reaction of the body's immune system to the foreign protein. Typical allergic reactions result in nasal, eye, and throat irritation as well as possible skin hives. These proteins may also trigger asthma attacks when sensitive individuals inhale the proteins, resulting in symptoms such as coughing, wheezing, chest tightness, and breathing difficulties.

ENVIRONMENTAL HAZARDS

Polychlorinated Biphenyls

Polychlorinated biphenyls (PCBs) are a class of man-made organic chemicals known as chlorinated hydrocarbons. They vary in consistency from thin, light-coloured liquids to

yellow or black waxy solids. They were manufactured in the United States from 1929 until their manufacture was banned in 1979. Although PCBs were not manufactured in Canada, they were imported from the U.S. over the years. Canada banned the import, manufacture and sale of PCBs in 1977.

PCBs are non-flammable, chemically stable over a wide range of temperature and physical conditions, not soluble in water, unaffected by acids, base or corrosive chemicals, and have a high dielectric or electrical insulating capacity. Due to these unique properties PCBs were used in hundreds of industrial and commercial applications, most commonly in electrical transformers and capacitors, including those capacitors found in light ballasts. They were also used as coolants, fire retardants and as insulation and in a number of other commercial applications including carbonless copy paper, dust suppressors for roads, hydraulic fluids, caulking compounds, plasticizers and lubricating oils and heat-transfer applications.

Although PCBs were found to be extremely useful in many industrial and commercial applications some of their chemical properties also made them an environmental and health hazard. PCBs are nearly indestructible and therefore persist if released into the natural environment. Their high fat and low water solubility result in a build-up (bioaccumulation) of PCBs in the fatty tissue of animals and humans if ingested/inhaled. Because PCBs persist in the fatty tissue of animals their concentration will tend to increase the higher up the food chain.

Most of what is known about the human health effects of PCBs is based on exposures due to accidental releases or job-related activities. These exposures are much higher than the levels normally found in the environment. The adverse health effects include a severe form of acne (chloracne), swelling of the upper eyelids, discolouring of the nails and skin, numbness in the arms and/or legs, weakness, muscle spasms, chronic bronchitis, and problems related to the nervous system. The International Agency for Research on Cancer (IARC) classifies PCBs as “probably carcinogenic to humans” (Group 2A) based on limited evidence that long-term, high-level occupational exposure can lead to increased incidence of liver and kidney cancers. The long-term impact of low-level exposures to PCBs that is common in the general population is unclear. The current state of knowledge suggests that low-level exposures to PCBs are unlikely to cause adverse health effects. However, people eating large amounts of certain sports fish, wild game and marine mammals are at increased risk for higher exposures and possible adverse health effects.

Ozone Depleting and Global Warming Substances

There are several different types of chemicals that are being or have been used as refrigerants in commercial, home and vehicle air conditioners and refrigerators or as fire extinguishing agents in portable and fixed fire extinguishing equipment. This includes groups of chemical compounds known as chlorofluorocarbons (CFCs),

hydrochlorofluorocarbons (HCFCs) and halons. Some of these chemicals have also been used as foam blowing agents, as cleaning solvents for electrical components, as aerosol spray propellants, and in hospital sterilization procedures. Fixed halon fire extinguishing systems have historically been used in areas such as data centers, IT rooms, museums, libraries, surgical suites, and other locations where use of water-based suppressants could irreparably damage electronics or vital archival collections. There is a large number of halon fire extinguishing systems still in service in Canada.

The concern regarding past and present use of many of the chemicals used as refrigerants or fire extinguishing agents is that they are ozone-depleting substances (ODS). When released into the environment these chemicals break down in the stratosphere and release chlorine or bromine, which destroy the stratospheric ozone layer. The ozone layer screens the earth from some of the sun's harmful ultraviolet rays (UVB). As the ozone layer is depleted, higher UVB levels reach the earth, resulting in increased exposure to UVB. Increased exposure to UVB can cause skin cancer and plays a major role in malignant melanoma development. It can also increase the likelihood of cataracts and may also suppress proper functioning of the body's immune system and the skin's natural defences.

CFCs, HCFCs and halons are also known to be greenhouse gases and contribute to global warming due to the build-up of these heat-trapping gases in the atmosphere. Hydrofluorocarbons (HFCs) are a common replacement chemical for CFC and HCFC refrigerants; and although they do not have any ozone depleting potential they are a potent greenhouse gas.

Due to the ozone-depleting potential and/or global warming potential of CFCs, HCFCs, HFCs and halons it is important to control their use and emission into the environment. The manufacture and use of CFCs has stopped while transitional refrigerants (HCFCs) are scheduled to be phased out of production. No phase-out dates are currently planned for any HFCs. In Ontario, Regulation 463/10, "Ozone Depleting Substances and Other Halocarbons" (made under the Environmental Protection Act) enhances the control and management of substances that deplete the ozone layer and contribute to global warming. This regulation has requirements to prevent or minimize ozone-depleting substances and other halocarbons emissions, which serves a dual environmental benefit of lowering emissions that destroy the ozone layer and contribute to climate change.

**REASSESSMENT OF
ASBESTOS-CONTAINING BUILDING MATERIALS
25/55 ST. CLAIR AVENUE EAST
TORONTO, ONTARIO**

Issued: February 14, 2011

Prepared for:

**Mr. Robert Bowes
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Safetech Environmental Limited

A handwritten signature in black ink, appearing to read "Marina Laccona".

**Marina Laccona, C.E.T., AMRT
Senior OH & S Technician**

Reviewed By:

A handwritten signature in black ink, appearing to read "Daniel D'Aloisio".

**Daniel D'Aloisio B.Sc., AMRT
Senior Project Manager**

SEL Project Number 150210

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EXECUTIVE SUMMARY

At the request of Mr. Robert Bowes, Maintenance Supervisor from SNC Lavalin Operations and Maintenance (SNC Lavalin), personnel from Safetech Environmental Ltd. (SEL) conducted a reassessment survey for asbestos containing building materials within the building located at 25/55 St. Clair Avenue East, Toronto, Ontario. The site investigation was conducted on January 10 to 13, 2011.

The objective of this study was to reassess the presence and condition of asbestos, a Designated Substance as defined under the Ontario Occupational Health and Safety Act that is present within the areas surveyed. The survey included a review of all accessible areas for the presence, type, degree of possible exposure and, remedial action (if necessary) for asbestos containing material (ACM).

To evaluate the condition of asbestos-containing surfacing materials such as fireproofing, non-mechanical thermal insulation, and texture finishes the following criteria was applied:

Good: Material exhibits no evidence of damage or deterioration. For mechanical insulation, no insulation is exposed. Includes conditions where jacketing has minor damage (i.e. scuffs or stains), but the jacketing is not penetrated.

Fair: Material exhibits minor damage or deterioration. For mechanical insulation, minor penetrating damage to jacketed insulation (cuts, tears, nicks, deterioration or delamination) or undamaged insulation that had never been jacketed. Insulation is exposed but not showing surface disintegration. The extent of missing insulation ranges from minor to none. Damage can be repaired.

Poor: Material is damaged or deteriorated. For mechanical insulation, original insulation jacket is missing, damaged, deteriorated, or delaminated. Insulation is exposed and significant areas have been dislodged. Damage cannot be readily repaired.

During the reassessment, SEL personnel made reference to the previous reassessment survey:

- ***Asbestos Building Materials Reassessment***, 25/55 St. Clair Avenue East, Toronto, Ontario. Pinchin Environmental Ltd., March 2006.
- ***Non-Friable Asbestos Product Survey, Government of Canada Building***, 25/55 St. Clair Avenue East, Toronto, Ontario. Advanced Environmental Corp., December 2006.

- **Asbestos Survey Report, Renovation Areas**, SNC Lavalin Profac, 25/55 St. Clair Avenue East, Toronto, Ontario. Stantec Consulting Ltd., March 2009.
- **Hazardous Materials Assessment**, 10th Floor, Arthur Meighen Building, 25-55 St. Clair Avenue East, Toronto, Ontario. Safetech Environmental Ltd., June 2009.

Based on the available records, interviews and a site review, the following Table I summarizes all the asbestos containing materials that were identified per floor and the associated priority assigned to each:

TABLE I
Summary of Asbestos Containing Materials
25/55 St. Clair Avenue East
Toronto, Ontario
January 13, 2011

Location Description	Material	Quantity	Condition	Type(s) of Asbestos	Friable (Y/N)	Photograph
Throughout building	Drywall joint compound	-	Good	Chrysotile	-	-
Throughout building	Vinyl floor tiles**	-	Good	-	N	-
Throughout inaccessible pipe chases between East Washrooms	Mechanical pipe insulation*	-	-	Chrysotile	Y	-
Throughout pipes chases on 9th, 8th, 7th and 4th floors adjacent to east washrooms	Suspect mechanical pipe insulation debris	-	Poor	Chrysotile	Y	11
1 st Floor, Canada Post	Mechanical pipe insulation	~30 linear feet	Good	Chrysotile	Y	1
1 st Floor, Canada Post	Mechanical pipe fitting insulation	~10 units	Good	Chrysotile	Y	1
1st Floor, Canada Post	Damaged mechanical pipe fitting insulation	~1 unit	Poor	Chrysotile	Y	2

Location Description	Material	Quantity	Condition	Type(s) of Asbestos	Friable (Y/N)	Photograph
1 st Floor, Canada Post	Texture Coat on ceiling	-	Good	Chrysotile	Y	3
1 st Floor, Canada Post	Floor coating**	-	Good	-	N	13
1 st Floor, Parking Garage	Mechanical pipe fitting insulation**	~2 units	Good	Chrysotile	Y	12
1 st and 2 nd Level, Parking Garage	Mechanical pipe and pipe fitting insulation concealed within bulkhead*	-	-	Chrysotile	Y	-
2 nd Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	Chrysotile	N	4
2 nd Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-
2 nd Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-
2 nd Floor, Closet by duct and pipe riser south of Stairwell E	Vinyl sheet flooring**	~40 square feet	Good	-	N	15
3 rd Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	Chrysotile	N	4
3 rd Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-
3 rd Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-

Location Description	Material	Quantity	Condition	Type(s) of Asbestos	Friable (Y/N)	Photograph
3 rd Floor, North wall (east side)	Transite cement board vapour barrier	~300 square feet	Good	Chrysotile	N	6
3 rd Floor, Closet adjacent to duct and pipe risers	Vinyl sheet flooring**	~40 square feet	Good	-	N	15
4 th Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	Chrysotile	N	4
4 th Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-
4 th Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-
4 th Floor, North wall (east side)	Transite cement board vapour barrier	~300 square feet	Good	Chrysotile	N	6
4 th Floor, East Elevator Lobby	Texture coat on ceiling	-	Good	Chrysotile	Y	7
4 th Floor, Closet adjacent to duct and pipe risers	Vinyl sheet flooring	~40 square feet	Good	-	N	15
5 th Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	Chrysotile	N	4
5 th Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-

Location Description	Material	Quantity	Condition	Type(s) of Asbestos	Friable (Y/N)	Photograph
5 th Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-
5 th Floor, North wall (east side)	Transite cement board vapour barrier	~300 square feet	Good	Chrysotile	N	6
5th Floor, Closet adjacent to duct and pipe riser	Mechanical pipe and pipe fitting insulation observed above ceiling	~6 square feet	Poor	Chrysotile	Y	5
5 th Floor, Closet adjacent to duct and pipe riser	Vinyl sheet flooring**		Good	-	N	15
6 th Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	Chrysotile	N	4
6 th Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-
6 th Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-
6 th Floor, North wall (east side)	Transite cement board vapour barrier	~300 square feet	Good	Chrysotile	N	6
6 th Floor, Closet adjacent to duct and pipe riser	Vinyl sheet flooring**	~40 square feet	Good	-	N	15
7 th Floor, Stairwell E	Paper-like duct	-	Good	Chrysotile	N	4

Location Description	Material	Quantity	Condition	Type(s) of Asbestos	Friable (Y/N)	Photograph
	insulation tape on fiberglass***					
7 th Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-
7 th Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-
7 th Floor, North wall (east side)	Transite cement board vapour barrier	~300 square feet	Good	Chrysotile	N	6
7 th Floor, Closet adjacent to duct and pipe riser	Vinyl sheet flooring**	~40 square feet	Good	-	N	15
8 th Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	Chrysotile	N	4
8 th Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-
8 th Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-
8 th Floor, Closet adjacent to duct and pipe riser	Vinyl sheet flooring**	~40 square feet	Good	-	N	15
9 th Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	Chrysotile	N	4
9 th Floor, Concrete Columns,	Mechanical pipe and pipe fitting	-	-	Chrysotile	Y	-

Location Description	Material	Quantity	Condition	Type(s) of Asbestos	Friable (Y/N)	Photograph
Offices	insulation					
9 th Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-
9 th Floor, Closet adjacent to duct and pipe riser	Vinyl sheet flooring**	~40 square feet	Good	-	N	15
10 th Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	Chrysotile	N	4
10 th Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-
10 th Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation*	-	-	Chrysotile	Y	-
10 th Floor, Closet adjacent to duct and pipe riser	Vinyl sheet flooring**	~40 square feet	Good	-	N	15

*Asbestos -containing insulation assumed to be present within inaccessible pipe risers within columns, above plaster ceilings , and within pipe/duct chase between east washrooms.

**Material not sampled (either not accessible or reported as asbestos-containing in previous reassessment) thus assumed to be asbestos containing unless sampling proves otherwise

***Material was observed encapsulated with canvass and lagging

Please note: Although efforts were made to confirm the presence of asbestos-containing vinyl floor products and mastics throughout, these materials may be present beneath carpets throughout the building and should be assumed to contain asbestos unless sampling proves otherwise or historic records can confirm the areas have been abated.

Based on the findings of this report SEL recommends the following:

Friable asbestos containing materials in POOR condition must be removed and/or repaired immediately following applicable asbestos abatement procedures. Friable asbestos-containing materials in GOOD condition can remain in place until major system upgrading, maintenance or demolition which could result in disturbance of this material. In the event the friable asbestos containing materials are removed, Type 3 operations apply as outlined in Ontario Regulation 278/05, Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations – made under the Ontario Occupational Health and Safety Act. Type 2 operations can be applied for the repair of friable materials or, removal of less than 1 square metre of friable asbestos containing materials. In addition, Type 2 Glove bag operations can be applied for the removal of asbestos containing mechanical pipe insulation fittings as outlined in Ontario Regulation 278/05.

Non-friable asbestos-containing materials in GOOD condition can remain in place until major system upgrading, maintenance or demolition which could result in disturbance of this material. In the event the non-friable asbestos containing materials are removed, Type 1 operations apply (provided that the material is wetted down and removed using non-powered hand held tools) as outlined in Ontario Regulation 278/05, Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations – made under the Ontario Occupational Health and Safety Act.

Asbestos containing drywall joint compound in GOOD condition can remain in place until major system upgrading, maintenance or demolition which could result in disturbance of this material. In the event the drywall with asbestos containing joint compound is removed, Type 1 operations apply for the removal of <1 square metres of drywall. Type 2 operations are required for removal of >1 square metre of drywall with asbestos joint compound as outlined in Ontario Regulation 278/05, Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations – made under the Ontario Occupational Health and Safety Act.

Respiratory protection equipment worn by contractors conducting asbestos abatement activities should be selected based on Table 2 Respirators found in Ontario Regulation 278/05.

In the event all asbestos material within the building is not removed, an asbestos management program must be implemented according to Ontario Regulation 278/05.

All asbestos repair or removal must be conducted according to Ontario Regulation 278/05, Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations - made under the Occupational Health and Safety Act. Asbestos containing waste has to be handled and disposed of according to Ontario Regulation



347/90 as amended – made under the Environmental Protection Act.

This survey satisfies requirements of Ontario Regulation 278/05, Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations. This executive summary is not to be used alone and the report should be reviewed in its entirety.

Should you have any questions or comments regarding this survey, please do not hesitate to contact our office.

Sincerely,

SAFETECH ENVIRONMENTAL LTD.

February 14, 2011

SNC-Lavalin Operations & Maintenance Inc.
25 St. Clair Avenue East, Suite 906
Toronto, Ontario
M4T 1M2

Attention: Mr. Robert Bowes
Maintenance Supervisor

Re: Reassessment of Asbestos-Containing Building Materials
25/55 St. Clair Avenue East, Toronto, Ontario

1.0 BACKGROUND

At the request of Mr. Robert Bowes, Maintenance Supervisor with SNC-Lavalin Operations & Maintenance Inc. (SNC-Lavalin), personnel from Safetech Environmental Limited (SEL) performed a reassessment of asbestos-containing materials within the building located at 25/55 St. Clair Avenue East, Toronto, Ontario. The reassessment was conducted from January 10th to 13th, 2011.

The objective of this study was to reassess whether asbestos, a designated substance as defined under the Ontario Occupational Health and Safety Act, RSO 1990 c. 0.1, is present in the surveyed areas. The survey included a review of all accessible project specific locations for the presence and extent of ACM, evaluation of the type of ACM and degree of possible exposure, and assessing requirements for any further investigation or remedial action, if necessary. The survey addressed only accessible areas of the facility. No destructive testing was performed.

This report summarizes results of our on-site assessment, laboratory analytical results and recommendations based on our findings.

2.0 HISTORY OF ASBESTOS

Asbestos-containing materials were used widely throughout Canada and other countries of the world during the 1900's. This naturally occurring mineral was used in building construction for its thermal properties, high tensile strength, low electrical conductivity and its ability to withstand chemical breakdown. This fibrous material when inhaled over a long period of time can lead to adverse health effects such as asbestosis, lung cancer and mesothelioma. Building materials with bound asbestos or asbestos that is in good condition pose little danger of releasing airborne fibres unless physically damaged (drilled, cut, sawn, ground or sanded).

An important factor when assessing the potential hazard associated with asbestos is its degree of friability. Ontario Regulation 278/05 – the Regulation respecting *Asbestos on Construction Projects and in Buildings and Repair Operations* as made under the Occupational Health & Safety Act defines friability as “material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled pulverized or powdered”.

Friable asbestos-containing materials have been banned from use in Ontario. The most common types of friable ACM include sprayed fireproofing and sprayed thermal insulation (ceased use circa 1973), sprayed acoustic texture coat finishes - stucco (ceased use circa 1982), and mechanical thermal system insulation (TSI) (ceased use circa 1981).

Non-friable ACM include vinyl floor tile - VAT (ceased use circa 1982), vinyl sheet flooring – VSF (ceased use circa 1982), floor adhesives (ceased use circa 1992), acoustic ceiling tile (ceased use circa 1982), plaster finishes (ceased use circa 1960's), drywall joint compound (ceased use circa 1980), roofing materials (ceased use circa 1991), and asbestos cement sheeting, piping, and gasketing material that may still be in use today.

This assessment identified all friable and non-friable material noted in the building.

3.0 REGULATIONS FOR ASBESTOS IN BUILDING MATERIALS

Management of asbestos-containing materials in buildings is regulated under Ontario Regulation 278/05, Regulation respecting *Asbestos on Construction Projects and in Buildings and Repair Operations* - made under the Occupational Health and Safety Act. Under this regulation an asbestos-containing material is defined as a material that contains 0.5 percent or more asbestos by dry weight. If materials are determined to be asbestos-containing this regulation requires that specific procedures are followed for ongoing management of these materials in buildings. This includes requirements such as – but not limited to – preparing and maintaining a record of the location and type (i.e. friable and non-friable) of asbestos-containing materials within the facility. This record is also required to be updated at least once in each 12 month period.

Specific procedures are also required to be followed during renovation or demolition projects that have the potential to disturb asbestos-containing materials. Specific procedures followed (i.e. Type 1, Type 2 or Type 3 operations) depends primarily on the type of asbestos present, the friability of the material, and quantity of material present.

For determining whether a material is considered asbestos-containing Ontario Regulation 278/05 outlines specific requirements for the collection of bulk samples of homogenous building materials. This includes the collection of a minimum number of samples for thermal system insulation, surfacing material and miscellaneous materials. In order for a building material to be deemed asbestos-containing only one of the samples analyzed within the sample set needs to contain 0.5% percent or more asbestos by dry weight. Therefore, if one sample in a sample set comes back positive the entire area of homogeneous material would then be deemed to be asbestos-containing. Table II outlines these bulk sample requirements.

TABLE II
Summary of Minimum Number of Bulk Samples Required
Under Ontario Regulation 278/05

Item	Type of Material	Size of Area of Homogenous Material	Minimum Number of Bulk Material Samples to be Collected
1	Surfacing material including without limitation material that is applied to surfaces by spraying, trowelling or otherwise, such as acoustical plaster on ceilings and fireproofing materials on structural members	<90m ²	3
		>90m ² to <450m ²	5
		>450m ²	7
2	Thermal system insulation, except as described in item 3	Any Size	3
3	Thermal Insulation Patch	< 2 linear metres or 0.5m ²	1
4	Other Material	Any Size	3

Management of asbestos waste is governed by Ontario Regulation 347/90 (amended to 110/09), General – Waste Management, made under the Environmental Protection Act. Section 17 of this regulation sets out requirements for proper handling, transportation and disposal of asbestos waste to protect those handling and disposing of the waste and to prevent it from becoming airborne.

4.0 METHODOLGY

Bulk Sampling of Suspect Building Materials

Samples of suspect asbestos-containing materials were retrieved for analysis during the survey. Bulk samples were retrieved from homogeneous materials that were suspected to potentially contain asbestos. The appropriate numbers of bulk samples were taken for each set of suspect materials based on the minimum sample requirements outlined in O. Reg. 278/05 and summarized in Table II.

As specified in O. Reg. 278/05 the analysis procedure employed is US EPA Method 600/R-93/116 for the determination of asbestos in suspect materials. Identification is made using polarized light microscopy (PLM), with confirmation of presence and type of asbestos made by dispersion staining optical microscopy.

Building materials that were visually similar to materials previously tested were considered to have consistent content and were not re-sampled. Additional sampling was only conducted where the investigator believed a need existed.

Accessible Areas

Destructive testing including that of fire door cores and roofing felts was not performed during this investigation. Locations of identified ACM have been detailed in this report where access was readily available. Inaccessible areas such as above solid drywall/plaster ceilings, within walls, enclosed mechanical shafts, enclosed bulkheads and pipe chases were not investigated. However, details regarding the possible presence of ACM were provided on a case by case basis.

Boilers and Other Mechanical Equipment

Boilers, vessels, kilns, sterilizers, chillers, tanks and other mechanical systems were not disassembled or demolished to determine the presence of asbestos within refractory brick, gaskets and other internal liners. Boilers were often constructed with asbestos insulations between the refractory brick and outer steel layer. Any work that will involve the demolition or replacement of these systems should be further investigated using destructive testing techniques prior to the commencement of such projects.

Non-Friable Materials

Some non-friable materials were not bulk sampled for asbestos content. For example, Transite pipe cannot be tested without compromising the integrity of the active pipe. Conclusions and recommendations regarding the presence of asbestos within identified non-friable materials were based on the past experience of the investigator.

General Note Regarding Investigation

Please be advised that SEL has made every effort to investigate all areas within the building. However, in some cases, areas that are not identified on floor plans and/or architectural drawings may not have been included. SEL should be contacted if this is determined to ensure that the survey is complete. In addition, if renovations or demolition is contemplated, a thorough reassessment must be conducted with destructive testing to ensure all ACM's are identified. The reassessment should be performed prior to the commencement of construction activity.

5.0 ASSESSMENT OF ASBESTOS-CONTAINING MATERIALS

5.1 Accessibility Rating

Accessibility, Condition and Action (Priority) ratings for individual items, or defined areas were developed by SEL to determine remedial action plans specific to the facility's needs. The rating criteria for each of these items is further detailed below.

Accessibility has been assessed as: (A) Accessible to all non-maintenance occupants of the building; (B) Accessible to maintenance staff without a ladder; (C) Accessible to maintenance staff with a ladder and exposed to view without moving a building component; (D) Accessible to maintenance staff with a ladder and concealed from view due to a building component; (E) Not accessible without demolition or removal of fixed building components or building systems.

5.2 Condition Rating

I. Sprayed Applied Fireproofing, Insulation and Texture Finishes

To evaluate the condition of asbestos-containing surfacing materials such as fireproofing, non-mechanical thermal insulation, and texture finishes the following criteria was applied:

Good condition would indicate the following:

Surface of material shows no significant signs of damage, deterioration, or delamination. Up to 1 percent visible damage to surface is allowed. Evaluation of sprayed materials requires the surveyor to be familiar with the typical irregular surface texture as installed. GOOD condition includes unencapsulated or unpainted fireproofing or texture finishes, where no delamination or damage is observed, and encapsulated fireproofing or texture finishes where the encapsulation has been applied after the damage or fallout occurred.

Fair condition rating is not utilized in the evaluation of the fireproofing, non-mechanical insulation, or texture coat finishes. These materials are only classified as in Good or Poor condition.

Poor condition would indicate the following:

Sprayed materials show signs of damage, delamination, or deterioration. More than 1% damage to surface of ACM spray.

In observation areas where damage exists in isolated locations, both GOOD and POOR condition may be applicable.

II. Mechanical Insulation

The evaluation of the condition of mechanical insulation (on boilers, breeching, ductwork, piping, tanks, equipment, etc.) utilizes the following criteria:

Good condition would indicate the following:

Insulation is completely covered in jacketing and exhibits no evidence of damage or deterioration. No insulation is exposed. Includes conditions where jacketing has minor damage (i.e. scuffs or stains), but the jacketing is not penetrated.

Fair condition would indicate the following:

Minor penetrating damage to jacketed insulation (cuts, tears, nicks, deterioration or delamination) or undamaged insulation that had never been jacketed. Insulation is exposed but not showing surface disintegration. The extent of missing insulation ranges from minor to none. Damage can be repaired.

Poor condition would indicate the following:

Original insulation jacket is missing, damaged, deteriorated, or delaminated. Insulation is exposed and significant areas have been dislodged. Damage cannot be readily repaired.

III. Non-friable and Potential Friable Materials

The condition of non-friable or potentially friable ACM, such as plaster finishes, drywall compound, ceiling tiles, asbestos cement products, vinyl asbestos tile and asbestos paper backed vinyl sheet flooring, which have the potential to become friable when handled is evaluated as follows:

Good condition would indicate the following:

No significant damage. Material may be cracked or broken but is stable and not likely to become friable upon casual contact. If there is no friable DEBRIS present, the condition is rated as GOOD.

Fair condition rating is not utilized in the evaluation of the condition of non-friable and potentially friable materials. These materials are only classified as in Good or Poor condition.

Poor condition would indicate the following:

Material is severely damaged. Loose DEBRIS is present or binder has disintegrated to the point where the material has become friable.

IV. Evaluation of Asbestos-Containing Debris

The presence of fallen debris must be noted separately from the presumed asbestos-containing source material. Debris is always considered to be in POOR condition.

Quantity

For each CONDITION, the approximate QUANTITY and the units of measure related to the QUANTITY (i.e.: linear feet (LF), square feet (SF) or each (EACH) as appropriate to the ITEM) has been recorded where applicable.

5.3 Action Rating

Recommended ACTION for compliance and for management of the ACM has been provided for each CONDITION and for each COMPONENT. Recommendations have been classified under the following 8 ACTIONS:

- Action 1: Action dealing with the immediate cleanup of fallen ACM likely to be disturbed.
- Action 2: Action dealing with the need to use Type 2 asbestos procedures to enter an area (other than a ceiling space).
- Action 3: Action dealing with performing asbestos removal for compliance with regulations.
- Action 4: Action dealing with Type 2 asbestos procedures for ceiling entry where friable ACM debris is present on the top side of a ceiling system.
- Action 5: Action dealing with the removal of asbestos that goes beyond compliance requirements but simplifies the asbestos management.
- Action 6: Action dealing with the repair of asbestos.
- Action 7: Action dealing with ACM surveillance requirements of the regulation.
- Action 8: Action for dealing with material that may contain asbestos but was not conclusively identified in the survey.

6.0 RESULTS

6.1 Laboratory Analytical Results

Results of our assessment for asbestos-containing materials based on visual assessment and the above laboratory analytical results are summarized in the following sections. Locations where bulk samples have been collected and results of analysis are summarized in Table III. Samples found to be asbestos containing are bolded and highlighted in yellow. Please refer to Appendix I for complete laboratory analytical results. For additional details regarding our asbestos survey please refer to Appendix II which includes project drawings that outline locations where the assessment was conducted, locations where bulk samples were collected and the locations of friable and non-friable asbestos-containing materials. Site photographs of conditions noted are included in Appendix III.

TABLE III
Summary of Asbestos Bulk Sample Analytical Results
25/55 St. Clair Avenue East, Toronto, Ontario
January 13, 2011

Sample #	Location	Sample Description	Asbestos Content
A1a	Mechanical Penthouse	Sprayed fireproofing hand patch	ND
A1b	Mechanical Penthouse	Sprayed fireproofing hand patch	ND
A1c	Mechanical Penthouse	Sprayed fireproofing hand patch	ND
A2a	Mechanical Penthouse	Sprayed fireproofing on beam	ND
A2b	Mechanical Penthouse	Sprayed fireproofing on beam	ND
A2c	Mechanical Penthouse	Sprayed fireproofing on beam	ND

ND – Not Detected

ANR – Analysis Not Required – Material Known to Be Asbestos-Containing

The following summarizes building materials (if present) that were investigated for asbestos content.

6.2 Sprayed Applied Fireproofing and Insulation

Sprayed fireproofing and hand patching material noted to be present on structural beams within the Mechanical Penthouse were sampled (Sample Sets A1 and A2) and analyzed for asbestos content using the PLM method of detection. The samples were found not to contain asbestos.

Sprayed fireproofing material was observed on concrete deck within various floors. As per Mr. Robert Bowes, Maintenance Supervisor, due to a number of renovations conducted on the various floors, the spray fireproofing identified was recently applied and thus is not suspected to contain asbestos and not sampled.

As per previous assessment report titled, "*Hazardous Materials Assessment, 10th Floor, Arthur Meighen Building, 25-55 St. Clair Avenue East, Toronto, Ontario*" dated June 2009 conducted by Safetech Environmental Ltd., asbestos-containing spray fireproofing overspray and debris was discovered in a location on the 10th Floor, and has since been abated. However, additional pre-existing asbestos-containing spray fireproofing material may be uncovered on floors and/or locations where back to base building renovations have not been conducted.

6.3 Thermal Systems Insulation (TSI)

As per the previous reassessment report titled, "*Asbestos Building Materials Reassessment, 25/55 St. Clair Avenue East, Toronto, Ontario*" conducted by Pinchin Environmental dated March 2006, mechanical pipe insulation referred to as air cell and mechanical pipe fitting insulation referred to as parging cement were sampled and found to contain **Chrysotile** asbestos. These materials are present throughout the building. Please note that most of this material is present within inaccessible areas such as within concrete columns and bulkheads and thus SEL personnel could not comment on the presence or condition of the material.

Accessible mechanical pipe insulation present in the Post Office Work Area was observed to be in good condition.

The majority of accessible mechanical pipe fitting insulation present in the Post Office Work Area, Mezzanine level was observed to be in good condition. The material was observed to be in Poor condition in the following areas: damaged mechanical pipe fitting insulation on Mezzanine Post Office Work Area and remnants of mechanical pipe insulation above ceiling on 5th Floor adjacent to duct and pipe riser.

Please note that asbestos-containing mechanical pipe insulation debris may be present within pipe chases adjacent to east washrooms, specifically within the 9th, 8th, 7th and 4th floors, where significant amounts of building material debris, such as clay brick and concrete, were observed.

Remaining mechanical insulation within the surveyed area were either non-insulated or insulation observed was visually identified to be a material not suspected to contain asbestos (i.e. fibreglass) and thus not sampled.

As per the previous reassessment report titled, "*Asbestos Building Materials Reassessment, 25/55 St. Clair Avenue East, Toronto, Ontario*" conducted by Pinchin Environmental dated March 2006, paper-like tape on ductwork insulation was previously sampled and found to contain **Chrysotile** asbestos. The material is predominately

present within duct risers adjacent to Stairwell 5 throughout each floor. Accessible material was observed to be in good condition.

Remaining mechanical duct insulation within the surveyed area were either non-insulated or insulation observed was visually identified to be a material not suspected to contain asbestos (i.e. fibreglass) and thus not sampled

No other mechanical insulations were observed within the surveyed area.

6.4 Architectural Finishes

6.4.1 Sprayed Textured/Stucco Finishes

As per the previous reassessment report titled, "*Asbestos Building Materials Reassessment, 25/55 St. Clair Avenue East, Toronto, Ontario*" conducted by Pinchin Environmental dated March 2006, sprayed textured finishes were previously sampled and found to contain **Chrysotile** asbestos. The material is present in the Post Office and 4th Floor East Elevator Lobby and was observed to be in good condition.

6.4.2 Plaster Finishes

As per the previous reassessment report titled, "*Non-Friable Asbestos Product Survey, Government of Canada Building, 25/55 St. Clair Avenue East, Toronto, Ontario*" conducted by Advanced Environmental Corporation dated December 2006, plaster finishes were previously sampled and found not to contain asbestos.

6.5 Drywall Joint Compound

As per the previous reassessment report titled, "*Asbestos Survey Report, Renovation Areas, SNC Lavalin, 25/55 St. Clair Avenue East, Toronto, Ontario*" conducted by Stantec Consulting Ltd., dated March 2009, drywall joint compound was previously sampled and found to contain **Chrysotile** asbestos. The material is present throughout the surveyed building and was observed to be in good condition.

6.6 Ceiling Tiles

As per the previous assessment report titled, "*Non-Friable Asbestos Product Survey, Government of Canada Building, 25/55 St. Clair Avenue East, Toronto, Ontario*" conducted by Advanced Environmental Corp., dated December 2006, various 2x4 ceiling tiles were previously sampled and found not to contain asbestos.

Remaining 2x4 ceiling tiles were observed to have manufacturers date stamp on the underside indicating material was installed within the last 10 years, thus not suspected to contain asbestos and not sampled.

As per the client, 1x1 ceiling tiles (and associated mastic) observed adhered to the

concrete deck of the Work Area within the Post Office, were previously sampled and analyzed for asbestos content using the PLM method of detection. The samples were found not to contain asbestos.

6.7 Manufactured Products

6.7.1 Vinyl Floor Tiles & Sheet Flooring

Various types of vinyl floor products were observed throughout the surveyed building. As per the previous reassessment report and client's request, the flooring materials were not sampled and thus are assumed to be asbestos-containing unless sampling proves otherwise, or historic records can confirm that material has been removed as part of numerous renovations conducted throughout various floors.

6.7.2 Asbestos Cement Products

Asbestos cement board, known in the industry as transite, was present in the form of a vapour board barrier on the north east side of the building within floors 3 to 7. The material was observed to be in good condition.

6.7.3 Other Manufactured Products

Green floor coating was observed within Canada Post. As per the previous reassessment report and client's request, the floor coating was not sampled and thus is assumed to be asbestos-containing unless sampling proves otherwise.

No other suspect asbestos-containing manufactured products were noted in the surveyed building.

7.0 CONCLUSIONS & RECOMMENDATIONS

Based on the investigation conducted by SEL, Accessibility, Condition and Action (Priority) ratings, to determine remedial action plans specific to the facility's needs, were assigned for all asbestos-containing materials identified within the surveyed area, and are summarized in the following Table IV. References to Rating Criteria are outlined in Section 5.0.

TABLE IV
Summary of Asbestos Containing Materials
25/55 St. Clair Avenue East, Toronto, Ontario
January 13, 2011

Location Description	Material	Quantity	Condition	Accessibility	Action	Friable (Y/N)
Throughout building	Drywall joint compound	-	Good	A	7	-

Location Description	Material	Quantity	Condition	Accessibility	Action	Friable (Y/N)
Throughout building	Vinyl floor tiles	-	Good	A	7	N
Throughout inaccessible pipe chases between East Washrooms	Mechanical pipe insulation*	-	-	E	7	Y
Throughout pipes chases on 9th, 8th, 7th and 4th floors adjacent to east washrooms	Suspect mechanical pipe insulation debris	-	Poor	B	7	Y
1 st Floor, Canada Post	Mechanical pipe insulation*	~30 linear feet	Good	C	7	Y
1 st Floor, Canada Post	Mechanical pipe fitting insulation*	~10 units	Good	C	7	Y
1st Floor, Canada Post	Damaged mechanical pipe fitting insulation	~1 unit	Poor	C	7	Y
1 st Floor, Canada Post	Texture Coat on ceiling	-	Good	C	7	Y
1 st Floor, Canada Post	Floor coating**	-	Good	A	7	N
1 st Floor, Parking Garage	Mechanical pipe fitting insulation**	~2 units	Good	C	7	Y
1 st and 2 nd Level, Parking Garage	Mechanical pipe and pipe fitting insulation concealed within bulkhead	-	-	E	7	Y
2 nd Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	B	7	N
2 nd Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y
2 nd Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y
2 nd Floor, Closet by duct and pipe riser south of Stairwell E	Vinyl sheet flooring**	~40 square feet	Good	A	7	N

Location Description	Material	Quantity	Condition	Accessibility	Action	Friable (Y/N)
3 rd Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	B	7	N
3 rd Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y
3 rd Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y
3 rd Floor, North wall (east side)	Transite cement board vapour barrier	~300 square feet	Good	B	7	N
3 rd Floor, Closet adjacent to duct and pipe risers	Vinyl sheet flooring**	~40 square feet	Good	A	7	N
4 th Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	B	7	N
4 th Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y
4 th Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y
4 th Floor, North wall (east side)	Transite cement board vapour barrier	~300 square feet	Good	B	7	N
4 th Floor, East Elevator Lobby	Texture coat on ceiling	-	Good	B	7	Y
4 th Floor, Closet adjacent to duct and pipe risers	Vinyl sheet flooring	~40 square feet	Good	A	7	N
5 th Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	B	7	N
5 th Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y
5 th Floor, Janitor's	Mechanical pipe and pipe fitting	-	-	E	7	Y

Location Description	Material	Quantity	Condition	Accessibility	Action	Friable (Y/N)
Closet by Freight Elevator	insulation					
5 th Floor, North wall (east side)	Transite cement board vapour barrier	~300 square feet	Good	C	7	N
5th Floor, Closet adjacent to duct and pipe riser	Mechanical pipe and pipe fitting insulation observed above ceiling	~6 square feet	Poor	C	7	Y
5 th Floor, Closet adjacent to duct and pipe riser	Vinyl sheet flooring**		Good	A	7	N
6 th Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	B	7	N
6 th Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y
6 th Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y
6 th Floor, North wall (east side)	Transite cement board vapour barrier	~300 square feet	Good	C	7	N
6 th Floor, Closet adjacent to duct and pipe riser	Vinyl sheet flooring**	~40 square feet	Good	A	7	N
7 th Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	B	7	N
7 th Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y
7 th Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y

Location Description	Material	Quantity	Condition	Accessibility	Action	Friable (Y/N)
7 th Floor, North wall (east side)	Transite cement board vapour barrier	~300 square feet	Good	C	7	N
7 th Floor, Closet adjacent to duct and pipe riser	Vinyl sheet flooring**	~40 square feet	Good	A	7	N
8 th Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	B	7	N
8 th Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y
8 th Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y
8 th Floor, Closet adjacent to duct and pipe riser	Vinyl sheet flooring**	~40 square feet	Good	A	7	N
9 th Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	B	7	N
9 th Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y
9 th Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y
9 th Floor, Closet adjacent to duct and pipe riser	Vinyl sheet flooring**	~40 square feet	Good	A	7	N
10 th Floor, Stairwell E	Paper-like duct insulation tape on fiberglass***	-	Good	B	7	N
10 th Floor, Concrete Columns, Offices	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y

Location Description	Material	Quantity	Condition	Accessibility	Action	Friable (Y/N)
10 th Floor, Janitor's Closet by Freight Elevator	Mechanical pipe and pipe fitting insulation	-	-	E	7	Y
10 th Floor, Closet adjacent to duct and pipe riser	Vinyl sheet flooring**	~40 square feet	Good	A	7	N

*Asbestos -containing insulation assumed to be present within inaccessible pipe risers within columns

**Material not sampled (either not accessible or reported as asbestos-containing in previous reassessment) thus assumed to be asbestos containing unless sampling proves otherwise

***Material was observed encapsulated with canvass and lagging

Friable Asbestos-Containing Materials

Friable asbestos-containing texture coat ceiling finishes (stucco), mechanical insulation (pipe and fittings) and ductwork tape was confirmed to be present within the surveyed building.

Friable asbestos containing materials in Poor condition must be removed and/or repaired immediately following applicable asbestos abatement procedures. Friable asbestos-containing materials in Good condition can remain in place until major system upgrading, maintenance or demolition which could result in disturbance of this material. In the event the friable asbestos containing materials are removed, Type 3 operations apply as outlined in Ontario Regulation 278/05, Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations – made under the Ontario Occupational Health and Safety Act. Type 2 operations can be applied for the repair of friable materials or, removal of less than 1 square metre of friable asbestos containing materials. In addition, Type 2 Glove Bag operations can be applied for the removal of asbestos containing mechanical pipe insulation fittings as outlined in Ontario Regulation 278/05.

Non-Friable Asbestos-Containing Materials

Non friable asbestos-containing Transite vapour board and vinyl floor products (unless vinyl sheet flooring contains asbestos paper backing, then friable) were confirmed to be present within the surveyed building.

Non-friable asbestos containing materials in Poor condition must be removed and/or repaired immediately following applicable asbestos abatement procedures. Non-friable asbestos-containing materials in Good condition can remain in place until major system upgrading, maintenance or demolition which could result in disturbance of this material. In the event the non-friable asbestos containing materials are removed, Type 1 operations apply (provided that the material is wetted down and removed using non-

powered hand held tools) as outlined in Ontario Regulation 278/05, Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations – made under the Ontario Occupational Health and Safety Act.

GENERAL

Building material(s) that are not detailed within this survey due to inaccessibility (i.e. behind solid ceilings and walls) during the time of the survey and/or are uncovered during renovation/demolition activities that are suspected to contain asbestos should be properly assessed by qualified person prior to their disturbance.

Due to potentially hazardous concealed conditions of pre-existing asbestos-containing spray fireproofing within original non-renovated locations of the subject building, utilize Type 2 asbestos abatement procedures for destructive/intrusive work conducted leading into wall and/or ceiling cavities of original building construction.

Asbestos containing drywall joint compound in Good condition can remain in place until major system upgrading, maintenance or demolition which could result in disturbance of this material. In the event the drywall with asbestos containing joint compound is removed, Type 1 operations apply for the removal of <1 square metres of drywall. Type 2 operations are required for removal of >1 square metre of drywall with asbestos joint compound as outlined in Ontario Regulation 278/05, Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations – made under the Ontario Occupational Health and Safety Act.

Asbestos removal work should be performed by a competent and qualified asbestos abatement contractor. It is recommended that all asbestos related work be subjected to inspection and air monitoring to ensure building occupants are safe from exposure.

Asbestos abatement work must be performed as outlined in Ontario Regulation 278/05. Asbestos-containing waste must be handled and disposed of according to Ontario Regulation 347, amended to O. Reg. 110/09 - General - Waste Management.

Regulation 278/05 requires regular inspections, at least annually, of all areas identified as having asbestos-containing materials. Any damaged or exposed items noted should be repaired or removed under the Operations and Maintenance program of the building's Asbestos Management Plan.

8.0 LIMITATIONS

The information and recommendations detailed in this report were carried out by trained professional and technical staff in accordance with generally accepted environmental and industrial hygiene work practices and procedures. Recommendations provided in this report have been generated in accordance with current regulations, accepted industry guidelines and practices. These regulations, guidelines and practices are considered acceptable as of the date of this report.

In preparation of this report, Safetech Environmental Limited (SEL) relied on information supplied by others including testing services provided by independent laboratories. Except as expressly set out in this report, SEL has not made any independent verification of this information provided by independent entities. The collection of samples at the location noted was consistent with the scope of work agreed-upon with the person or entity to whom this report is addressed and the information obtained concerning prior site investigations. As conditions between samples may vary, the potential remains for the presence of unknown additional contaminants for which there were no known indicators. Conclusions are based on site conditions at the time of inspection and can only be extrapolated to an undefined limited area around inspected locations. The extent of the limited area depends on building construction and conditions. SEL cannot warrant against undiscovered environmental liabilities. If any information becomes available that differs from the findings in this report, we request that we be notified immediately to reassess the conclusions provided herein.

This report has been prepared for the sole use of the person or entity to who it is addressed. No other person or entity is entitled to use or rely upon this report without the express written consent of Safetech Environmental Limited and the person or entity to who it is addressed. Any use that a third party makes of this report, or any reliance based on conclusions and recommendations made, are the responsibility of such third parties. SEL accepts no responsibility for damages suffered by third parties as a result of actions based on this report.

APPENDIX I
Laboratory Certificates of Analysis

**EMSL Canada Inc.**

10 Falconer Drive, Unit #3 Mississauga, ON L5N 3L8

Phone: 289-997-4602

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Web: <http://www.emsl.com>Email: torontolab@emsl.com

Attn: Marina Laccona
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Proj: 150210

EMSL Order: 551100115
Customer ID: 55SELI62
Collected: 1/17/2011 5:50:00PM
Received: 1/17/2011

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: A1A **Lab Sample ID:** 551100115-0001
Sample Description: SPRAYED FIREPROOFING PATCHING ON BEAM, MECHANICAL'

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	1/18/2011	Gray/White	90%	10%	None Detected	

Client Sample ID: A1B **Lab Sample ID:** 551100115-0002
Sample Description: SPRAYED FIREPROOFING PATCHING ON BEAM, MECHANICAL'

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	1/18/2011	Gray/White	90%	10%	None Detected	

Client Sample ID: A1C **Lab Sample ID:** 551100115-0003
Sample Description: SPRAYED FIREPROOFING PATCHING ON BEAM, MECHANICAL'

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	1/18/2011	Gray/White	90%	10%	None Detected	

Client Sample ID: A2A **Lab Sample ID:** 551100115-0004
Sample Description: SPRAYED FIREPROOFING ON BEAM, MECHANICAL PENTHOUSE'

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	1/18/2011	Gray	85%	15%	None Detected	

Client Sample ID: A2B **Lab Sample ID:** 551100115-0005
Sample Description: SPRAYED FIREPROOFING ON BEAM, MECHANICAL PENTHOUSE'

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	1/18/2011	Gray	90%	10%	None Detected	

Client Sample ID: A2C **Lab Sample ID:** 551100115-0006
Sample Description: SPRAYED FIREPROOFING ON BEAM, MECHANICAL PENTHOUSE'

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	1/18/2011	Gray	85%	15%	None Detected	



EMSL Canada Inc.

10 Falconer Drive, Unit #3 Mississauga, ON L5N 3L8

Phone: 289-997-4602 Fax: (289) 997-4607 Web: <http://www.emsl.com> Email: torontolab@emsl.com

Attn: Marina Laccona
Safetech Environmental Limited
3045 Southcreek Road
Unit 14
Mississauga, ON L4X 2X7
Proj: 150210

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Initial report from: 01/20/2011 20:22:05

Analyst(s)

Kevin Pang (6)

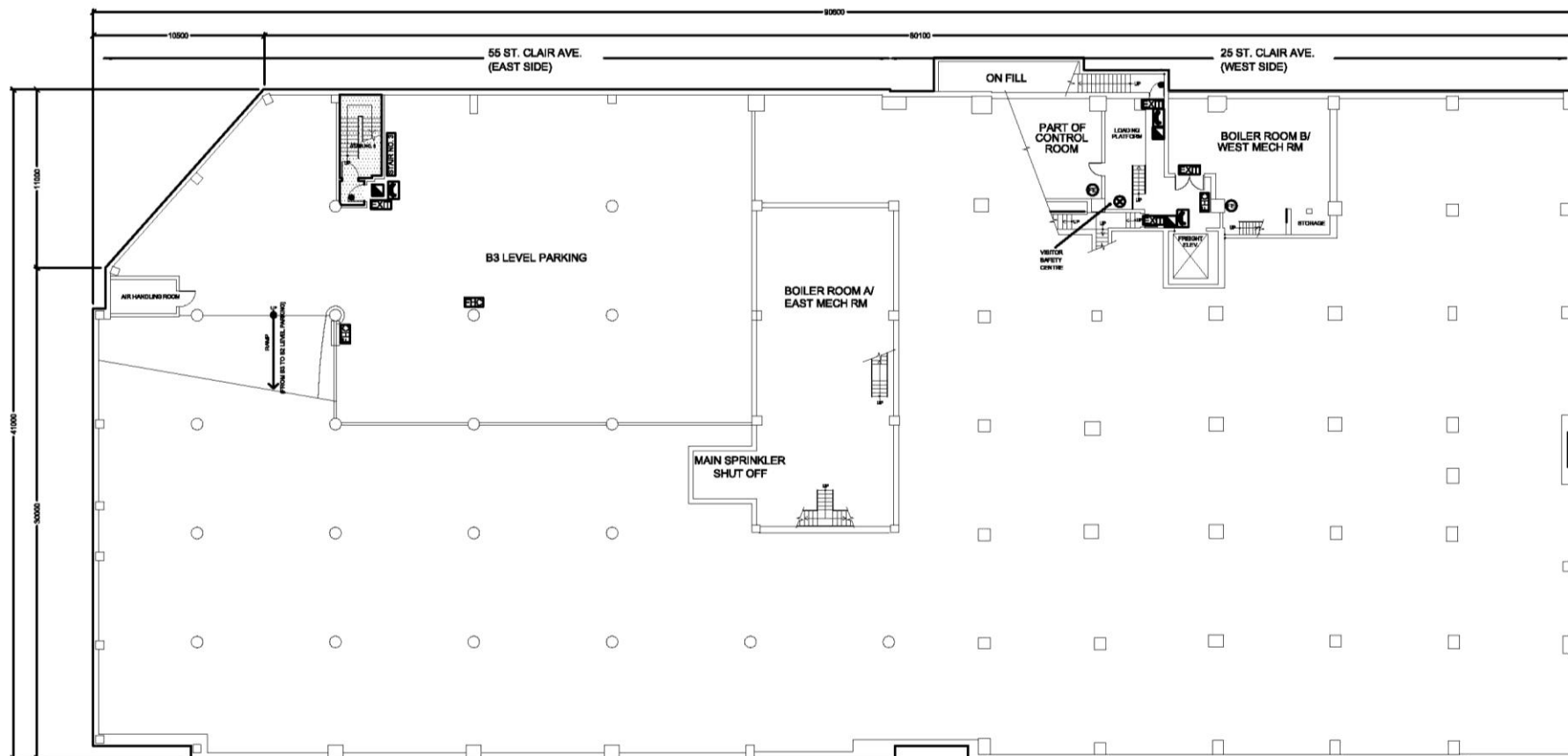
Kevin Pang
or other Approved Signatory

Any questions please contact Kevin Pang.

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. 10 Falconer Drive, Unit #3, Mississauga ON NVLAP Lab Code 200877-0

APPENDIX II
Drawing of Survey Location



SUB BASEMENT FIRE EVACUATION PLAN
SCALE: 1:300

Note: ACM drywall joint compound is present throughout building and ACM mechanical insulation is present within columns throughout building.

Although efforts were made to confirm the presence of asbestos-containing vinyl floor products and mastics throughout, these materials may be present beneath carpets throughout the building and should be assumed to contain asbestos unless sampling proves otherwise or historic records can confirm the areas have been abated.

LEGEND:

PROJECT: 25/55 St. Clair Avenue East
Toronto, Ontario
Sub Basement

Not to Scale

DATE: February 2011

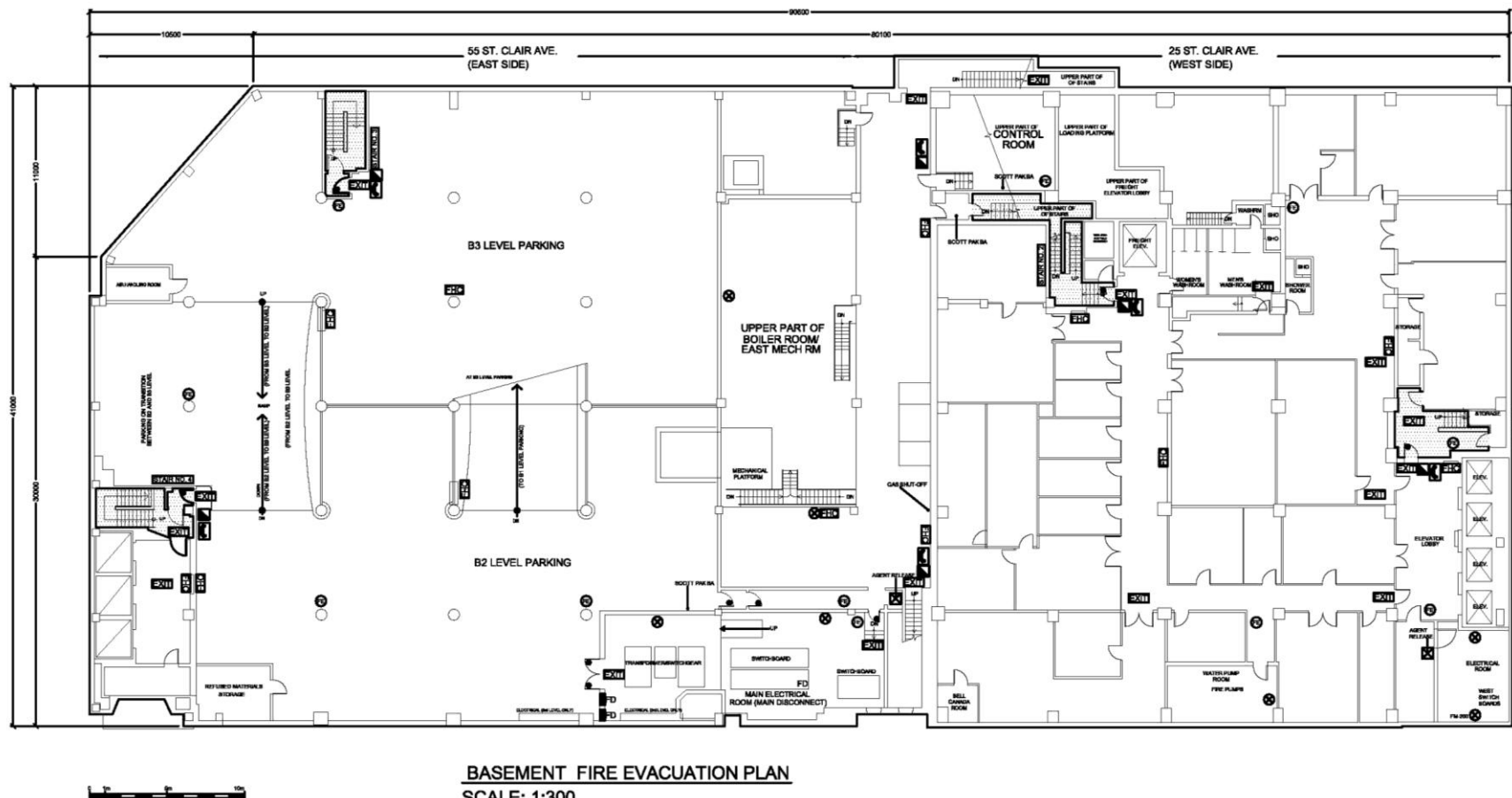
DRAWING BY: ML

PROJECT No. 150210

REVIEWED BY: DD



Safetech Environmental Limited
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7



Note: ACM drywall joint compound is present throughout building and ACM mechanical insulation is present within columns throughout building.

Although efforts were made to confirm the presence of asbestos-containing vinyl floor products and mastics throughout, these materials may be present beneath carpets throughout the building and should be assumed to contain asbestos unless sampling proves otherwise or historic records can confirm the areas have been abated.

LEGEND:

PROJECT: 25/55 St. Clair Avenue East
Toronto, Ontario
Basement

Not to Scale

DATE: February 2011

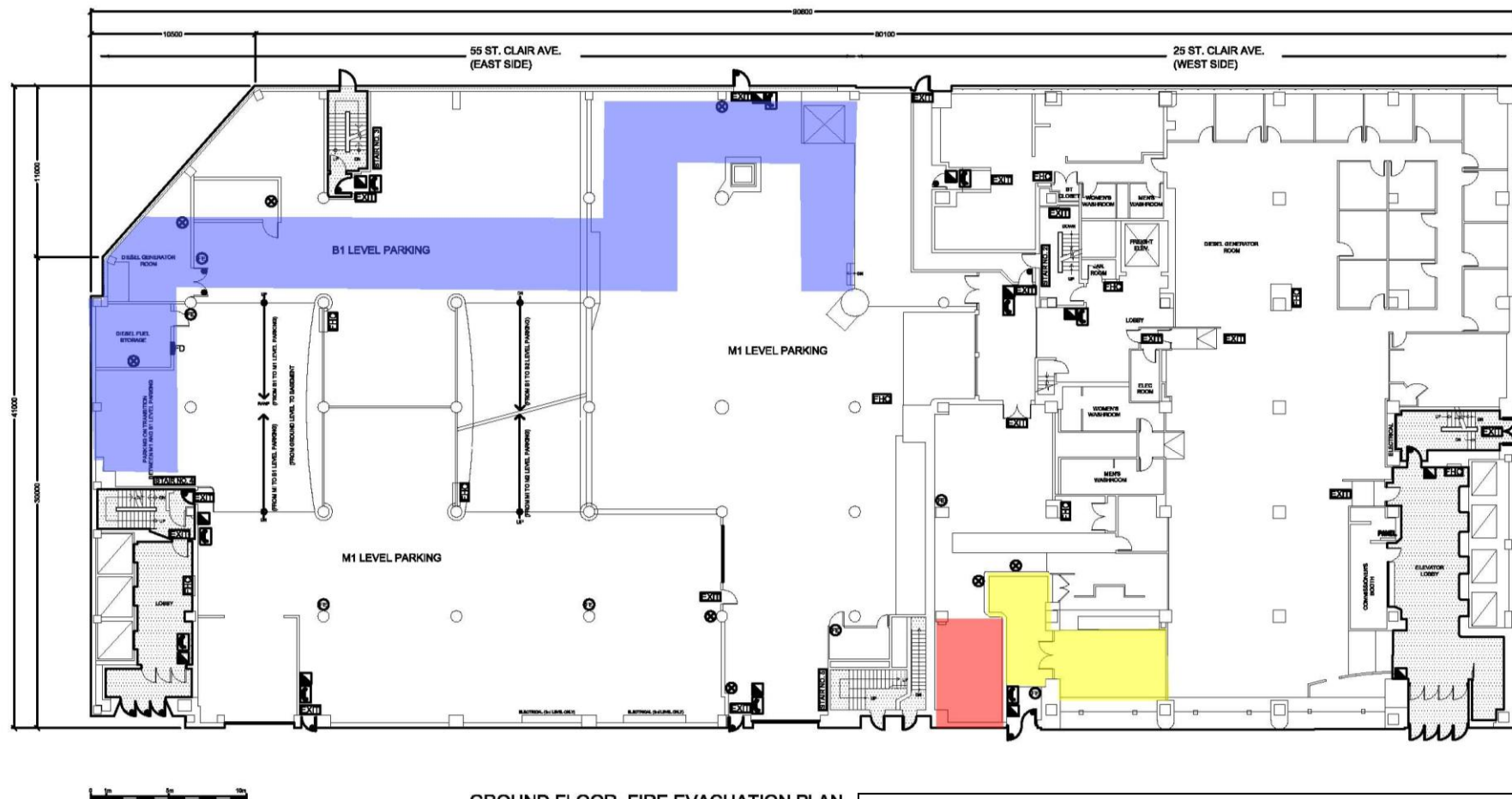
DRAWING BY: ML

PROJECT No. 150210

REVIEWED BY: DD



Safetech Environmental Limited
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7



GROUND FLOOR FIRE EVACUATION PLAN
SCALE: 1:300

Note: ACM drywall joint compound is present throughout building and ACM mechanical insulation is present within columns throughout building.

Although efforts were made to confirm the presence of asbestos-containing vinyl floor products and mastics throughout, these materials may be present beneath carpets throughout the building and should be assumed to contain asbestos unless sampling proves otherwise or historic records can confirm the areas have been abated.

LEGEND:

- Concealed ACM mechanical pipe insulation
- ACM mechanical pipe insulation
- ACM texture coat

PROJECT: 25/55 St. Clair Avenue East
Toronto, Ontario
Ground Floor

Not to Scale

DATE: February 2011

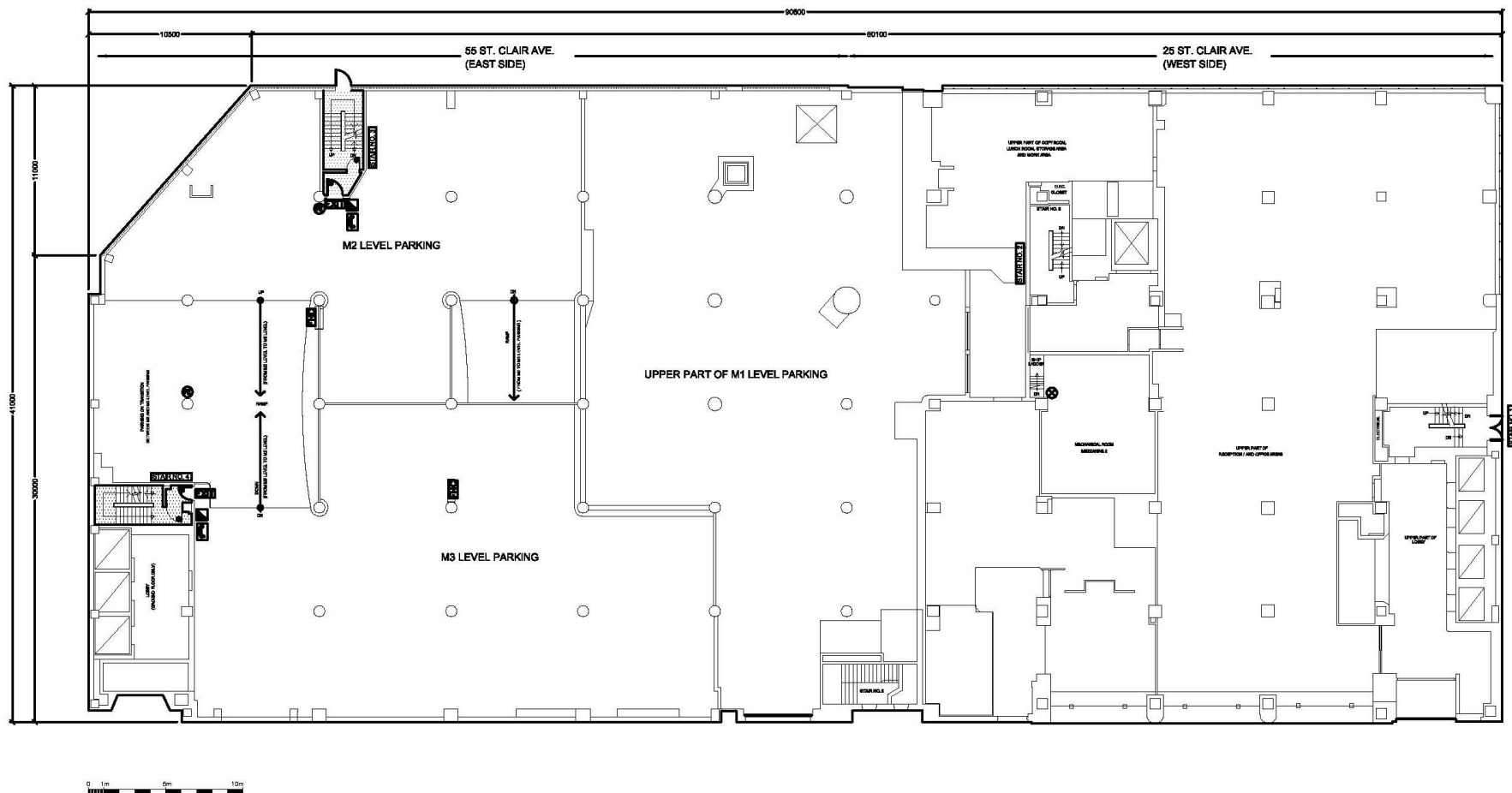
DRAWING BY: ML

PROJECT No. 150210

REVIEWED BY: DD



Safetech Environmental Limited
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7



1st FLOOR MEZZANINE FIRE EVACUATION PLAN

SCALE: 1:300

Note: ACM drywall joint compound is present throughout building and ACM mechanical insulation is present within columns throughout building.

Although efforts were made to confirm the presence of asbestos-containing vinyl floor products and mastics throughout, these materials may be present beneath carpets throughout the building and should be assumed to contain asbestos unless sampling proves otherwise or historic records can confirm the areas have been abated.

PROJECT: 25/55 St. Clair Avenue East
Toronto, Ontario
Ground Floor, Mezzanine

Not to Scale

DATE: February 2011

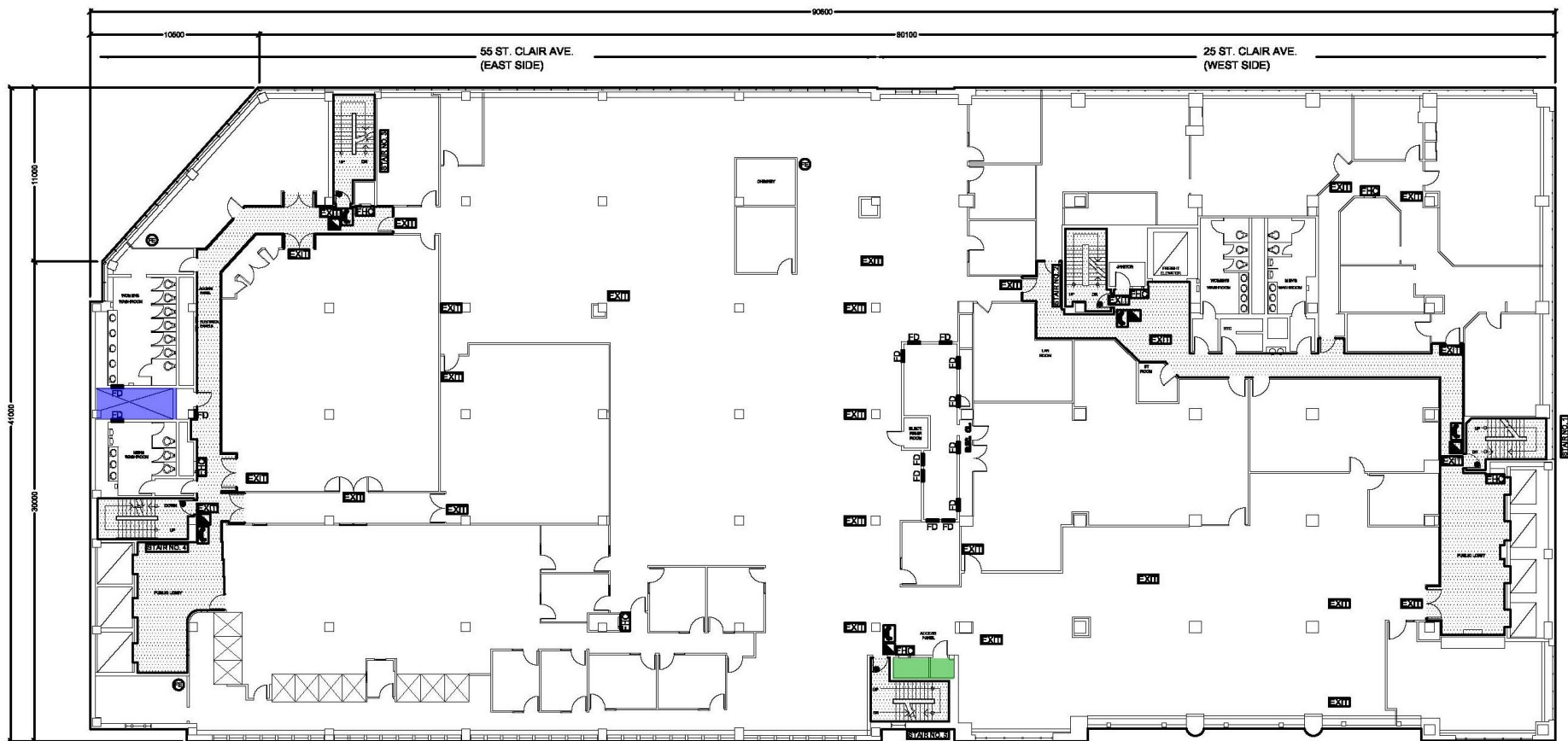
DRAWING BY: ML

PROJECT No. 150210

REVIEWED BY: DD



Safetech Environmental Limited
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7



2nd FLOOR FIRE EVACUATION PLAN
SCALE: 1:300

Note: ACM drywall joint compound is present throughout building and ACM mechanical insulation is present within columns throughout building.

Although efforts were made to confirm the presence of asbestos-containing vinyl floor products and mastics throughout, these materials may be present beneath carpets throughout the building and should be assumed to contain asbestos unless sampling proves otherwise or historic records can confirm the areas have been abated.

LEGEND:

- Concealed ACM mechanical pipe insulation
- ACM mechanical duct tape insulation

PROJECT: 25/55 St. Clair Avenue East
 Toronto, Ontario
 2nd Floor

Not to Scale

DATE: February 2011

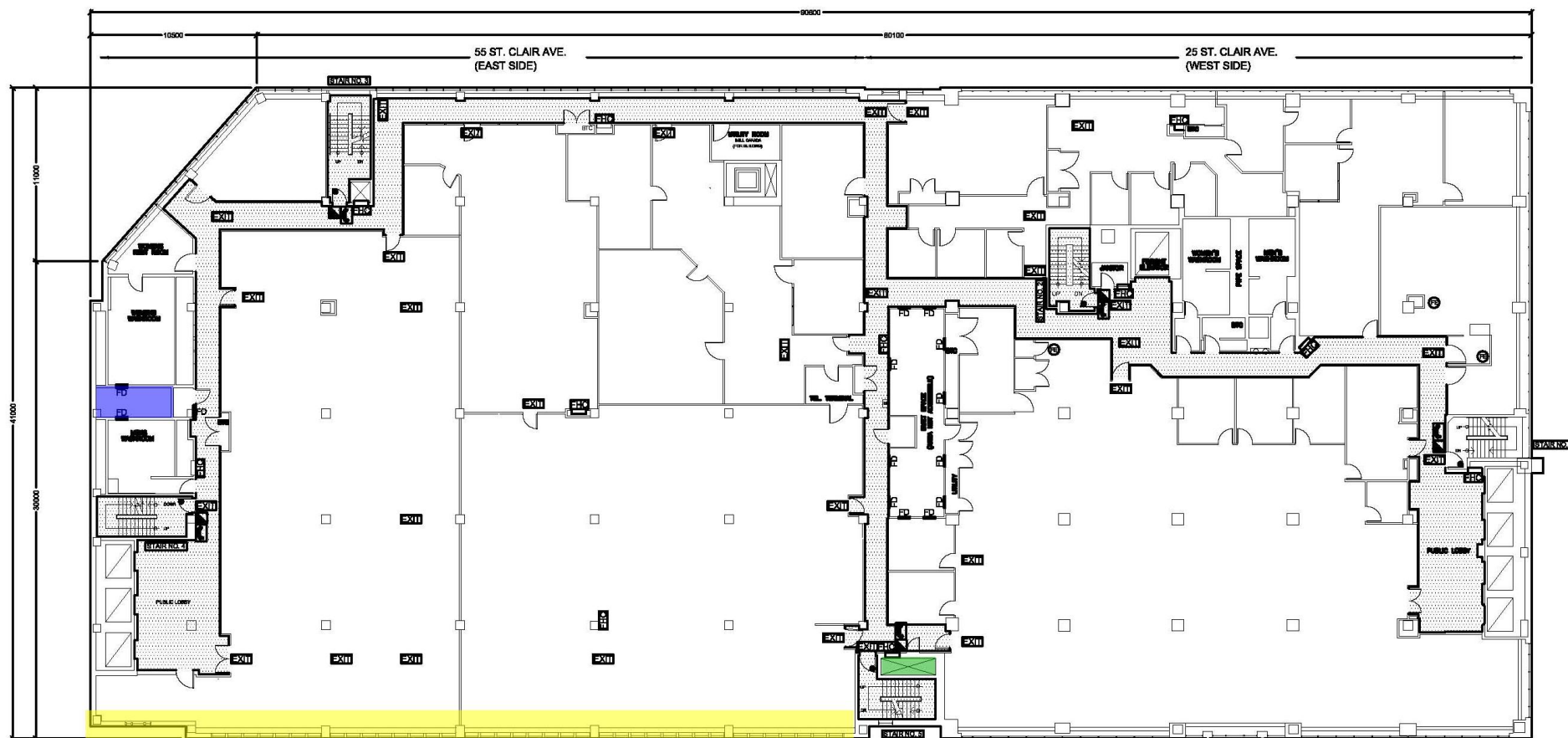
DRAWING BY: ML

PROJECT No. 150210

REVIEWED BY: DD



Safetech Environmental Limited
 #14 - 3045 Southcreek Rd
 Mississauga, ON L4X2X7



3rd FLOOR FIRE EVACUATION PLAN - CROSSOVER FLOOR

SCALE: 1:300

Note: ACM drywall joint compound is present throughout building and ACM mechanical insulation is present within columns throughout building.

Although efforts were made to confirm the presence of asbestos-containing vinyl floor products and mastics throughout, these materials may be present beneath carpets throughout the building and should be assumed to contain asbestos unless sampling proves otherwise or historic records can confirm the areas have been abated.

LEGEND:

- Concealed ACM mechanical pipe insulation
- ACM mechanical pipe insulation
- ACM transite vapour board barrier

PROJECT: 25/55 St. Clair Avenue East
Toronto, Ontario
3rd Floor

Not to Scale

DATE: February 2011

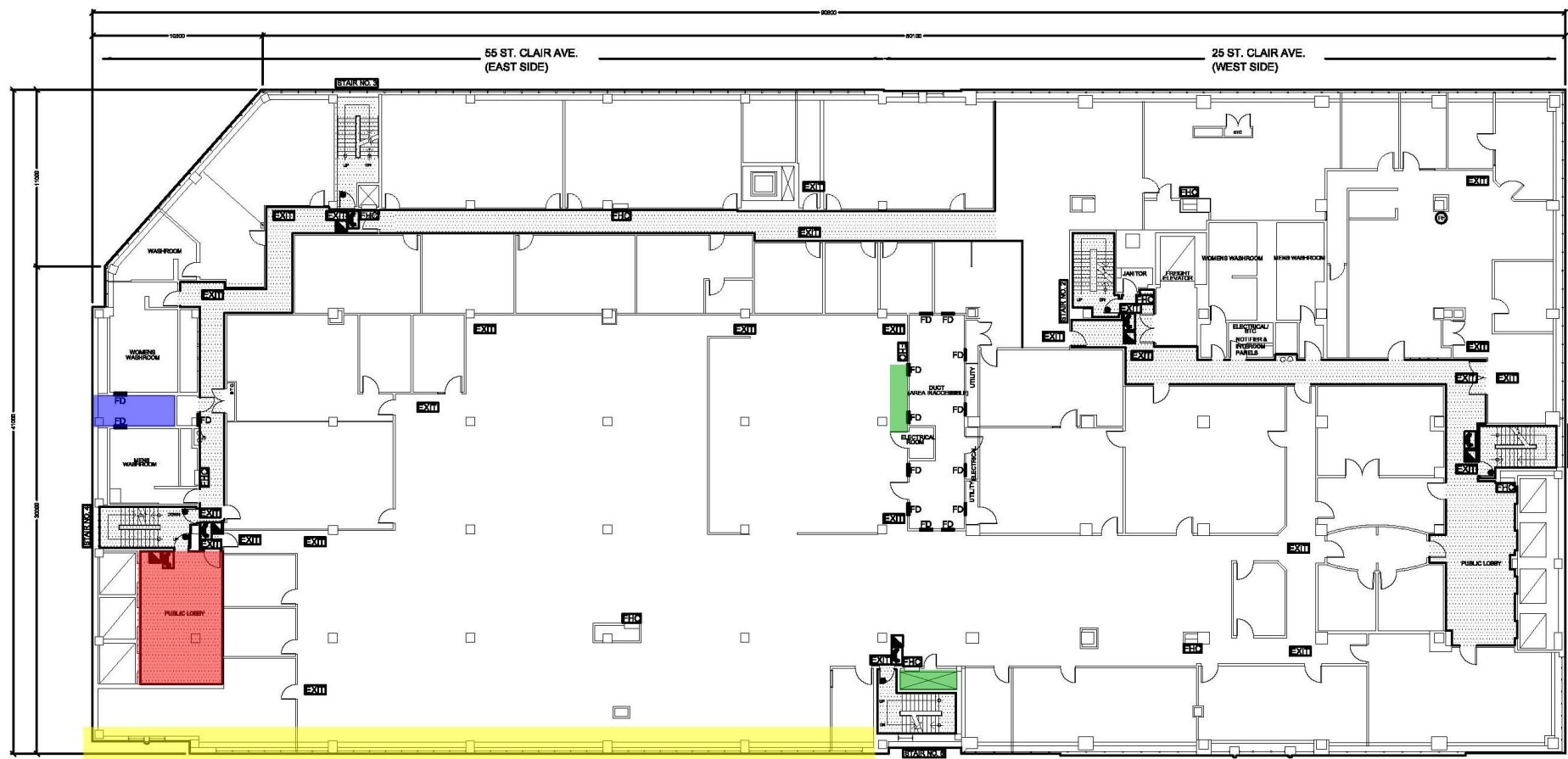
DRAWING BY: ML

PROJECT No. 150210

REVIEWED BY: DD



Safetech Environmental Limited
#14 - 3045 Southcreek Rd
Mississauga, ON L4X2X7



4th FLOOR FIRE EVACUATION PLAN
SCALE: 1:300

Note: ACM drywall joint compound is present throughout building and ACM mechanical insulation is present within columns throughout building.

Although efforts were made to confirm the presence of asbestos-containing vinyl floor products and mastics throughout, these materials may be present beneath carpets throughout the building and should be assumed to contain asbestos unless sampling proves otherwise or historic records can confirm the areas have been abated.

LEGEND:

- Concealed ACM mechanical pipe insulation
- ACM mechanical duct tape insulation
- ACM transite vapour board barrier
- ACM texture coat

PROJECT: 25/55 St. Clair Avenue East
 Toronto, Ontario
 4th Floor

Not to Scale

DATE: February 2011

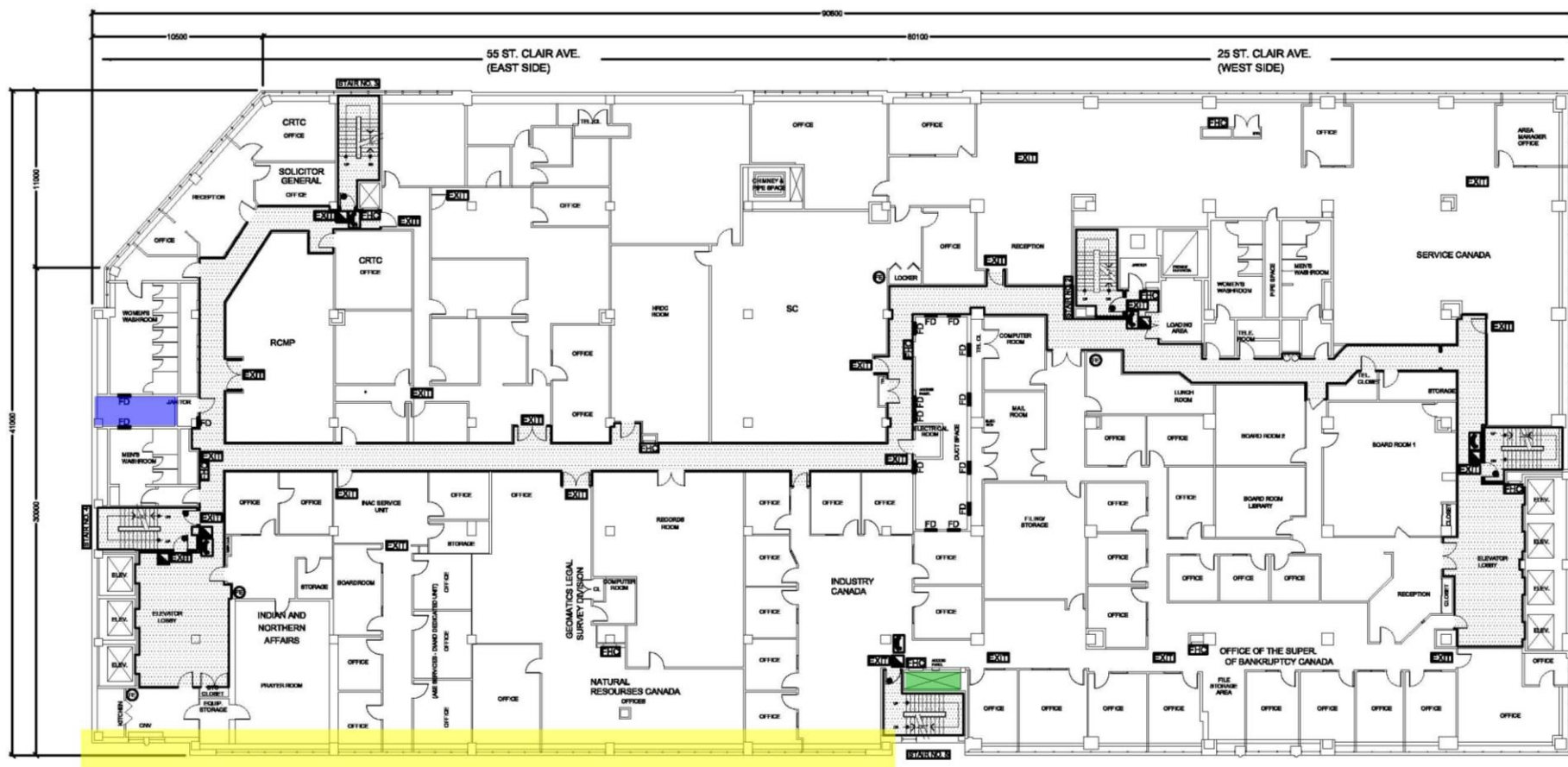
PROJECT No. 150210

DRAWING BY: ML

REVIEWED BY: DD



Safetech Environmental Limited
 #14 - 3045 Southcreek Rd
 Mississauga, ON L4X2X7



6th FLOOR FIRE EVACUATION PLAN - CROSSOVER FLOOR
SCALE: 1:300

Note: ACM drywall joint compound is present throughout building and ACM mechanical insulation is present within columns throughout building.

Although efforts were made to confirm the presence of asbestos-containing vinyl floor products and mastics throughout, these materials may be present beneath carpets throughout the building and should be assumed to contain asbestos unless sampling proves otherwise or historic records can confirm the areas have been abated.

LEGEND:

- Concealed ACM mechanical pipe insulation
- ACM mechanical duct tape insulation
- ACM transite vapour board barrier

PROJECT: 25/55 St. Clair Avenue East
 Toronto, Ontario
 6th Floor

Not to Scale

DATE: February 2011

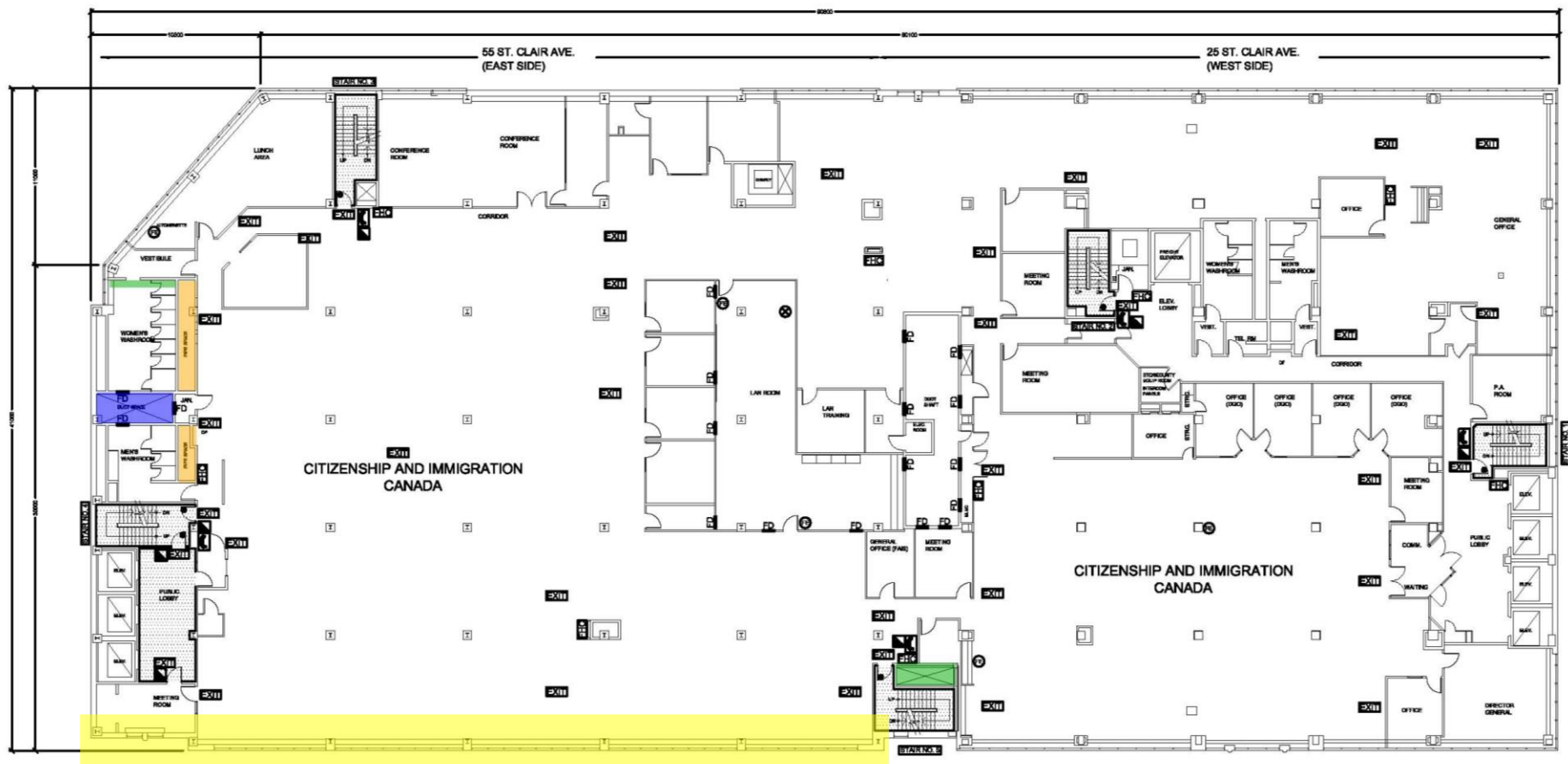
DRAWING BY: ML

PROJECT No. 150210

REVIEWED BY: DD



Safetech Environmental Limited
 #14 - 3045 Southcreek Rd
 Mississauga, ON L4X2X7



7th FLOOR FIRE EVACUATION PLAN
SCALE: 1:300

Note: ACM drywall joint compound is present throughout building and ACM mechanical insulation is present within columns throughout building.

Although efforts were made to confirm the presence of asbestos-containing vinyl floor products and mastics throughout, these materials may be present beneath carpets throughout the building and should be assumed to contain asbestos unless sampling proves otherwise or historic records can confirm the areas have been abated.

LEGEND:

- Concealed ACM mechanical pipe insulation
- ACM mechanical duct tape insulation
- ACM transite vapour board barrier
- Suspect ACM debris

PROJECT: 25/55 St. Clair Avenue East
 Toronto, Ontario
 7th Floor

Not to Scale

DATE: February 2011

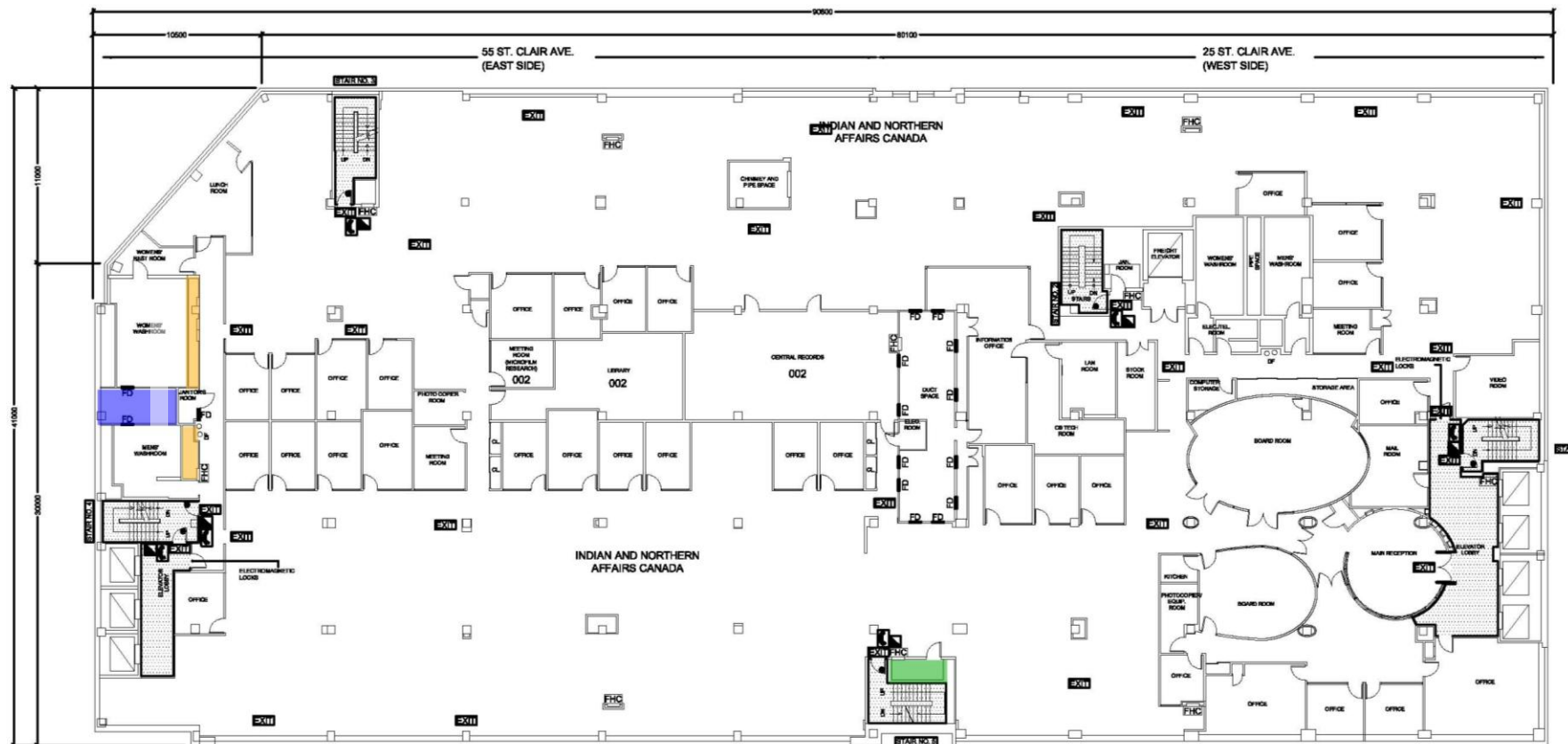
DRAWING BY: ML

PROJECT No. 150210

REVIEWED BY: DD



Safetech Environmental Limited
 #14 - 3045 Southcreek Rd
 Mississauga, ON L4X2X7



8th FLOOR FIRE EVACUATION PLAN
SCALE: 1:300

Note: ACM drywall joint compound is present throughout building and ACM mechanical insulation is present within columns throughout building.

Although efforts were made to confirm the presence of asbestos-containing vinyl floor products and mastics throughout, these materials may be present beneath carpets throughout the building and should be assumed to contain asbestos unless sampling proves otherwise or historic records can confirm the areas have been abated.

LEGEND:

- Concealed ACM mechanical pipe insulation
- ACM mechanical duct tape insulation
- Suspect ACM debris

PROJECT: 25/55 St. Clair Avenue East
 Toronto, Ontario
 8th Floor

Not to Scale

DATE: February 2011

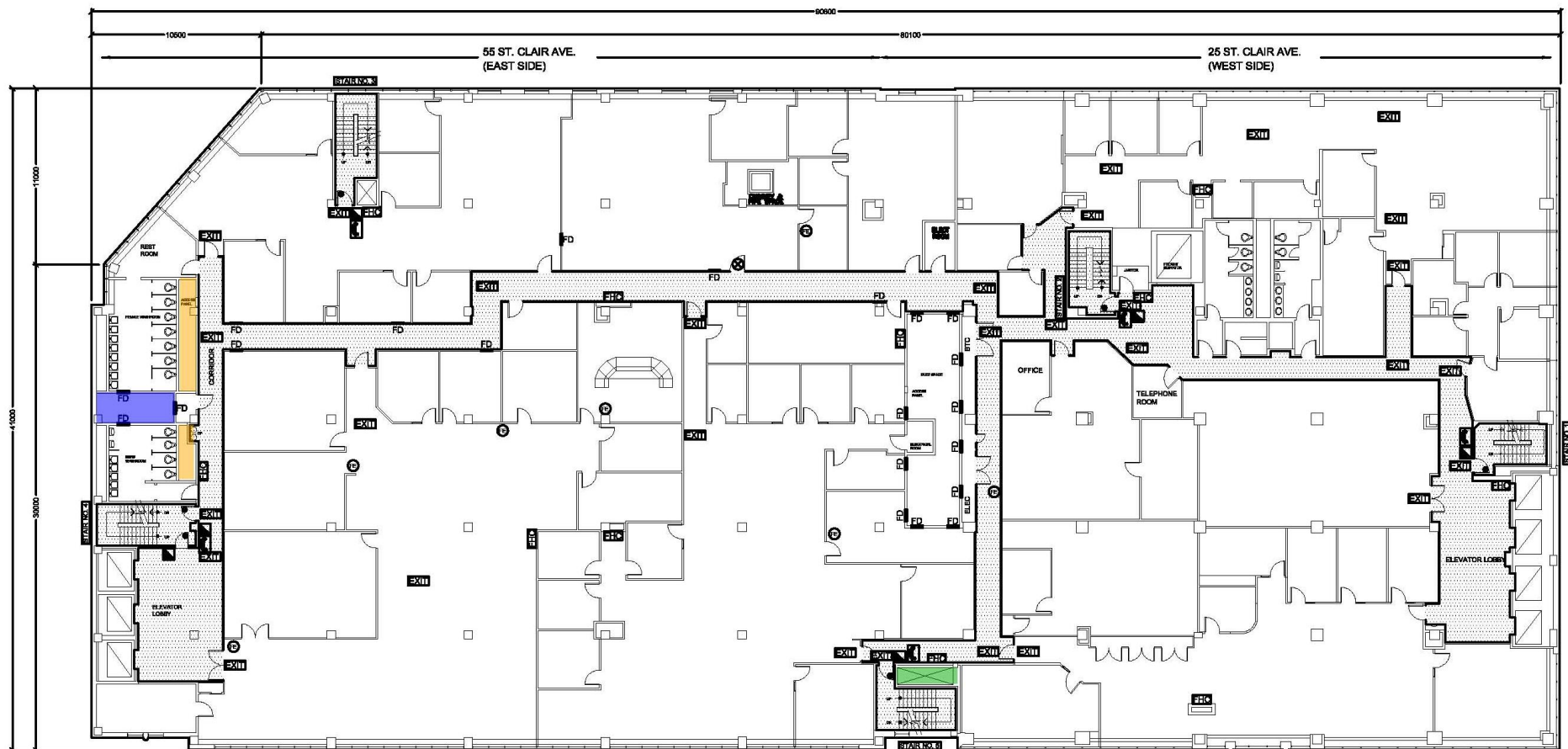
DRAWING BY: ML

PROJECT No. 150210

REVIEWED BY: DD



Safetech Environmental Limited
 #14 - 3045 Southcreek Rd
 Mississauga, ON L4X2X7



9th FLOOR FIRE EVACUATION PLAN - CROSSOVER FLOOR
SCALE: 1:300

Note: ACM drywall joint compound is present throughout building and ACM mechanical insulation is present within columns throughout building.

Although efforts were made to confirm the presence of asbestos-containing vinyl floor products and mastics throughout, these materials may be present beneath carpets throughout the building and should be assumed to contain asbestos unless sampling proves otherwise or historic records can confirm the areas have been abated.

LEGEND:

- Concealed ACM mechanical pipe insulation
- ACM mechanical duct tape insulation
- Suspect ACM debris

PROJECT: 25/55 St. Clair Avenue East
 Toronto, Ontario
 9th Floor

Not to Scale

DATE: February 2011

DRAWING BY: ML

PROJECT No. 150210

REVIEWED BY: DD



Safetech Environmental Limited
 #14 - 3045 Southcreek Rd
 Mississauga, ON L4X2X7



10th FLOOR FIRE EVACUATION PLAN
SCALE: 1:300

Note: ACM drywall joint compound is present throughout building and ACM mechanical insulation is present within columns throughout building.

Although efforts were made to confirm the presence of asbestos-containing vinyl floor products and mastics throughout, these materials may be present beneath carpets throughout the building and should be assumed to contain asbestos unless sampling proves otherwise or historic records can confirm the areas have been abated.

LEGEND:

- Concealed ACM mechanical pipe insulation
- ACM mechanical duct tape insulation

PROJECT: 25/55 St. Clair Avenue East
 Toronto, Ontario
 10th Floor

Not to Scale

DATE: February 2011

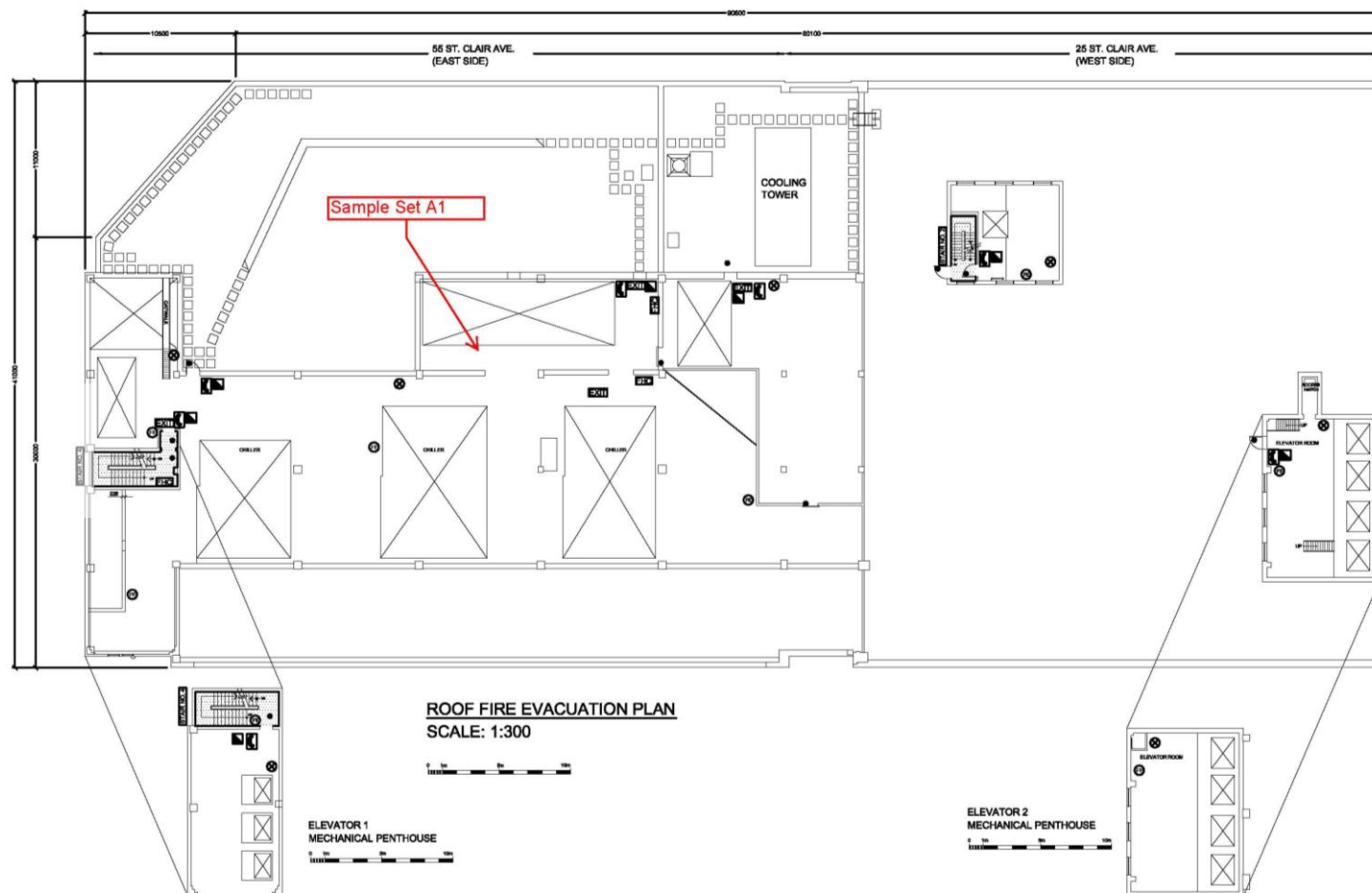
DRAWING BY: ML

PROJECT No. 150210

REVIEWED BY: DD




Safetech Environmental Limited
 #14 - 3045 Southcreek Rd
 Mississauga, ON L4X2X7



Note: ACM drywall joint compound is present throughout building and ACM mechanical insulation is present within columns throughout building.

Although efforts were made to confirm the presence of asbestos-containing vinyl floor products and mastics throughout, these materials may be present beneath carpets throughout the building and should be assumed to contain asbestos unless sampling proves otherwise or historic records can confirm the areas have been abated.

		PROJECT: 25/55 St. Clair Avenue East Toronto, Ontario Roof Plan		
LEGEND:				
<div>A#</div>	Bulk sample location	Not to Scale		Safetech Environmental Limited #14 - 3045 Southcreek Rd Mississauga, ON L4X2X7
		DATE: February 2011	DRAWING BY: ML	
		PROJECT No. 150210	REVIEWED BY: DD	

Safetech Environmental Limited
 #14 - 3045 Southcreek Rd
 Mississauga, ON L4X2X7

APPENDIX III

Photographs



Photograph 1: View of **asbestos-containing** mechanical pipe fitting and pipe insulation observed on mezzanine within Post Office Work Area.



Photograph 2: View of **damaged asbestos-containing** mechanical pipe fitting insulation observed on mezzanine of Post Office Work Area.



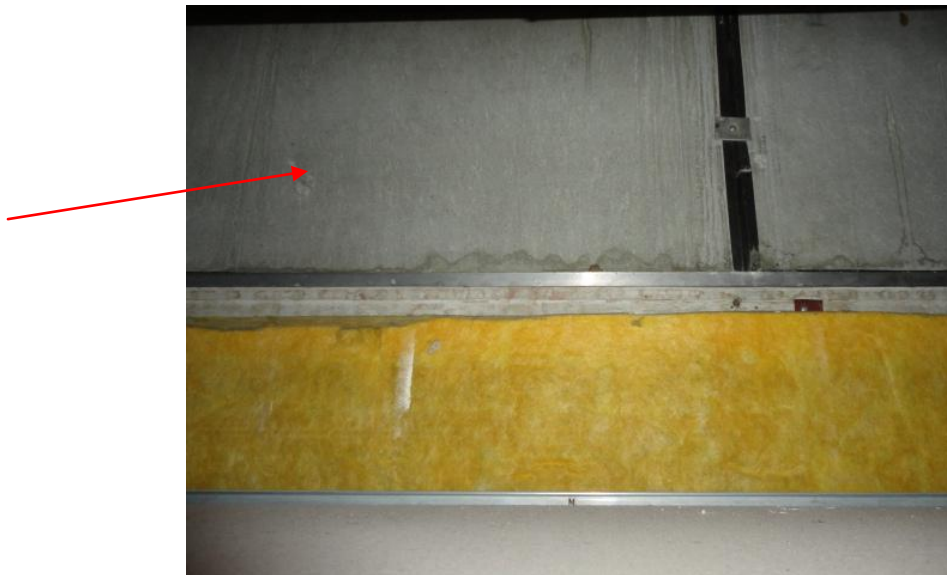
Photograph 3: View of **asbestos-containing** texture coat observed on ceiling within Post Office.



Photograph 4: View of **asbestos-containing** paper-like duct insulation tape observed to be repaired throughout duct riser adjacent to Stairwell E.



Photograph 5: View of **damaged asbestos-containing** mechanical pipe fitting insulation observed above ceiling on 5th floor within closet adjacent to duct and pipe riser.



Photograph 6: View of **asbestos-containing** transite vapour board barrier observed on North side of floors 3 to 7.



Photograph 7: View of **asbestos-containing** texture coat observed on 4th floor Elevator Lobby.



Photograph 8: View of non asbestos sprayed fireproofing and hand patching observed on structural beams within Mechanical Penthouse.



Photograph 9: View of non asbestos sprayed fireproofing observed on structural beams within renovated floors of surveyed building.



Photograph 10: Typical view of non-asbestos mechanical insulation observed within duct and pipe risers located south of Stairwell E.



Photograph 11: Typical view of *suspect asbestos-containing* debris observed within pipe chases within east washrooms.



Photograph 12: View of *suspect asbestos-containing* mechanical pipe fitting insulation observed within the Parking Garage.



Photograph 13: View of *suspect asbestos-containing* green flooring observed within the Post Office Work Area.



Photograph 14: View of non-asbestos 1x1 ceiling tiles (and associated mastic) observed above lay-in tiles within Post Office Work Area.



Photograph 15: View of *suspect asbestos-containing* vinyl sheet flooring observed within closets adjacent to duct and pipe risers within surveyed building.

HAZARDOUS BUILDING MATERIALS REASSESSMENT

Floors 2-9 - Mechanical Areas, Pipe Shafts, Elevator Shafts, Elevator Penthouse

25/55 St. Clair Avenue East
Toronto, Ontario
M4T 1 M2

Issued: August 21st, 2012

Prepared for:

Mr. Jeff Gorman
SNC-Lavalin Operations & Maintenance Inc.
25 St. Clair Avenue East, Suite 906
Toronto, Ontario
M4T 1M2

Performed by:

Safetech Environmental Limited



Steve March, AMRT
OH & S Technician

Reviewed By:



D. Glenn Smith, B.Sc. (HE), CRSP, AMRT
Senior Project Manager

SEL Project Number 143112

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EXECUTIVE SUMMARY

Safetech Environmental Limited was retained by SNC-Lavalin Operations & Maintenance Inc. to conduct a Hazardous Building Materials Survey located at 25/55 St. Clair Avenue East, Toronto, Ontario. The survey was conducted from July 30th to August 1st and on August 9th, 2012, and included select accessible mechanical areas (Floors 2 to 9, Elevator Shafts & Elevator Machine Rooms) of the facility. Each mechanical area has been assigned a location number for reference, refer to Appendix III - Drawing. The facility investigated encompasses approximately 350,000 ft² of floor space. The objective of this study was to determine whether any hazardous building materials, including designated substances, as defined under the Ontario Occupational Health and Safety Act, were present in the above noted property specific to the project locations. The assessment included a survey of all accessible areas to determine the presence of designated substances and assessing requirements for any further investigation or remedial action, if necessary.

Results of our survey findings are summarized below:

- **Asbestos-Containing Materials** (ACM) were noted to be present within select mechanical areas in the form of suspect sprayed fireproofing debris, mechanical pipe insulation, mechanical pipe insulation debris, mechanical pipe fitting insulation, mechanical pipe insulation debris, stucco finishes, transite cement board, vinyl floor tiles, HVAC flex connections, window caulking and drywall joint compound. For demolition projects, removal of asbestos-containing materials must be conducted in accordance with Ontario Regulation 278/05, *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations* - made under the Occupational Health and Safety Act. Asbestos - containing waste has to be handled and disposed of according to Ministry of Environment, Regulation 347/90 as amended – made under the Environmental Protection Act for disposal of hazardous waste

Based on the investigation conducted by SEL, the following Table I summarizes all the ACM identified within surveyed areas of the facility.

TABLE I
Summary of Asbestos Containing Materials
25/55 St. Clair Avenue East
Toronto, Ontario
July 30th – August 1st, 2012

Location Description	Material	Quantity	Condition	Type(s) of Asbestos	Friable (Y/N)	Photograph
Throughout building	Drywall joint compound	-	Good	Chrysotile	N	-
Floors 2-9 Mechanical Pipe Shaft (Closet/Electrical Room) Area 11	Vinyl floor tiles**	-	Good	Chrysotile	N	1 & 2
Floors 2-9 Pipe Shaft Areas 4, 6, 7, 8, 9, 10, 12, 13, 15, 16, 18, 19	Sprayed Fireproofing Debris*	-	-	Suspect Chrysotile	Y	-
Floors 2-9 Pipe Shaft Areas 1, 2, 10, 11, 14, 16, 18	Mechanical pipe and pipe fitting insulation, debris*	-	Poor	Chrysotile	Y	11, 12, 13, 14 & 15
Floors 2-9 Mechanical HVAC Shaft Area 20	HVAC Duct Insulation	-	Good	Chrysotile	Y	-
Elevator Machine Rooms	Window Caulking**	-	Good	Suspect Chrysotile	N	19
4 th Floor, East Elevator Lobby	Texture coat on ceiling	-	Good	Chrysotile	Y	7
6 th Floor, North wall (east side)	Transite cement board vapour barrier	~300 square feet	Good	Suspect Chrysotile	N	6
7 th Floor, North wall (east side)	Transite cement board vapour barrier	~300 square feet	Good	Chrysotile	N	-

*Asbestos -containing insulation assumed to be present within inaccessible pipe shafts within columns, above plaster ceilings , and within pipe/duct chase between east washrooms.

**Material not sampled (either not accessible or reported as asbestos-containing in previous reassessment) thus assumed to be asbestos containing unless sampling proves otherwise.

- **Silica** (including free crystalline silica) may be a component of ceiling tiles and gypsum board, and concrete and brick surfaces noted in the investigated areas. Testing for silica in these materials was not conducted. Exposure to airborne silica is regulated under Ontario Regulation 490/09, respecting Silica - made under the Occupational Health and Safety Act. For construction related projects, Ministry of Labour guideline *"Silica on Construction Projects"* (April 2011) should be followed. Precautions must be taken to prevent silica-containing particles from becoming airborne during the disturbance of these materials through renovation or demolition projects.
- **Lead** was identified in various types of paints located throughout the surveyed areas via confirmatory bulk sampling results. Paints tested within the surveyed facility were found to have lead content levels above 0.009% lead content by weight. A summary of the paints and their associated lead concentrations can be found in Table III in section 2.1.2. Paints observed in the surveyed area that are similar in colour to the paints listed in Table III, should be assumed to have the same lead concentrations unless proven otherwise. Lead may be present as a component in pipes and in solder used in pipe fittings. Prior to renovations and/or demolition activities that may disturb materials identified to contain lead, specifications for individual projects should follow the *Ministry of Labour Guideline regarding Lead on Construction Projects (April 2011)* to ensure worker safety and prevent exposure to building occupants.
- **Mercury** may be present within old thermostat control switches identified during the survey. In addition, mercury may also be present in the form of mercury vapour within fluorescent light tubes where present. Testing for mercury was not conducted during this assessment. Exposure to airborne mercury is regulated under Ontario Regulation 490/09, respecting Mercury - made under the Occupational Health and Safety Act. Mercury waste has to be handled and disposed of according to Ministry

of Environment Regulation 347/90 as amended – made under the Environmental Protection Act for disposal of hazardous waste and may be subject to Leachate Criteria (Schedule 4) of this Regulation.

- Suspect hazardous building material(s) and/or designated substances not identified within this survey that are uncovered during renovation/demolition activities (i.e. asbestos), should be properly assessed by qualified person prior to disturbance.

This executive summary must be reviewed with the main survey report.

Safetech Environmental Limited



Steve March, AMRT
OH & S Technician

August 21st, 2012

SNC-Lavalin Operations & Maintenance Inc.
25 St. Clair Avenue East, Suite 906
Toronto, Ontario
M4T 1M2

Attention: Mr. Jeff Gorman

**RE: Hazardous Building Materials Reassessment – Mechanical Areas, Floors 2-9
25/55 St. Clair Avenue East, Toronto, Ontario**

1.0 INTRODUCTION

On July 30th to August 1st and on August 9th, 2012 personnel from Safetech Environmental Limited (SEL) performed a hazardous building materials reassessment of project specific mechanical areas on Floors 2-9 of the facility located at 25/55 St. Clair Avenue East, Toronto, Ontario, to determine the presence, quantity, forms, and conditions of designated substances present. This assessment was performed at the request of Mr. Jeff Gorman, for SNC-Lavalin Operations & Maintenance Inc.

The survey included a review of Floors 2 to 9 Mechanical areas, Elevator Shafts and Elevator Machine Rooms within the facility for the presence and extent of hazardous materials, including the type and degree of possible exposure, and assessing requirements for any further investigation or remedial action, if necessary. The survey addressed only accessible areas of the facility. No destructive testing was performed.

Under Section 30 of the Occupational Health and Safety Act RSO 1990 c. 0.1, a building owner must determine if there are any hazardous materials on site prior to construction or demolition activity. Hazardous Materials or "Designated Substances" are a list of eleven organic and inorganic contaminants defined in the Act. The building owner must provide a list of hazardous materials present on site to contractors and subcontractors during the bidding process. An owner who fails to comply with Section 30 is liable to the constructor and every contractor and subcontractor who suffers any loss or damages due to non-compliance.

Identification of suspect building materials was performed by conducting appropriate laboratory analysis of bulk samples of suspect material. Other designated substances such as mercury or silica, if present, were identified by observation only. Individual assessments were made to identify designated substances and their condition and requirements for special treatment such as control programs or specialized removal and disposal techniques. In conjunction with the survey for designated substances, the presence of Polychlorinated Biphenyl's (PCBs) in fluorescent light fixture ballasts, ozone depleting substances, and other potentially hazardous materials associated with the building were noted.

This report documents findings of our on-site inspection. Sampling was carried out only for those compounds that were known to be present or those deemed to have a likely source of origin in the area under study. Survey Methodologies carried out for the investigation are outlined within Appendix I.

2.0 FINDINGS

Area Description

Typical building construction consists of precast concrete slab floors, cinderblock walls, and precast concrete slab deck. The facility investigated encompasses approximately 350,000 ft² of floor space.

2.1 Designated Substances

The following is a list which includes observations for any designated substances that were present and/or suspected in the surveyed areas. The survey primarily focused on building materials; however designated substances may exist within equipment of various operations on site. Survey reports were used as a reference to identify previously recorded asbestos containing materials (ACM) noted within the facility.

2.1.1 Asbestos-Containing Materials

Laboratory Certificates of Analysis detailing results of bulk samples collected during the last re-assessment are attached in Appendix II with results summarized in Table II below.

TABLE II
Summary of Previously Confirmed Asbestos Bulk Sample Analytical Results
25/55 St. Clair Avenue East
Toronto, Ontario
January 13th, 2011

Sample #	Location	Sample Description	Asbestos Content
A1a	Mechanical Penthouse	Sprayed fireproofing hand patch	ND
A1b	Mechanical Penthouse	Sprayed fireproofing hand patch	ND
A1c	Mechanical Penthouse	Sprayed fireproofing hand patch	ND
A2a	Mechanical Penthouse	Sprayed fireproofing on beam	ND
A2b	Mechanical Penthouse	Sprayed fireproofing on beam	ND
A2c	Mechanical Penthouse	Sprayed fireproofing on beam	ND

ND – Not Detected

Summary of Asbestos Bulk Sample Analytical Results
25/55 St. Clair Avenue East
Toronto, Ontario
July 30th – August 1st, 2012

Sample #	Location	Sample Description	Asbestos Content
01A	5 th Floor Location 10 (Pipe Shaft Column)	Mechanical Pipe Insulation	50% Chrysotile
01B	5 th Floor Location 10 (Pipe Shaft Column)	Mechanical Pipe Insulation Debris	50% Chrysotile
01C	9 th Floor Location 16 (Pipe Shaft Column)	Mechanical Pipe Insulation	50% Chrysotile
02A	5 th Floor Location 2 (Men's Washroom Pipe Shaft)	Mechanical Pipe Insulation Debris	70% Chrysotile
02B	5 th Floor Location 2 (Men's Washroom Pipe Shaft)	Mechanical Pipe Insulation Debris	70% Chrysotile
02C	5 th Floor Location 2 (Men's Washroom Pipe Shaft)	Mechanical Pipe Insulation Debris	70% Chrysotile
03A	5 th Floor Stairwell Location 3 (Pipe Shaft)	Mechanical Pipe Insulation, Black Sweatwrap	ND
03B	5 th Floor Stairwell Location 3 (Pipe Shaft)	Mechanical Pipe Insulation, Black Sweatwrap	ND
03C	5 th Floor Stairwell Location 3 (Pipe Shaft)	Mechanical Pipe Insulation, Black Sweatwrap	ND
04A	3 rd Floor Location 11 (Pipe Shaft)	Mechanical Pipe Insulation Debris	35% Chrysotile
04B	4 th Floor Location 11 (Pipe Shaft)	Mechanical Pipe Insulation Debris	35% Chrysotile
04C	5 th Floor Location 11 (Pipe Shaft)	Mechanical Pipe Insulation Debris	35% Chrysotile
04D	6 th Floor Location 11 (Pipe Shaft)	Mechanical Pipe Insulation Debris	35% Chrysotile
04E	7 th Floor Location 11 (Pipe Shaft)	Mechanical Pipe Insulation Debris	35% Chrysotile
05A	5 th Floor Location 20	HVAC Duct Insulation	15% Chrysotile
05B	5 th Floor Location 20	HVAC Duct Insulation	15% Chrysotile
05C	5 th Floor Location 20	HVAC Duct Insulation	15% Chrysotile
06A	5 th Floor Location 7 (Pipe Shaft)	Sprayed Fireproofing (Accessible at top of Column)	ND
06B	5 th Floor Location 7 (Pipe Shaft)	Sprayed Fireproofing (Accessible at top of	ND

Sample #	Location	Sample Description	Asbestos Content
		Column)	
06C	5 th Floor Location 7 (Pipe Shaft)	Sprayed Fireproofing (Accessible at Pipe)	ND
06D	5 th Floor Location 7 (Pipe Shaft)	Sprayed Fireproofing (Accessible at Pipe)	ND
06E	5 th Floor Location 7 (Pipe Shaft)	Sprayed Fireproofing (Accessible at Deck)	ND
06F	5 th Floor Location 7 (Pipe Shaft)	Sprayed Fireproofing (Accessible at Deck)	ND
06G	5 th Floor Location 7 (Pipe Shaft)	Sprayed Fireproofing (Accessible at Deck)	ND

ND – Not Detected

The following building materials (if present) were inspected.

Sprayed Applied Fireproofing and Insulation

Sprayed fireproofing and hand patching material observed on structural beams within the Mechanical Penthouse were previously sampled (2011) and were identified as non-asbestos.

Sprayed fireproofing material observed at 5th Floor Location 7 (Pipe Shaft, Deck & Mechanical Pipe) were sampled (Sample Set 06) and analyzed for asbestos content using the PLM method of detection. The samples were found to not contain asbestos. However, asbestos-containing spray fireproofing material may be uncovered in inaccessible locations (i.e. wall cavities, pipe shafts, columns) where major renovations have not been conducted or that were not accessed during previous abatement projects.

Thermal Systems Insulation (TSI)

Asbestos-containing mechanical pipe insulation debris was observed to be present within pipe shaft Locations 2, 10, 11, 14, specifically Floors 2 to 9. Accessible material was observed to be in poor condition. Please see Sample #'s 01B, 02A, 02B, 02C, 04A to 04E.

Asbestos-containing mechanical pipe insulation was observed to be present within mechanical pipe shaft Locations 1, 10, 14, 16 & 20, specifically Floors 2 to 9. Accessible material was observed to be in poor condition. Please see Sample #'s 01A & 01C.

Remaining mechanical insulation within the surveyed area were either non-insulated or insulation observed was visually identified to be a material not suspected to contain asbestos (i.e. fibreglass) and thus not sampled.

HVAC duct insulation observed within 5th Floor duct shaft Location 20 adjacent to the Stairwell was sampled (Sample Set 05) and analyzed for asbestos content using the PLM

method of detection. The samples were found to contain asbestos. Accessible material was observed to be in good condition.

Remaining mechanical duct insulation within the surveyed area were either non-insulated or insulation observed was visually identified to be a material not suspected to contain asbestos (i.e. fibreglass) and thus not sampled

No other mechanical insulations were observed within surveyed areas of the facility.

Architectural Finishes

Sprayed Textured/Stucco Finishes

Asbestos-containing sprayed textured stucco finishes were noted within the project specific 4th Floor Elevator Lobby work area, noted in Good Condition.

Plaster Finishes

Plaster finishes were previously sampled and found not to contain asbestos.

Drywall Joint Compound

Drywall joint compound was previously sampled and found to contain Chrysotile asbestos. The material is present throughout project specific locations and was noted to be in Good Condition.

Ceiling Tiles

Various 2x4 ceiling tiles were previously sampled and found not to contain asbestos.

Remaining 2'x4' ceiling tiles were observed to have manufacturer date stamps on the backside of the ceiling tile indicating that the material was installed within the last ten years. As such, these ceiling tiles are not suspected to contain asbestos and not sampled.

As reported by SNC Lavalin O&M, 1'x1' ceiling tiles (and associated mastic) observed within the facility (adhered to the concrete deck), were previously sampled and analyzed for asbestos content using the PLM method of detection. The samples were found not to contain asbestos.

Vinyl Floor Tiles

Various types of vinyl floor products were observed throughout the surveyed building. Vinyl flooring materials were not sampled and thus are assumed to be asbestos-containing unless sampling proves otherwise, or historic records can confirm that material has been removed as part of numerous renovations conducted throughout various floors.

Vinyl Sheet Flooring

Various types of vinyl floor products were observed throughout the surveyed building. Vinyl flooring materials were not sampled and thus are assumed to be asbestos-containing unless sampling proves otherwise, or historic records can confirm that material has been removed as part of numerous renovations conducted throughout various floors.

Other

Asbestos cement board (i.e. transite) was present in the form of a vapour board barrier on the north east side of the building from the 3rd Floor to the 7th Floor. The material was observed to be in good condition.

HVAC flex connections observed within HVAC duct shafts were not sampled as the units were operational at the time of the assessment and thus are assumed to be asbestos-containing unless sampling proves otherwise.

Window caulking observed on windows within the Penthouse Elevator Machine Rooms were not sampled and thus are assumed to be asbestos-containing unless sampling proves otherwise, or historic records can confirm that material has been removed as part of numerous renovations conducted throughout various floors.

No other suspect asbestos-containing manufactured products were noted in the surveyed building.

2.1.2 Lead-Containing Material - Paints

To measure lead content in paints, representative paint samples were scraped down to the building base structure, with all possible layers present, and submitted to an independent laboratory for analysis. Results of the laboratory analysis for paint samples tested are detailed in Table III below, and laboratory certificate of analysis is attached in Appendix II.

TABLE III
Summary of Lead Bulk Analytical Results
25/55 St. Clair Avenue East
Toronto, Ontario
July 30th – August 1st, 2012

No. (LCP)	Location	Colour	Surface	Concentration Lead by Weight (%)
LP1	4 th Floor Stairwell Location 12	White	Plaster	1.1
LP2	3 rd Floor Stairwell Location 20	White	Plaster	0.83
LP3	6 th Floor Stairwell Location 12	Grey	Concrete	<0.009
LP4	8 th Floor Offices Location 18	White	Drywall	0.057

Paint samples collected (LP1, LP2 & LP4) were found to contain lead concentrations above 0.009% by weight and are considered to be lead-containing.

Lead may also be a component of pipes or in solder on pipe fittings, and glazing on ceramic tile surfaces.

2.1.3 Silica-Containing Materials

Silica (including free crystalline silica) may be a component of ceiling tiles and gypsum board, and may also be a component of concrete, brick, and mortar noted in the surveyed area.

2.1.4 Mercury-Containing Materials

Mercury fluid may be present within switches of Thermostatic controls observed within the facility. Mercury may be present in the form of mercury vapour within fluorescent light tubes, where present.

2.1.5 Other Designated Substances

2.1.5.1 Acrylonitrile

No source was identified. Acrylonitrile or ACN (also known as vinyl cyanide) is an explosive, flammable liquid used in the manufacture of acrylic fibres, rubber-like materials and pesticide fumigants.

2.1.5.2 Arsenic

No source was identified. Arsenic is used in metallurgy for hardening copper, lead and alloys, in pigment production, in the manufacture of certain types of glass, in insecticides, fungicides and rodenticides, as a by-product in the smelting of copper ores, and as a dopant material in semiconductor manufacturing.

2.1.5.3 Benzene

No source was identified. Benzene or benzol is a colourless liquid. It is used as an intermediate in the production of styrene, phenol, cyclohexane, and other organic chemicals, and in the manufacture of detergents, pesticides, solvents, and paint removers. It is also found in gasoline.

2.1.5.4 Coke Oven Emissions

Not applicable for the building surveyed.

2.1.5.5 Ethylene Oxide

No source was identified. Ethylene oxide is a colourless gas liquefying below 12°C. It is used generally as a fumigant and sterilizing agent for medical equipment.

2.1.5.6 Isocyanates

No source was identified. Isocyanates (HDI, MDI and TDI) are used in the production of polyurethane and as an elastomer in casting compounds, mastics, and textile coatings (IPDI).

2.1.5.7 Vinyl Chloride

No source was identified. Vinyl chloride, also known as chloroethylene, is a colourless gas but is usually handled as a liquid under pressure. It is used in the production of PVC resins and in organic synthesis.

2.2 Other Hazardous Materials

2.2.1 PCB-Containing Material

As reported by SNC Lavalin O&M, fluorescent light ballasts observed within the facility were recently retrofitted and thus are not suspected to contain PCB's.

Fluorescent light ballasts designated for removal should have serial numbers and date stamps accessed to determine if ballasts are PCB containing. For all Canadian General Electric ballasts ending in T the ballast capacitor may contain PCB's. The date code stamped on the back of the ballast housing or on the name plate may help to more accurately determine whether the ballast contains PCBs. Ballasts manufactured before March 1978 could potentially contain PCB capacitors.

A transformer and switchgear unit present within the Penthouse Mechanical Room was observed to be stamped with the date 2005, and therefore is considered to be non PCB-containing. Additionally, no liquid cooled transformers were observed within the facility.

No bulk sampling of suspected PCB-containing materials was performed during this assessment.

2.2.2 Ozone Depleting Substances (ODS's)

No samples of refrigerants were taken as part of this investigation. Based on the age of the HVAC equipment present within the facility, ODS's may be present in minor quantities as coolants in refrigeration and air conditioner units.

2.2.3 Mould Contaminated Building Materials

No visible mould contamination was noted within the surveyed areas of the facility.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 Asbestos-Containing Materials (ACM)

Based on the investigation conducted by SEL, Accessibility, Condition and Action (Priority) ratings, to determine remedial action plans specific to the facility's needs, were assigned for all asbestos-containing materials identified within the project specific surveyed area, and are summarized in the following Table V. References to Rating Criteria are detailed within Appendix I Survey Methodology, Sub-Section 1.1.1 Asbestos, under Assessment of Asbestos-Containing Materials.

TABLE V
Summary of Asbestos Containing Materials
25/55 St. Clair Avenue East, Toronto, Ontario
July 30th – August 1st, 2012

Location Description	Material	Quantity	Condition	Accessibility	Action	Friable (Y/N)
Throughout building	Drywall joint compound	-	Good	A	7	N
Floors 2-9 Mechanical Pipe Shaft (Closet/Electrical Room) Area 11	Vinyl floor tiles**	-	Good	A	7	N
Floors 2-9 Pipe Shaft Areas 4, 6, 7, 8, 9, 10, 12, 13, 15, 16, 18, 19	Sprayed Fireproofing Debris*	-	-	B, E	7	Y
Floors 2-9 Pipe Shaft Areas 1, 2, 10, 11, 14, 16, 18	Mechanical pipe and pipe fitting insulation, debris*	-	Poor	B, E	3	Y
Floors 2-9 Mechanical HVAC Shaft Area 20	HVAC Duct Insulation	-	Good	B, E	7	Y
4 th Floor, East Elevator Lobby	Texture coat on ceiling	-	Good	B	7	Y
Elevator Machine Rooms	Window Caulking**	-	Good	B	7	N
6 th Floor, North wall (east side)	Transite cement	~300 square	Good	B	7	N

Location Description	Material	Quantity	Condition	Accessibility	Action	Friable (Y/N)
	board vapour barrier	feet				
7 th Floor, North wall (east side)	Transite cement board vapour barrier	~300 square feet	Good	B	7	N

*Asbestos -containing insulation assumed to be present within inaccessible pipe shafts within columns, above plaster ceilings and within pipe/duct chases.

**Material not sampled (either not accessible or reported as asbestos-containing in previous reassessment) thus assumed to be asbestos containing unless sampling proves otherwise

Friable Asbestos-Containing Materials

Type 2 operations are recommended where entry is required within mechanical pipe shafts, columns and mechanical pipe chases where major renovations have not been conducted or that were not accessed during previous abatement projects.

Friable asbestos containing materials in Poor condition must be removed and/or repaired immediately following applicable asbestos abatement procedures. Friable asbestos-containing materials in Good condition can remain in place until major system upgrading, maintenance or demolition which could result in disturbance of this material. In the event the friable asbestos containing materials are removed, Type 3 operations apply as outlined in Ontario Regulation 278/05, Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations – made under the Ontario Occupational Health and Safety Act. Type 2 operations can be applied for the repair of friable materials or, removal of less than 1 square metre of friable asbestos containing materials. In addition, Type 2 Glove Bag operations can be applied for the removal of asbestos containing mechanical pipe insulation fittings as outlined in Ontario Regulation 278/05.

Non-Friable Asbestos-Containing Materials

Non-friable asbestos containing materials in Poor condition must be removed and/or repaired immediately following applicable asbestos abatement procedures. Non-friable asbestos-containing materials in Good condition can remain in place until major system upgrading, maintenance or demolition which could result in disturbance of this material.

As per O.Reg. 278/05, removal of non-friable ACM can be conducted following Type 1 operations; as long as the material can be removed without being broken, cut, drilled or otherwise similarly disturbed. If the material cannot be removed without it breaking or being similarly disturbed then the work should be conducted using non-powered hand tools and the material should be wetted to control the spread of dust. If the material cannot be wetted or if power tools attached to dust-collecting devices equipped with HEPA (high efficiency particulate aerosol) filters are used during removal or disturbance, then work should be performed following Type 2 operations. If non-friable materials are removed or disturbed using power tools that are not attached to dust-collecting devices that are equipped with HEPA filters then work should be conducted following Type 3 operations.

In accordance with O.Reg. 278/05, removal of less than 1 square metre of drywall where asbestos-containing drywall joint compound has been used can be conducted following Type 1 operations. If 1 square metre or more of drywall is removed where asbestos-containing drywall joint compound has been used then work should be conducted following Type 2 operations.

GENERAL

Building material(s) that are not detailed within this survey due to inaccessibility (i.e. behind solid ceilings and walls) during the time of the survey and/or are uncovered during renovation/demolition activities that are suspected to contain asbestos should be properly assessed by qualified person prior to their disturbance.

Due to potentially hazardous concealed conditions of pre-existing asbestos-containing spray fireproofing within original non-renovated locations of the subject building, utilize Type 2 asbestos abatement procedures for destructive/intrusive work conducted leading into wall and/or ceiling cavities of original building construction.

Asbestos removal work should be performed by a competent and qualified asbestos abatement contractor. It is recommended that all asbestos related work be subjected to inspection and air monitoring to ensure building occupants are safe from exposure.

Asbestos abatement work must be performed as outlined in Ontario Regulation 278/05. Asbestos-containing waste must be handled and disposed of according to Ontario Regulation 347, amended to O. Reg. 234/11 - General - Waste Management.

Regulation 278/05 requires regular inspections, at least annually, of all areas identified as having asbestos-containing materials. Any damaged or exposed items noted should be repaired or removed under the Operations and Maintenance program of the building's Asbestos Management Plan.

3.2 Lead-Containing Materials

Laboratory results presented in Table III indicate paint samples collected within the facility were found to contain lead concentrations above 0.009% by weight.

The Surface Coating Materials Regulation made under the Federal Hazardous Product Act lowered the allowable concentration of lead in paints for new consumer products to 0.06% lead content by weight (600 ppm) in 1993 to 0.009% lead content by weight (90 ppm) in June 2011. In our opinion the Surface Coating Materials Regulation is applicable and therefore the 90 ppm (0.009%) criteria is the appropriate guideline limit for demolition, renovation, and construction related activity. However, prior to any renovations or demolition activities that may disturb materials identified to contain lead of any concentration, precautions must be taken as described in Ontario Regulation 213/91 amend to 96/11, Regulations for Construction Projects – made under the Occupational

Health and Safety Act. This may include conducting an assessment of the potential exposure of airborne lead by a qualified person. Exposure to lead-containing materials is regulated under Ontario Regulation 490/09, *Designated Substance - Lead* - made under the Occupational Health and Safety Act. Care must be taken to prevent lead-containing particles from becoming airborne during the disturbance of lead-containing surfaces (i.e., during renovation or demolition projects). All lead abatement work must follow procedures outlined in the Guideline for Lead on Construction Projects, issued in April 2011 by the Occupational Health and Safety branch of the Ministry of Labour.

Lead may also be a component in solder on copper plumbing fixtures and in ceramic tile glazing.

Specifications for individual projects should follow the *Ministry of Labour Guideline regarding Lead on Construction Projects (April 2011)* to ensure worker safety and prevent exposure to building occupants. Care must be taken to prevent lead-containing dust and particles from becoming airborne during the disturbance of lead-containing painted surfaces during building renovations and demolition projects.

All lead-containing waste material has to be handled and disposed of according to Ministry of Environment Regulation 347/90 as amended – made under the Environmental Protection Act and may be subject to Leachate Criteria (Schedule 4) of this Regulation.

3.3 Silica-Containing Materials

Silica (including free crystalline silica) may be a component of ceiling tiles and gypsum board, and concrete and brick surfaces noted in the investigated areas.

Precautions must be taken to prevent silica-containing particles becoming airborne during disturbance of silica-containing surfaces such as during renovation or demolition projects. Exposure to airborne silica is regulated under Ontario Regulation 490/09 respecting Silica - made under the Occupational Health and Safety Act. For construction related projects, Ministry of Labour guideline "*Silica on Construction Projects*" (April 2011) should be followed.

3.4 Mercury-Containing Materials

Mercury fluid may be present within switches of Thermostatic controls observed within the facility. Mercury may be present in the form of mercury vapour within fluorescent light tubes, where present.

Precautions must be taken to prevent mercury vapours becoming airborne during renovations or building demolition. Exposure to airborne mercury is regulated under Ontario Regulation 490/09 respecting Mercury, made under the Occupational Health and Safety Act. All mercury-containing waste material must be handled and disposed of according to Ontario Regulation 347/90 as amended – made under the Environmental Protection Act and may be subject to Leachate Criteria (Schedule 4) of this Regulation.

3.5 Other Designated Substances

No other designated substances were identified as a component of building materials within the surveyed areas.

3.6 Other Hazardous Materials

3.6.1 PCB-Containing Materials

Newer T8 fluorescent light fixtures were identified within surveyed areas of the facility and internal ballasts are not suspected to contain PCB's.

No bulk sampling of suspected PCB-containing materials was performed during this assessment.

At the time of removal or replacement of transformers, capacitors and/or fluorescent light ballasts, the units should be inspected for PCB content. Fluorescent light ballasts designated for removal should have serial numbers and date stamps accessed to determine if ballasts are PCB containing. For all Canadian General Electric ballasts ending in T the ballast capacitor may contain PCB's. The date code stamped on the back of the ballast housing or on the name plate may help to more accurately determine whether the ballast contains PCBs. Ballasts manufactured before March 1978 could potentially contain PCB capacitors.

All PCB waste must follow requirements of Ontario Regulation 362 Waste Management PCB's, amended to 232/11.

3.6.2 Ozone Depleting Substance (ODS's)

As stated above in 2.2.2 no samples of refrigerants were taken as part of this investigation. Based on the age of the equipment present ODS's are suspected to be present in minor quantities as coolants in refrigeration and air conditioner units. Standard requirements regarding leaks and/or draining of equipment prior to removal of equipment must follow Ontario Regulation 463/10 Refrigerants.

3.6.3 Mould

No mould contaminated building materials were noted within the surveyed area.

In the event that mould contaminated building materials are uncovered during demolition, precautions should be taken to prevent mould spores from becoming airborne during demolition activity in order to protect workers. Workers should exercise caution and follow precautions and protection procedures detailed in the Environmental Abatement Council of Ontario's Mould Abatement Guidelines and Canadian Construction Association (CCA) document 82 on mould. Should any of the buildings be scheduled for demolition it is

important that demolition workers implement the use of personal protective equipment during demolition activities in accordance with EACO and CCA documents should be followed.

Surface growth on non-porous surfaces is easily cleaned up, in most cases using mild detergent, and can be addressed as part of routine building maintenance activity. In areas with high humidity such as heated swimming pool rooms, it is not unusual to have minor surface mould growth occurring. Such areas should be cleaned up as soon as identified. It is important to identify the source of moisture and implement procedures to minimize mould growth

3.6.4 General

Building material(s) that are not detailed within this survey due to inaccessibility during the time of the survey and/or are uncovered during renovation/demolition activities, notably materials that are suspected to contain asbestos, should be properly assessed by qualified person prior to their disturbance.

4.0 LIMITATIONS

The information and recommendations detailed in this report were carried out by trained professional and technical staff in accordance with generally accepted environmental and industrial hygiene work practices and procedures. Recommendations provided in this report have been generated in accordance with accepted industry guidelines and practices. These guidelines and practices are considered acceptable as of the date of this report.

In preparation of this report, Safetech Environmental Limited (SEL) relied on information including testing services provided by independent laboratories. Except as expressly set out in this report, SEL has not made any independent verification of this information provided by independent entities.

The collection of samples at the location noted was consistent with the scope of work agreed-upon with the person or entity to whom this report is addressed and the information obtained concerning prior site investigations. As conditions between samples may vary, the potential remains for the presence of unknown additional contaminants for which there were no known indicators.

Conclusions are based on site conditions at the time of inspection and can only be extrapolated to an undefined limited area around inspected locations. The extent of the limited area depends on building construction and conditions. SEL cannot warrant against undiscovered environmental liabilities. If any information becomes available that differs from the findings in this report, we request that we be notified immediately to reassess the conclusions provided herein.

No other person or entity is entitled to use or rely upon this report without the express written consent of Safetech Environmental Limited and the person or entity to who it is addressed. Any use that a third party makes of this report, or any reliance based on conclusions and recommendations made, are the responsibility of such third parties. SEL accepts no responsibility for damages suffered by third parties as a result of actions based on this report.

APPENDIX I
SURVEY METHODOLOGY

1.0 SURVEY METHODOLOGY

1.1 Sampling Methodologies

Not all compounds classified as designated substances were sampled. As such, positive identification of suspect substances, using bulk sampling and laboratory analysis, was conducted only for suspect lead and asbestos-containing materials. Other materials were identified by observation only.

Sample analyses were performed by independent laboratories. Details of laboratory analyses are listed in Appendix I. Materials similar in appearance or texture to others tested were considered to be of similar composition.

Destructive testing was not performed during this investigation. Locations of identified ACM have been detailed in this report where access was readily available. Inaccessible areas such as above solid/drywall ceilings, within walls, enclosed mechanical shafts, enclosed bulkheads and pipe chases were not investigated. However, details regarding the possible presence of ACM were provided on a case by case basis. Similarly, motors, blowers, electrical panels, etc., were not de-energized or disassembled to examine concealed conditions. Such items should be considered to have asbestos as a component until proven otherwise.

Boilers were frequently constructed (i.e. lined, bedded, etc.) with asbestos refractory materials. Demolition and/or renovations to existing boiler units which may elicit a disturbance of suspect ACM's should necessitate prior investigation to determine for the presence of ACM's. In addition, fire doors that may be present in the surveyed areas were not tested intrusively and therefore should be considered to contain ACM's until proven otherwise. Further examples of such assumptions include: elevator brakes, roofing felts and mastics, caulking, high voltage wiring, mechanical packing and gaskets, and underground services or piping.

1.1.1 Asbestos

Samples of suspect asbestos-containing materials were retrieved for analysis during the survey. Bulk samples were retrieved from homogeneous materials that were suspected to potentially contain asbestos, and placed in zip-lock polyethylene storage bags for transportation to an independent accredited laboratory for analysis.

The appropriate numbers of bulk samples were taken for each set of suspect materials based on the minimum sample requirements outlined in O. Reg. 278/05 and summarized in Table I within Appendix I.

As specified in O. Reg. 278/05 the analysis procedure employed is US EPA Method 600/R-93/116 for the determination of asbestos in suspect materials. Identification is made using polarized light microscopy (PLM), with confirmation of presence and type of asbestos made by dispersion staining optical microscopy.

Building materials that were visually similar to materials previously tested were considered to have consistent content and were not re-sampled. Additional sampling was only conducted where the investigator believed a need existed.

Asbestos-containing materials were used widely throughout Canada and other countries of the world during the 1900's. This naturally occurring mineral was used in building construction for its thermal properties, electrical conductivity and its ability to withstand chemical breakdown. This fibrous material when inhaled over a long period of time can lead to adverse health effects such as asbestosis, lung cancer and mesothelioma. Building materials with bound asbestos or asbestos that is in good condition often pose little danger of releasing airborne fibres unless physically damaged (drilled, cut, sawn, ground or sanded).

An important factor when assessing the potential hazard associated with asbestos is its degree of friability. Ontario Regulation 278/05 defines friability as "material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled pulverized or powdered". This assessment identified all friable and non-friable material noted in the building.

Friable asbestos-containing materials have been banned from use in Ontario. The most common friable ACM include sprayed fireproofing and sprayed thermal insulation (ceased use circa 1973), sprayed acoustic texture coat finishes - stucco (ceased use circa 1982), and mechanical thermal system insulation (TSI) (ceased use circa 1981).

Non-friable ACM include vinyl floor tile - VAT (ceased use circa 1982), vinyl sheet flooring - VSF (ceased use circa 1982), floor adhesives (ceased use circa 1992), acoustic ceiling tile (ceased use circa 1982), plaster finishes (ceased use circa 1960's), drywall joint compound (ceased use circa 1980), roofing materials (ceased use circa 1991), and asbestos cement sheeting, piping, and gasketing material that may still be in use today.

Assessment of Asbestos-Containing Materials

Accessibility, Condition and Action (Priority) ratings for individual items, or defined areas were developed by SEL to determine remedial action plans specific to the facility's needs. The rating criteria for each of these items is further detailed below.

Accessibility Rating

Accessibility, Condition and Action (Priority) ratings for individual items, or defined areas were developed by SEL to determine remedial action plans specific to the facility's needs. The rating criteria for each of these items is further detailed below.

Accessibility has been assessed as: (A) Accessible to all non-maintenance occupants of the building; (B) Accessible to maintenance staff without a ladder; (C) Accessible to maintenance staff with a ladder and exposed to view without moving a building component; (D) Accessible to maintenance staff with a ladder and concealed from view due to a building component; (E) Not accessible without demolition or removal of fixed building components or building systems.

Condition Ratings

I. **Sprayed Applied Fireproofing, Insulation and Texture Finishes**

To evaluate the condition of asbestos-containing surfacing materials such as fireproofing, non-mechanical thermal insulation, and texture finishes the following criteria was applied:

Good condition would indicate the following:

Surface of material shows no significant signs of damage, deterioration, or delamination. Up to 1 percent visible damage to surface is allowed. Evaluation of sprayed materials requires the surveyor to be familiar with the typical irregular surface texture as installed. GOOD condition includes unencapsulated or unpainted fireproofing or texture finishes, where no delamination or damage is observed, and encapsulated fireproofing or texture finishes where the encapsulation has been applied after the damage or fallout occurred.

Fair condition rating is not utilized in the evaluation of the fireproofing, non-mechanical insulation, or texture coat finishes. These materials are only classified as in Good or Poor condition.

Poor condition would indicate the following:

Sprayed materials show signs of damage, delamination, or deterioration. More than 1% damage to surface of ACM spray.

In observation areas where damage exists in isolated locations, both GOOD and POOR condition may be applicable.

II. Mechanical Insulation

The evaluation of the condition of mechanical insulation (on boilers, breeching, ductwork, piping, tanks, equipment, etc.) utilizes the following criteria:

Good condition would indicate the following:

Insulation is completely covered in jacketing and exhibits no evidence of damage or deterioration. No insulation is exposed. Includes conditions where jacketing has minor damage (i.e. scuffs or stains), but the jacketing is not penetrated.

Fair condition would indicate the following:

Minor penetrating damage to jacketed insulation (cuts, tears, nicks, deterioration or delamination) or undamaged insulation that had never been jacketed. Insulation is exposed but not showing surface disintegration. The extent of missing insulation ranges from minor to none. Damage can be repaired.

Poor condition would indicate the following:

Original insulation jacket is missing, damaged, deteriorated, or delaminated. Insulation is exposed and significant areas have been dislodged. Damage cannot be readily repaired.

III. Non-friable and Potential Friable Materials

The condition of non-friable or potentially friable ACM, such as plaster finishes, drywall compound, ceiling tiles, asbestos cement products, vinyl asbestos tile and asbestos paper backed vinyl sheet flooring, which have the potential to become friable when handled is evaluated as follows:

Good condition would indicate the following:

No significant damage. Material may be cracked or broken but is stable and not likely to become friable upon casual contact. If there is no friable DEBRIS present, the condition is rated as GOOD.

Fair condition rating is not utilized in the evaluation of the condition of non-friable and potentially friable materials. These materials are only classified as in Good or Poor condition.

Poor condition would indicate the following:

Material is severely damaged. Loose DEBRIS is present or binder has disintegrated to the point where the material has become friable.

IV. Evaluation of Asbestos-Containing Debris

The presence of fallen debris must be noted separately from the presumed asbestos-containing source material. Debris is always considered to be in POOR condition.

Quantity

For each CONDITION, the approximate QUANTITY and the units of measure related to the QUANTITY (i.e.: linear feet (LF), square feet (SF) or each (EACH) as appropriate to the ITEM) has been recorded where applicable.

Action Ratings

Recommended ACTION for compliance and for management of the ACM has been provided for each CONDITION and for each COMPONENT. Recommendations have been classified under the following 8 ACTIONS:

- 1: Action dealing with the immediate cleanup of fallen ACM likely to be disturbed.
- 2: Action dealing with the need to use Type 2 asbestos procedures to enter an area (other than a ceiling space).
- 3: Action dealing with performing asbestos removal for compliance with regulations.
- 4: Action dealing with Type 2 asbestos procedures for ceiling entry where friable ACM debris is present on the top side of a ceiling system.
- 5: Action dealing with the removal of asbestos that goes beyond compliance requirements but simplifies the asbestos management.
- 6: Action dealing with the repair of asbestos.
- 7: Action dealing with ACM surveillance requirements of the regulation.
- 8: Action for dealing with material that may contain asbestos but was not conclusively identified in the survey.

1.1.1.1 Regulation for Asbestos in Building Materials

Management of asbestos-containing materials in buildings is regulated under Ontario Regulation 278/05, Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations - made under the Occupational Health and Safety Act. Under this regulation an asbestos-containing material is defined as a material that contains 0.5 percent or more asbestos by dry weight. If materials are determined to be asbestos-containing this regulation requires that specific procedures are followed for ongoing management of these materials in buildings.

Specific procedures are also required to be followed during renovation or demolition projects that have the potential to disturb asbestos-containing materials. Specific procedures followed (i.e. Type 1, Type 2 or Type 3 operations) depends primarily on the type and quantity of material present. Ontario Regulation 278/05 outlines specific requirements for the collection of bulk samples of homogenous building materials including thermal insulation, surfacing material and miscellaneous materials. Table I below outlines these requirements.

TABLE I
Ontario Regulation 278/05 Bulk Sample Requirements

Item	Type of Material	Size of Area of Homogenous Material	Minimum Number of Bulk Material Samples to be Collected
1	Surfacing material including without limitation material that is applied to surfaces by spraying, trowelling or otherwise, such as acoustical plaster on ceilings and fireproofing materials on structural members	<90m ²	3
		>90m ² to <450m ²	5
		>450m ²	7
2	Thermal system insulation, except as described in item 3	Any Size	3
3	Thermal Insulation Patch	< 2 linear metres or 0.5m ²	1
4	Other Material	Any Size	3

1.1.2 Lead in Paint

The Surface Coating Materials Regulation made under the Federal Hazardous Product Act lowered the allowable concentration of lead in paints for new consumer products to 0.06% lead content by weight (600 ppm) in 1993 to 0.009% lead content by weight (90 ppm) in June 2011. This regulation applies to all interior and exterior paints and surface coatings. The above lead-based paint standards are the generally accepted threshold for defining a “lead-based paint”. These levels are used as action levels where special precautions are typically implemented to contain debris created during construction or renovation activities and to protect workers from exposure during these activities.

1.1.2.1 Bulk Paint Chip Sampling and Analysis

Lead paint chip samples were collected from various painted surfaces throughout the Survey Area. Paint samples were scraped down to the building base structure, with all possible layers present. The samples were subsequently submitted to an independent laboratory that participates and is accredited in the National Lead Laboratory Accreditation Program (NLLAP). Analysis of paint samples was performed according to ASTM Standard D3335-85A, "Standard Method to Test for Low Concentrations of Lead in Paint by Atomic Absorption Spectrophotometry". Results of analysis were reported by the laboratory as a percentage of lead by weight.

Other lead-containing materials such as lead solder or lead pipes were not sampled during this investigation.

As previously indicated, the presence of all other designated substances and potentially hazardous materials were identified through visual inspection only. Where possible observations regarding the location, quantity and conditions of all materials investigated was made in order to determine the potential for exposure and provide appropriate recommendations for remedial action, if necessary.

Other Hazardous Materials

1.1.3 PCBs

When possible, fluorescent light fixtures are inspected for possible PCB containing light ballasts. Typically 5% to 10% of fixtures are examined and when possible are disassembled in order to expose the ballast case to verify ballast make and model. Light fixtures that are in operation are not typically opened for inspection. In many cases light fixtures in facilities built prior to 1979, and having T-12 light tubes are assumed to be PCB containing until proven otherwise.

PCB-containing ballasts are identified by model number, serial number, and date code, as listed in *Environment of Canada Identification of Lamp Ballasts Containing PCB's - Report EPS 2/CC/2 (revised) August 1991*.

Regulations pertaining to PCB's include the Federal PCB Regulations, SOR/2008-273, and Ontario Regulation (Environmental Protection Act) R.R.O. 1990, Regulation 362 Waste Management - last amendment O. Reg. 33/07.

1.1.4 CFC's

Effective January 1, 2009, wholesalers will be required to accept refrigerant containing chlorofluorocarbons at no-cost. Technicians are required to continue to follow the comprehensive record keeping requirements already established for

refrigerant waste under (R.R.O. 1990, Regulation 347, General - Waste Management.

Protocols and procedures detailed in Ontario Regulation 463/10 Refrigerants, must be followed when dealing with CFC's.

2.0 DESIGNATED SUBSTANCES – DEFINITIONS

The Occupational Health & Safety Act allows a toxic substance to be "designated", and its use in the workplace to be either prohibited or strictly controlled. Designation is reserved for substances known to be particularly hazardous. There are eleven designated substances under the Act, including asbestos, lead, mercury and arsenic. The Act sets out the amount of the substance that workers can be exposed to in a given time period, and ways to both control and measure the substance in the workplace.

The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

Ontario Regulation 490/09, s.14, within the Occupational Health and Safety Act, does not apply; at a project, to an employer who engages in construction, or to workers of an employer who are engaged in construction.

The eleven designated substances in the Province of Ontario are defined as follow:

ACRYLONITRILE

Acrylonitrile or ACN (also known as vinyl cyanide) is an explosive, flammable liquid used in the manufacture of acrylic fibres, rubber-like materials and pesticide fumigants. Exposure to acrylonitrile occurs mostly from breathing it in the air. Acrylonitrile primarily affects the nervous system and lungs. If it is spilled on the skin, the skin will turn red and blisters may form.

ARSENIC

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic is used in metallurgy for hardening copper, lead and certain metal alloys; in pigment production, in the manufacture of certain types of glass, in insecticides, fungicides, and rodent poisons, as a by-product in the smelting of copper ores, and as a dopant material in semiconductor manufacturing. Exposure to high levels of inorganic arsenic can give you a sore throat or irritated lungs. Ingesting high levels of inorganic arsenic can result in death. Lower levels of arsenic can cause nausea and vomiting,

decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet. Ingesting or breathing low levels of inorganic arsenic for a long period of time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso. Skin contact with inorganic arsenic may cause redness and swelling.

ASBESTOS

Asbestos is the name given to a group of six different fibrous minerals (amosite, chrysotile, crocidolite, and the fibrous varieties of tremolite, actinolite, and anthophyllite) that occur naturally in the environment. Asbestos minerals have separable long fibers that are strong and flexible enough to be spun and woven and are heat resistant. Because of these characteristics, asbestos has been used for a wide range of manufactured goods, mostly in building materials (roofing shingles, ceiling and floor tiles, paper products, and asbestos cement products), friction products (automobile clutch, brake, and transmission parts), heat-resistant fabrics, packaging, gaskets, and coatings. Some vermiculite or talc products may contain asbestos. Exposure to asbestos usually occurs by breathing contaminated air in workplaces that make or use asbestos. Asbestos is also found in the air of buildings containing asbestos that are being torn down or renovated. Asbestos exposure can cause serious lung disease and cancer. Asbestos on Construction projects is governed by Ontario Regulation 278/05.

BENZENE

Benzene, or Benzol, is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia.

COKE OVEN EMISSIONS

Coke Oven Emissions refers to the benzene soluble fraction of total particulate matter (BSFTPM) of the substances released into the atmosphere from metallurgical coke ovens including condensed vapours and solid particulates.

ETHYLENE OXIDE

Ethylene oxide is a flammable gas with a somewhat sweet odor. It dissolves easily in water. Ethylene oxide is a man-made chemical that is used primarily to make ethylene glycol (a chemical used to make antifreeze and polyester). A small amount (less than 1%) is used to control insects in some stored agricultural products and a very small amount is used in hospitals to sterilize medical equipment and supplies. Exposure to ethylene oxide can cause irritation of the eyes, skin, nose, throat, and lungs, and can cause damage to the brain and central nervous system.

ISOCYANATES

Isocyanates are a group of low molecular weight aromatic and aliphatic compounds containing the isocyanate group (-NCO). They are widely used in the manufacture of flexible and rigid foams, fibres, coatings such as paints and varnishes, and elastomers. Isocyanates are powerful irritants to the mucous membranes of the eyes, gastrointestinal and respiratory tracts. Exposure usually manifests in symptoms such as excessive tear secretion, dry throat, dry cough, chest pains and difficulty in breathing. Direct skin contact with isocyanates can also cause marked skin irritation and rashes.

LEAD

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found throughout our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing. Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Exposure to lead can arise from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed to Lead from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Lead affects the digestive system and causes anaemia. It is a cumulative poison and a common occupational disease. Lead compounds may be carcinogenic and teratogenic.

MERCURY

Mercury is a naturally occurring metal which has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas. Exposure to mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury is a neurotoxin and that high levels of exposure can lead to serious illness. Mercury, at high levels, may damage the brain, kidneys, and developing fetus.

SILICA

Industrial sand and gravel, often called "silica," "silica sand," and "quartz sand," includes sands and gravels with high silicon dioxide (SiO₂) content. These sands are used in glassmaking; for foundry, abrasive, and hydraulic fracturing (frac) applications; and for many other industrial uses. The specifications for each use vary, but silica resources for most uses are abundant. Silicon is not particularly toxic but finely divided silicates or silica cause major damage to lungs.

VINYL CHLORIDE

Vinyl chloride is a colorless, flammable gas at normal temperatures with a mild, sweet odor. It is a manufactured substance that is used to make polyvinyl chloride (PVC). PVC is used to make a variety of plastic products, including pipes, wire and cable coatings, and is also used to make furniture and automobile upholstery. Breathing high levels of vinyl chloride for short periods of time can cause dizziness, sleepiness, unconsciousness, and at extremely high levels can cause death. Breathing vinyl chloride for long periods of time can result in permanent liver damage, immune reactions, nerve damage, and liver cancer.

2.1 OTHER HAZARDOUS MATERIALS – DEFINITIONS

POLYCHLORINATED BIPHENYLS (PCBs)

Federal PCB Regulation SOR/2008-273 consolidates and replaces the *Chlorobiphenyls Regulations*, SOR/91-152 and the *Storage of PCB Material Regulations*, SOR/92-507. PCB Regulation SOR/2008-273 requirements are outlined in the following Figure 1.

Figure 1
PCB Regulation SOR/2008-273 - Requirements

Equipment	Concentration	End of Use Date	Quantity	Storage Requirements	Labeling Requirements
Light Ballasts	≥50 mg/Kg	December 31, 2025	≥100 L of liquid, ≥100kg of solid or ≥1kg of PCB's <100L of liquid, <100kg of solid or <1kg of PCB's	Store within 30 days of end-of-use Destroy within 2 years of end-of-use No storage requirements Destroy as soon as feasible	Labeling Requirement 1
Pole Top Electrical Transformers and their Auxiliary Electrical Equipment	<50 mg/Kg	May be used until removed from its equipment	Any	No storage requirements Destroy as soon as feasible	Labeling is recommended, but not required.
Electrical capacitors, other than light ballasts. Electrical transformers and their auxiliary electrical equipment, except pole-top. Electromagnets not used in the handling of food, feed, or any additive to food or feed. Heat Transfer Equipment. Hydraulic Equipment. Vapour Diffusion Pumps. Bridge Bearings.	≥500 mg/Kg	December 31, 2009	≥100 L of liquid, ≥100kg of solid or ≥1kg of PCB's	Store within 30 days of end-of-use Destroy within 2 years of end-of-use	Labeling Requirement 1
	<500 mg/Kg, but ≥50 mg/Kg On sensitive site	December 31, 2009	≥100 L of liquid, ≥100kg of solid or ≥1kg of PCB's	No storage permitted on site after September 5, 2009. Send away for storage or destroy immediately after end-of-use. (Applies to all equipment containing PCB's in concentration of ≥50mg/Kg except for light ballasts.)	
	<500 mg/Kg, but ≥50 mg/Kg Not on sensitive site	December 31, 2025	≥100 L of liquid, ≥100kg of solid or ≥1kg of PCB's	Store within 30 days of end-of-use Destroy within 2 years of end-of-use	
	<50 mg/Kg	May be used until removed from its equipment	Any	No storage requirements Destroy as soon as feasible	Labelling is recommended, but not required.
Any Liquid	≥2 mg/Kg (but <50 mg/Kg)	May be used until removed from its equipment	Any	No storage requirements Destroy as soon as feasible	Labeling is recommended, but not required.
	<2 mg/Kg	Classified as non-PCB containing and has no end-of-use date.		Classified as non-PCB containing. No storage requirements.	None
Cables. Pipelines that transport natural gas, petroleum or petroleum products and any associated equipment that is in contact with natural gas, petroleum, or petroleum products. Fusion sealed capacitors if they are used in relation to communication equipment or electronic control equipment.	≥50 mg/Kg	May be used until equipment is removed from its place.	≥100 L of liquid, ≥100kg of solid or ≥1kg of PCB's	Store within 30 days of end-of-use Destroy within 2 years of end-of-use	Labeling Requirement 2
	<50 mg/Kg		<100 L of liquid, <100kg of solid, or <1kg of PCB's	No storage requirements Destroy as soon as feasible	Labeling is recommended, but not required.
			Any	No storage requirements Destroy as soon as feasible	
Equipment or containers that already display a PCB warning label on September 5, 2008, or that are too small to bear the proper label, need not adhere to the new labeling laws.					
Labeling Requirement 1:			Labeling Requirement 2:		
The label must:					
a) State "ATTENTION - contains 50mg/Kg or more PCB's / contient 50mg/Kg ou plus de BPC" in black lettering on a white background, in a font size no less than 36 points;			The Owner of a cable, or pipeline, or equipment associated with a pipeline, located in a room, tunnel, or facility that state		
b) measure at least 150mm by 150mm or at least 76mm by 76mm in the case of capacitors; and			a) affix the label detailed in Labeling Requirement 1 in a readily visible location on a part of the cable		
c) in the case of equipment for which an extension is applied for under section 17 of the PCB Regulations, state a unique identification number			b) place a notice in a readily visible location at the entrance of the room, tunnel, or facility that state "ATTENTION - contains 50mg/Kg or more PCB's / contient 50mg/Kg ou plus de BPC" in black lettering on a white background, in a font size no less than 36 points;		

Part 1 of the regulation involves the end-of-use for specific equipment:

Equipment containing greater than 500 ppm PCBs must have been removed from service as of December 31, 2009; People in “sensitive” locations must eliminate their 50 ppm to 500 ppm equipment by this same date; All others have until December 31, 2014 for their equipment containing 50 ppm to 500 ppm PCBs; Specific equipment such as pole top transformers and ballasts have until December 31, 2025.

A “sensitive” location is a food or feed processing plant, a drinking water treatment plant, hospitals and senior citizen care facilities as well as schools (preschool, primary or secondary) “or on the property on which the plant or facility is located and within 100 metres of it.

Part 2 of the regulation deals with the elimination of PCB storage sites:

As of December 31, 2009, all current PCB storage sites are to have been eliminated. Any PCB material that went into a storage site prior to the regulation coming into effect can stay there for no more than one year; PCB storage sites at or within 100 metres of a sensitive location will have to be eliminated within one year of the regulation coming into force.

Part 3 of the regulation deals with labeling and reporting requirements:

PCB owners must prepare annual reports outlining quantities in use and stored as well as progress towards achieving end-of-use targets; Labels must be placed on all known PCB items except ballasts; Labels must be affixed prior to end-of-use deadline; Even PCB cable and decontaminated transformers must be labeled; The owner’s name must be clearly visible as well as the date when the material was placed in storage.

MOULD

Fungi can be found almost everywhere in indoor and outdoor environments. They are a naturally occurring and essential part of our environment and include a wide variety of organisms such as moulds, yeasts and mushrooms. Fungi act as decomposers in the outdoor environment, breaking down dead organic material (such as leaves, wood and other plant debris) which they use as a food source.

Mould spores are brought into indoor environments through ventilation systems, open windows or doors, or tracked in on footwear. If conditions exist that allow fungi to grow indoors, concentrations will increase to levels that are typically not found in buildings. Mould growth indoors primarily occurs when water damages cellulose-containing building materials and/or furnishings (such as wood, drywall, wallpaper, ceiling tiles, etc.) due to catastrophic or chronic events such as leaks,

floods, condensation (associated with high humidity or cold spots), improper design or operation of humidification systems and building envelope failures. Under these conditions fungal growth may present a risk to the building structure itself (through decomposition of building materials) as well as to occupants in the building (through potentially adverse health effects).

Regardless of the type or severity of health effects that may be caused by exposure to mould, mould growth inside a building should be considered unacceptable from a building operations and maintenance standpoint as well as from a health risk standpoint. In Ontario, the Ministry of Labour (MOL) recognized this and in September of 2000 issued an alert regarding mould titled "*Mould in Workplace Buildings*". This alert outlined potential health effects caused by mould exposure, causes of mould growth in buildings and the need to properly remediate mould-contaminated building materials. The requirement for employers to provide a safe and healthy workplace for all employees was indicated by the MOL within this alert by citing section 25(2)(h) of the Occupational Health and Safety Act, which states that employers are required to take every precaution reasonable in the circumstances for the protection of workers. This includes protecting workers from mould in workplace buildings.

Further to the MOL alert, several government agencies and special interest groups have developed guidelines for the proper assessment and remediation of mould-contaminated buildings. In Canada, guidelines have been published by the Canadian Construction Association (CCA) entitled "*Mould Guidelines for the Canadian Construction Industry*" (March 2004) while in Ontario the Environmental Abatement Council of Ontario (EACO) has published "*EACO Mould Abatement Guidelines*" (April 2004). Currently, this guideline is being considered by the MOL for adoption as a recognized code of practice.

CHLOROFLUOROCARBONS (CFCs)

Chlorofluorocarbons (CFCs) are the most well known ozone depleting substances, and were the most used. CFCs are a family of long-lasting synthetic chemicals that were developed about 60 years ago as a substitute for ammonia in refrigerators and air conditioners. They have also been used as blowing agents in foam product manufacturing, as cleaning solvents for electrical components, in aerosol sprays, and in hospital sterilization procedures.

The most common uses of ozone depleting substances are as refrigerants in commercial, home and vehicle air conditioners and refrigerators, foam blowing agents, solvents, aerosol spray propellants, fire extinguishing agents and chemical reactants. The regulation that governs CFC's is Ontario Regulation 463/10 Refrigerants.

APPENDIX II

LABORATORY CERTIFICATES OF ANALYSIS

**EMSL Canada Inc.**

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 3045 Southcreek Road
 Unit 14
 Mississauga, ON L4X 2X7
Fax: (905) 624-4306 **Phone:** (905) 624-2722
Proj: 150210

EMSL Order: 551100115
Customer ID: 55SELI62
Collected: 1/17/2011 5:50:00PM
Received: 1/17/2011

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: A1A **Lab Sample ID:** 551100115-0001
Sample Description: SPRAYED FIREPROOFING PATCHING ON BEAM, MECHANICAL'

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	1/18/2011	Gray/White	90%	10%	None Detected	

Client Sample ID: A1B **Lab Sample ID:** 551100115-0002
Sample Description: SPRAYED FIREPROOFING PATCHING ON BEAM, MECHANICAL'

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	1/18/2011	Gray/White	90%	10%	None Detected	

Client Sample ID: A1C **Lab Sample ID:** 551100115-0003
Sample Description: SPRAYED FIREPROOFING PATCHING ON BEAM, MECHANICAL'

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	1/18/2011	Gray/White	90%	10%	None Detected	

Client Sample ID: A2A **Lab Sample ID:** 551100115-0004
Sample Description: SPRAYED FIREPROOFING ON BEAM, MECHANICAL PENTHOUSE'

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	1/18/2011	Gray	85%	15%	None Detected	

Client Sample ID: A2B **Lab Sample ID:** 551100115-0005
Sample Description: SPRAYED FIREPROOFING ON BEAM, MECHANICAL PENTHOUSE'

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	1/18/2011	Gray	90%	10%	None Detected	

Client Sample ID: A2C **Lab Sample ID:** 551100115-0006
Sample Description: SPRAYED FIREPROOFING ON BEAM, MECHANICAL PENTHOUSE'

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	1/18/2011	Gray	85%	15%	None Detected	



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Proj: 150210

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Initial report from: 01/20/2011 20:22:05

Analyst(s)

Kevin Pang (6)

Kevin Pang
or other Approved Signatory

Any questions please contact Kevin Pang.

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. 10 Falconer Drive, Unit #3, Mississauga ON NVLAP Lab Code 200877-0

**EMSL Canada Inc.**

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EMSL Canada Or 551203557

CustomerID: 55SELI62

CustomerPO:

ProjectID:

Attn: **Steve March**
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Mississauga, ON L4X 2X7

Phone: (905) 624-2722
Fax: (905) 624-4306
Received: 08/03/12 2:39 PM
Collected:

Project: 25 ST. CLAIR

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B*/7000B)

<i>Client Sample Description</i>	<i>Lab ID</i>	<i>Collected</i>	<i>Analyzed</i>	<i>Lead Concentration</i>
LP1	0001	8/3/2012		1.1 % wt
Site: D-5 WHITE PAINT ON PLASTER 4TH FLOOR STAIRWELL				
LP2	0002	8/3/2012		0.83 % wt
Site: N-IY WHITE PAINT ON PLASTER 3RD FLOOR STAIRWELL				
LP3	0003	8/3/2012		<0.0090 % wt
Site: D-5 GREY FLOOR PAINT ON CONCRETE 6TH FLOOR				
LP4	0004	8/3/2012		0.057 % wt
Site: B-2 WHITE WALL ON DRYWALL 8TH FLOOR OFFICES				

Kevin Pang
or other approved signatory

Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. The QC data associated with these results included in this report meet the method QC requirements, unless specifically indicated otherwise. Unless noted, results in this report are not blank corrected. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. * slight modifications to methods applied. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 08/07/2012 09:26:00



EMSL Canada Inc.

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EMSL Canada Order 551203558
Customer ID: 55SELI62
Customer PO:
Project ID:

Attn: Steve March
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3045 Southcreek Road
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Phone: (905) 624-2722
Fax: (905) 624-4306
Collected:
Received: 8/03/2012
Analyzed: 8/07/2012

Proj: 25 ST. CLAIR

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: 01A **Lab Sample ID:** 551203558-0001
Sample Description: K-6 AIRCELL PIPE INSUL.

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	0%	50%	50% Chrysotile	

Client Sample ID: 01B **Lab Sample ID:** 551203558-0002
Sample Description: K-6 AIRCELL DEBRIS

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	0%	50%	50% Chrysotile	

Client Sample ID: 01C **Lab Sample ID:** 551203558-0003
Sample Description: 9TH FLOOR PHOTOCOPY RM COLUMN AIRCELL INSUL.

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	0%	50%	50% Chrysotile	

Client Sample ID: 02A **Lab Sample ID:** 551203558-0004
Sample Description: P-3X DEBRIS MENS W/R PIPE SHAFT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	0%	30%	70% Chrysotile	

Client Sample ID: 02B **Lab Sample ID:** 551203558-0005
Sample Description: P-3X DEBRIS MENS W/R PIPE SHAFT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	0%	30%	70% Chrysotile	

Client Sample ID: 02C **Lab Sample ID:** 551203558-0006
Sample Description: P-3X DEBRIS MENS W/R PIPE SHAFT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	0%	30%	70% Chrysotile	

Client Sample ID: 03A **Lab Sample ID:** 551203558-0007
Sample Description: N-6 BLACK SWEATWRAP 5TH FLOOR STAIRWELL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Brown	80%	20%	None Detected	



EMSL Canada Inc.

10 Falconer Drive, Unit #3 Mississauga, ON L5N 3L8
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<http://www.emsl.com> / torontolab@emsl.com

EMSL Canada Order 551203558
Customer ID: 55SELI62
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: 03B **Lab Sample ID:** 551203558-0008
Sample Description: N-6 BLACK SWEATWRAP 5TH FLOOR STAIRWELL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Brown	80%	20%	None Detected	

Client Sample ID: 03C **Lab Sample ID:** 551203558-0009
Sample Description: N-6 BLACK SWEATWRAP 5TH FLOOR STAIRWELL

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Brown	80%	20%	None Detected	

Client Sample ID: 04A **Lab Sample ID:** 551203558-0010
Sample Description: DEBRIS ON FLOOR MIDDLE PIPE RISER SHAFT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012				Not Submitted	

Client Sample ID: 04B **Lab Sample ID:** 551203558-0011
Sample Description: DEBRIS ON FLOOR MIDDLE PIPE RISER SHAFT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	0%	65%	35% Chrysotile	

Client Sample ID: 04C **Lab Sample ID:** 551203558-0012
Sample Description: DEBRIS ON FLOOR MIDDLE PIPE RISER SHAFT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	0%	65%	35% Chrysotile	

Client Sample ID: 04D **Lab Sample ID:** 551203558-0013
Sample Description: DEBRIS ON FLOOR MIDDLE PIPE RISER SHAFT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	0%	65%	35% Chrysotile	

Client Sample ID: 04E **Lab Sample ID:** 551203558-0014
Sample Description: DEBRIS ON FLOOR MIDDLE PIPE RISER SHAFT

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	0%	65%	35% Chrysotile	

Client Sample ID: 05A **Lab Sample ID:** 551203558-0015
Sample Description: F-1Z DUCT INSULATION 5TH FLOOR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	White	0%	85%	15% Chrysotile	



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EMSL Canada Order 551203558
Customer ID: 55SELI62
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: 05B

Lab Sample ID: 551203558-0016

Sample Description: F-1Z DUCT INSULATION 5TH FLOOR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	0%	85%	15% Chrysotile	

Client Sample ID: 05C

Lab Sample ID: 551203558-0017

Sample Description: F-1Z DUCT INSULATION 5TH FLOOR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	0%	85%	15% Chrysotile	

Client Sample ID: 06A

Lab Sample ID: 551203558-0018

Sample Description: L-5 COLUMN SFP- 5TH FLOOR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	60%	40%	None Detected	

Client Sample ID: 06B

Lab Sample ID: 551203558-0019

Sample Description: L-3 COLUMN SFP 5TH FLOOR

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	60%	40%	None Detected	

Client Sample ID: 06C

Lab Sample ID: 551203558-0020

Sample Description: L-1Z COLUMN SFP

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	60%	40%	None Detected	

Client Sample ID: 06D

Lab Sample ID: 551203558-0021

Sample Description: SPRAYED FIREPROOFING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	60%	40%	None Detected	

Client Sample ID: 06E

Lab Sample ID: 551203558-0022

Sample Description: SPRAYED FIREPROOFING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	60%	40%	None Detected	

Client Sample ID: 06F

Lab Sample ID: 551203558-0023

Sample Description: SPRAYED FIREPROOFING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	60%	40%	None Detected	



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Customer ID: 55SELI62
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: 06G

Lab Sample ID: 551203558-0024

Sample Description: SPRAYED FIREPROOFING

TEST	Analyzed Date	Color	Non-Asbestos		Asbestos	Comment
			Fibrous	Non-Fibrous		
PLM	8/07/2012	Gray	60%	40%	None Detected	

Analyst(s)

Matthew Davis PLM (23)

Kevin Pang
or other Approved Signatory

Any questions please contact Kevin Pang.

None Detected = <0.5%. 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: 08/07/2012 12:52:42

APPENDIX III
SITE DRAWINGS



SNC • LAVALIN

25/55 St. Clair Avenue East
Toronto, Ontario

1	ISSUED FOR CLIENT REVIEW	AUG12
No.	Revision / Issue	Date

CONSULTANT



Safetech
Environmental
Limited

3045
Southcreek
Rd. Unit 14
Miss, Ont
L4X 2X7
905.624.2722

Client

SNC Lavalin O&M

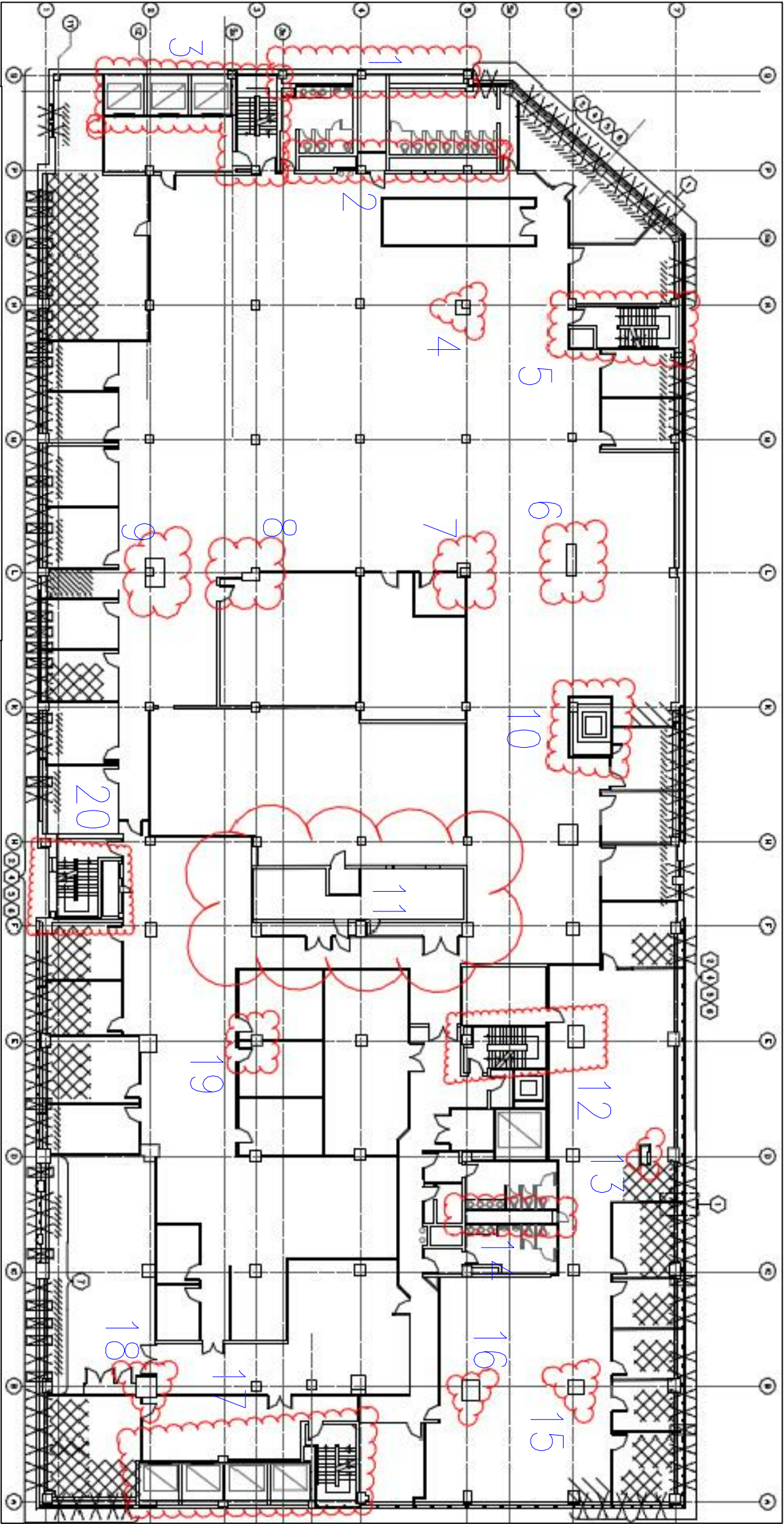
Drawing Title

Hazardous Building
Materials Assessment

**Floors 2-9 - Mechanical
Areas, Pipe Shafts,
Elevator Shafts, Elevator
Machine Rooms**

Typical Layout Mechanical
Areas Floor Plan

Drawn By:	SM	Checked:	GS
Project #	143112	Drawing #	
Date	AUG 2012		
Scale	NO SCALE	Sht. 1 of 1	



Location	Material	Quantity	Condition	Type(s) of Asbestos	Friable (Y/N)	Photograph
Throughout building	Drywall joint compound	-	Good	Chrysotile	N	-
Floors 2-9						
Mechanical Pipe Shaft (Close Electrical Room) Area 11	Vinyl floor tiles**	-	Good	Chrysotile	N	1 & 2
Floors 2-9 Pipe Shaft Areas 4, 6, 7, 8, 9, 10, 12, 13, 15, 16, 18, 19	Sprayed Fireproofing Debris*	-	-	Suspect Chrysotile	Y	-
Floors 2-9 Pipe Shaft Areas 1, 2, 10, 11, 14, 16, 18	Mechanical pipe and pipe fitting insulation, debris*	-	Poor	Chrysotile	Y	11, 12, 13, 14 & 15
Floors 2-9 Mechanical HVAC Shaft Area 20	HVAC Duct Insulation	-	Good	Chrysotile	Y	-
Elevator Machine Rooms	Window Caulking**	-	Good	Suspect Chrysotile	N	19
4 th Floor, East Elevator Lobby	Texture coat on ceiling	-	Good	Chrysotile	Y	7
6 th Floor, North wall (east side)	Transite cement board vapour barrier	~300 square feet	Good	Suspect Chrysotile	N	6
7 th Floor, North wall (east side)	Transite cement board vapour barrier	~300 square feet	Good	Chrysotile	N	-

NOTES:

This drawing is project specific to the 2012 Hazardous Building Materials Assessment project pertaining to Floors 2–9 Mechanical Areas, Pipe Shafts, Elevator Shafts & Elevator Penthouse only. Please refer to report titled “Safetech Environmental Ltd. – Hazardous Building Materials Assessment Report dated August, 2012” for details.

*Asbestos containing insulation assumed to be present within inaccessible pipe shafts within columns, above plaster ceiling, and within pipe ducts between east washrooms.
**Material not sampled (either not accessible or reported as asbestos-containing in previous reassessment) thus assumed to be asbestos containing unless sampling proves otherwise.

APPENDIX IV
PHOTOGRAPHS



P1

View of assumed asbestos-containing vinyl floor tile observed within Floors 2 to 9 Electrical Closets, Location 11.



P2

View of assumed asbestos-containing vinyl floor tile observed within Floors 2 to 9 Pipe Shaft Closets, Location 11.



P3

View of non-asbestos sprayed fireproofing material applied to deck sampled at 5th Floor Location 7.



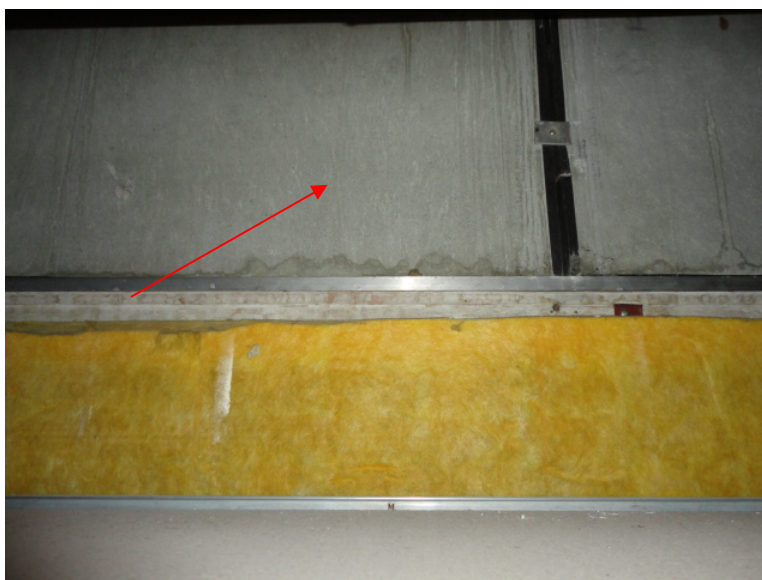
P4

View of non-asbestos sprayed fireproofing material applied to mechanical pipe sampled at 5th Floor Location 7.



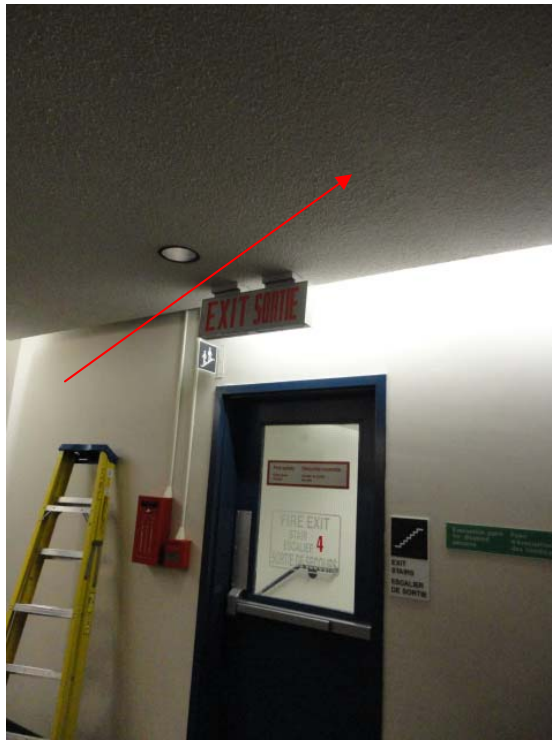
P5

View of non-asbestos sprayed fireproofing material applied to top side of column sampled at 5th Floor Location 7. Asbestos-containing sprayed fireproofing likely present inside inaccessible column pipe chase within this location.



P6

View of asbestos-containing transite vapour board barrier observed on North side of floors 3 to 7.



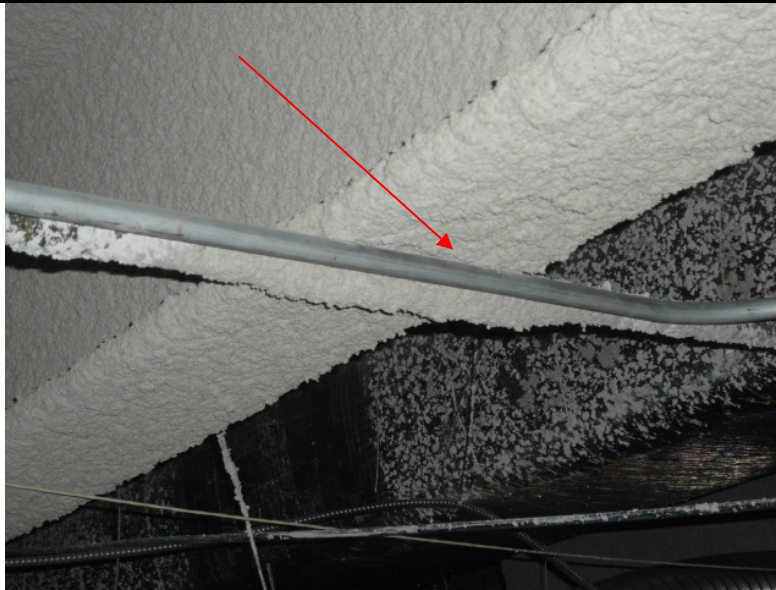
P7

View of asbestos-containing texture coat observed on 4th floor Elevator Lobby.



P8

View of non asbestos sprayed fireproofing and hand patching observed on structural beams within Mechanical Penthouse.



P9

View of non asbestos sprayed fireproofing observed on structural beams within renovated floors of surveyed building.



P10

View of non-asbestos mechanical insulation observed within duct and pipe shafts located south of Stairwell E. Asbestos pipe insulation debris present within this pipe shaft Floors 2-9 Location 11.



P11

View of asbestos-containing debris observed within pipe chases within east washrooms Floors 2-9 Locations 1 & 2.



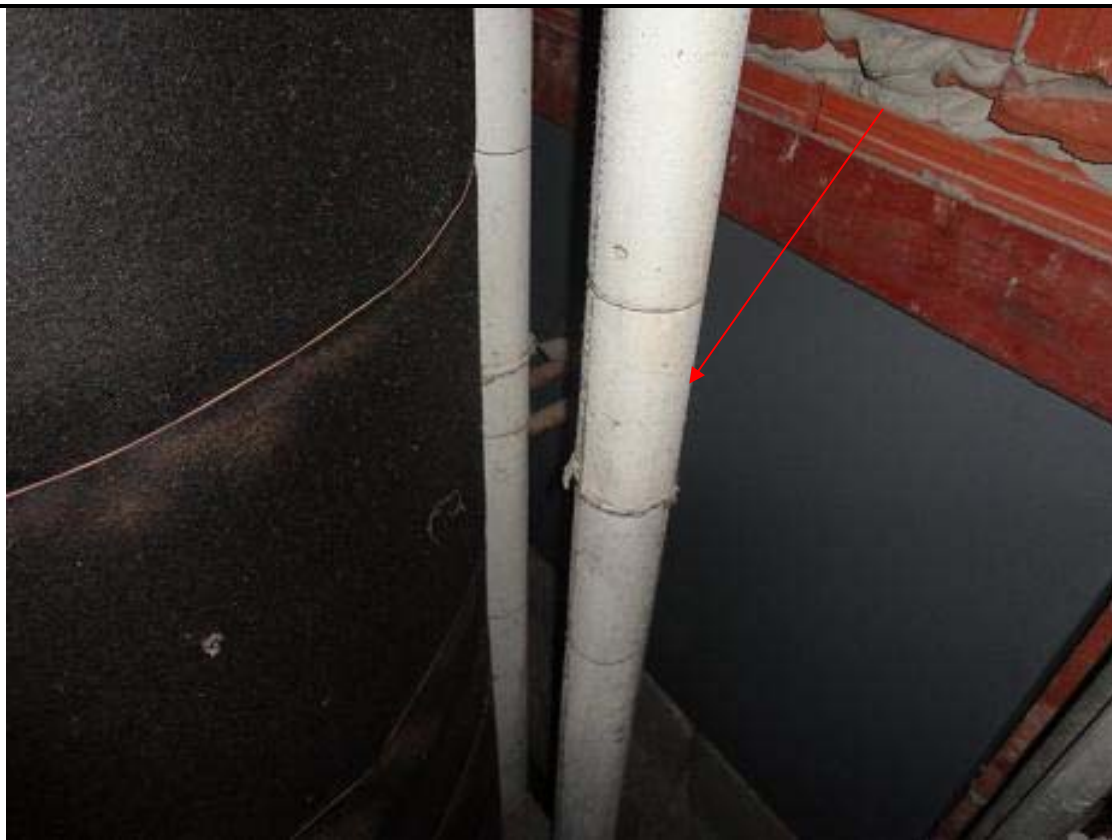
P12

View of asbestos-containing pipe insulation observed within pipe chases within east washrooms Floors 2-9 Location 1.



P13

View of asbestos-containing debris observed within pipe chases within Floors 2-9 Locations 11.



P14

View of asbestos-containing pipe insulation observed within pipe chase Floors 2-9 Location 10. Black sweatwrap mechanical pipe insulation is non-asbestos.



P15

**View of asbestos-containing pipe insulation observed within pipe chase
Floors 2-9 Location 16.**



P16

**View of Elevator Shaft. No sprayed fireproofing material or mechanical
pipe insulation observed to be present within Elevator Shaft Locations 3 &
17.**



P17

View of Elevator Machine Room. No sprayed fireproofing material or mechanical pipe insulation observed to be present within Elevator Machine Rooms.



P18

View of Elevator Machine Room. No sprayed fireproofing material or mechanical pipe insulation observed to be present within Elevator Machine Rooms.



P19

View of suspect asbestos-containing window caulking observed within the Elevator Machine Room.



APPLICATION OF THE NATIONAL BUILDING AND FIRE CODE OF CANADA FOR:

25/55 ST. CLAIR AVE EAST ELEVATOR MODERNIZATION & ELEVATOR SHAFTS FIRE-RESISTANCE REMEDIATION WORK

Prepared by:
David Galvao, B. Tech.
Senior Associate

Reviewed by:
John Roberts, P. Eng.
Senior Associate

Date: May 6, 2013

LRI File: 2012-777

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1.0 INTRODUCTION

At the request of NORR Limited, Leber|Rubes Inc. (LRI) has conducted an audit of the existing composition of the elevator shaft walls to determine what upgrades are necessary in order to satisfy the current building and fire code requirements for 25/55 St. Clair Ave East located in Toronto, Ontario.

The purpose of the audit was to evaluate the inherent fire-resistance rating of the existing elevator shaft walls and determine what upgrades to these shafts would be necessary in order to meet the specific requirements outlined in Division B, Part 3 of the 2010 National Building Code of Canada (NBCC) and Division B, Part 2 of the 2010 National Fire Code of Canada (NFCC), as per the request for proposal by Public Works and Government Services Canada (PWGSC).

Section 7.0 of this report identifies the existing provisions for fire fighting with respect to fire department access, fire hydrant locations, and elevator operations in order to evaluate the existing conditions with respect to current code requirements. The description of the existing elevator operations is based on visual observation only. Further confirmation of additional emergency power operation is required.

Site photos referenced herein are in context to Appendix A Site Photos prepared by NORR.

1.1 SCOPE/LIMITATIONS

The report is not intended as a detailed review with respect to all aspects of the NBCC and NFCC.

Particular attention was paid to new construction and fire separation requirements under Subsections 3.2.2 and 3.5.3., respectively and provisions for firefighting under Subsection 3.2.5. of the NBCC and Section 2.2 of the NFCC.

1.2 METHODOLOGY

This report is based on the findings of a walk-through of the building in the company of Lauris Kuksis (NORR), Rick Marsiglio (HHAngus), and Robert Bowes (SNC Lavalin).

The building walk-through consisted of inspecting the construction of each elevator shaft at various levels in order to establish a representative composition of the elevator shaft as well as an inspection of the elevator machine rooms.

Drawings provided in an email dated November 8, 2012 were reviewed in preparation of this report.

The initial site inspection which took place on November 27, 2012 was conducted to evaluate general construction of the existing elevator shafts.

The initial building inspection did not include destructive testing to verify building materials and construction assemblies of an elevator shaft wall constructed with clay tile block. This occurred in a subsequent site inspection, which took place on January 18, 2013 in order to review the construction details of a representative clay tile block by exposing the clay tile block and removing the exposed face on the office floor side of the elevator shaft serving the freight elevator (Elevator #8).

1.3 ASSUMPTIONS

PWGSC provided existing Architectural "As built" architectural floor plans of the existing building layout. The elevator consultant, HHAngus, has provided input with respect to the existing elevator operations.

LRI has relied on the accuracy of this information and has not undertaken independent investigations in these areas.

2.0 EXECUTIVE SUMMARY

25/55 St. Clair Ave East, also known as the Arthur Meighen Building, is a federal government building located in Toronto, Ontario. As directed in the scope of the project by PWGSC, this building has been reviewed in terms of the applicable construction requirements of the 2010 NBCC, Subsection 3.2.2.

If the building were to be constructed using the current applicable building code, elevator shafts would be required to be constructed as 2 hr fire separations and the building would be required to be sprinklered.

The fire-resistance rating of the elevator shafts has been evaluated based on Appendix D¹ of the NBCC and, for comparison purposes, the "Guideline on Fire Ratings of Archaic Materials and Assemblies"², 2000 edition.

Based on the evaluation contained herein, the concrete block wall assemblies achieve a 2 hr fire resistance rating. The existing clay tile block wall assemblies do not achieve a 2 hr fire-resistance rating (actual rating is 30 minutes) assuming the parging covering the blocks consists of a Portland cement-sand mix plaster. If, however, the parging consists of gypsum-sand plaster, then the existing clay tile block wall assemblies can be considered to provide a 45 min fire resistance rating. Visual observation alone cannot distinguish between these two types of plaster.

Analytical lab testing may be considered to evaluate a sample parge coat specimen taken from one of the exposed walls outside of each elevator shaft in order to determine if the existing shaft construction provides a 45 minute fire-

resistance rating. Substantial upgrades will be necessary however and, as such, the lab testing may not warrant the cost. As per previous concerns cited by Human Resources and Skills Development Canada (HRSDC), samples of the existing mortar supporting the clay tile block assemblies should be tested to ensure structural integrity.

If it is intended to retain the existing clay tile block assembly. One option available, to provide the required 2 hr fire separation, is to provide shaft wall construction to the office side of the shaft (i.e. anticipated fire exposed side). The shaft wall construction will be required to achieve a minimum 1.5 hr fire-resistance rating based on the most conservative evaluation of a 30 min fire-resistance rating of the existing clay tile block assembly.

Any damage to the existing shaft wall assemblies is required to be repaired in accordance with Part 2, Fire Safety³ of the NFCC. A cursory visual review observed damaged wall assemblies, damaged sprayed fire proofing, and missing fire stopping material in all of the elevator shafts. Repairs are outlined with respect to the damaged or missing fire separations.

A detailed inspection, provided by a qualified contractor to identify all repairs, is required to ensure that the integrity of each elevator shaft fire separation is maintained.

Any investigative or repair work which is to take place within the elevator shafts /pits will have to be performed under the direct supervision of a qualified elevator contractor. Similar expectations should also apply to work in the elevator machine rooms.

Provisions for firefighting appear to meet the code requirements of the current NBCC with respect to fire department access and fire hydrant locations. Elevator operation is required to be confirmed.

3.0 BUILDING DESCRIPTION

25/55 St. Clair Ave East, also known as the Arthur Meighen Building, is a 10 storey office building with a basement level. 25 St. Clair Ave East was built in the 1940's and 55 St. Clair Ave East was built in 1961. The building is federally owned by the Government of Canada.

The building consists of non-combustible construction and has a building area (i.e. footprint area) of approximately 3700 m². The basement and parking garage of the building are protected with a sprinkler system. The remainder of the building is not sprinklered. The building is equipped with the following fire protection systems:

- fire alarm system
- standpipe system

- sprinkler system (basement and parking garage only)

There are two principal entrances accessible from St. Clair Ave East. 25 St. Clair Ave East is located on the west side of the building and provides access to the west core elevator lobby. 55 St. Clair Ave East is located on the east side of the building and provides access to the east core elevator lobby.

4.0 CONSTRUCTION REQUIREMENTS

The following requirements apply to new construction based on the NBCC. New construction requirements have been reviewed as per the scope of the project in order to evaluate upgrades based on existing conditions.

Specifically, in order to evaluate the required elevator shaft fire separation, the construction requirements of the building need to be identified such that the corresponding elevator shaft fire separation can be determined.

In no way is the following structural fire protection an indication of the existing conditions. Rather it has been reviewed in order to derive the current fire resistance rating requirement of the elevator shaft fire separation if it were new construction.

4.1 STRUCTURAL FIRE PROTECTION

The building is classified as a Group D major occupancy. Structural fire protection is based on the Subsection 3.2.2 building construction requirements as described below.

If the building were constructed under the current applicable building code, the building would be constructed under Article 3.2.2.54, "Group D, Any height, Any Area, Sprinklered" relative to the major occupancy of the building and its building area.

Structural fire protection is summarized as follows:

1. Floor assemblies - 2 hr fire separation
2. Roof assemblies – No fire-resistance rating is required for a sprinklered building in accordance with Article 3.2.2.17.
3. Columns and load bearing walls supporting floors and roofs - 2 hr fire separation except for roof supporting structure.

4.2 ELEVATOR SHAFT FIRE PROTECTION

Elevator shafts are required to be provided with a fire separation in accordance with Article 3.5.3.1. and Table 3.5.3.1.

In accordance with Table 3.5.3.1., a building required to be constructed with a 2 hr fire separation for the floor assembly is required to be provided with a 2 hr fire separation for the elevator hoistways.

5.0 ELEVATOR SHAFT CONSTRUCTION DETAILS

For purposes of evaluating the inherent fire-resistance rating of the existing shaft wall construction, the review of a typical block was necessary.

In the case of the clay tile block, a destructive test was necessary to examine the internal dimensions. LRI assessed some of the exposed clay tile block and conducted an audit of internal dimensions and void characteristics.

The construction details of the concrete block were provided by HHAngus based on a field review of a typical concrete block without destructive testing. In the case of the concrete block, it was possible to visually examine the top course of the block located in the front shaft wall above the penthouse floor, which revealed the internal dimensions.

5.1 OVERVIEW

There are three elevator shafts located in the building. The elevator shafts are equipped with rated door assemblies.

The west core elevator shaft consists of elevators #1 to #4. It is constructed of a clay tile block assembly on the front and side walls and brick on the rear exterior wall. The clay tile block assembly is not covered with a parging within the shaft. (Refer to Photo No. 11, 14, and 15, Appendix A).

The east core elevator shaft consists of elevators #5 to #7. It is mainly constructed of a concrete block assembly. Brick construction is present on some portions of the rear wall of the shaft. (Refer to Photo No. 19, 20, 21, 23, and 27, Appendix A).

The freight elevator shaft consists of elevator #8. It is constructed of a clay tile block assembly. The clay tile block assembly is not covered with a parging within the shaft (Refer to Photo No. 28, Appendix A).

5.2 CLAY TILE BLOCK WALL ASSEMBLY

In order to review the construction details of the clay tile block, destructive testing took place on the 9th floor of the freight elevator shaft in the adjacent Janitor Room (Rm 918). (Refer to Photo No. 32, 33, 34, and 35, Appendix A).

The cement parging from a clay tile block was removed from a few blocks on the office floor side of the shaft in order to expose a typical clay tile block. One of the exposed blocks was then further subjected to the removal of its exposed face in order to view the interior of the block.

The clay tile block consists of the following characteristics:

- 12 inches (305 mm) in length x 12 inches (305 mm) in height x 6 inches (152 mm) in depth
- single cell (i.e. void) in depth between the shaft and the floor area
- subdivided into 3 cells (i.e. voids) along its length with ½ inch (12.7 mm) thick walls
- voids are approximately 85 mm in length by 127 mm in depth
- plaster parging with a ½ inch (12.7 mm) of thickness on the janitor room floor side of the block (i.e. no parging on the inside of shaft).

5.3 CONCRETE BLOCK WALL ASSEMBLY

The internal characteristics of a typical concrete block are based on visual observations of exposed concrete blocks located in the front shaft wall above the penthouse floor. A typical concrete block consists of the following characteristics:

- individual blocks measuring approximately 15.4 inches (390 mm) in length X 7.5 inches (190 mm) in height x 7.5 inches (190 mm) in depth.
- block has 1-1/2 inch (38 mm) thick walls
- single cell (i.e. void) in depth between the shaft and the floor area
- subdivided into 3 cells (i.e. voids) along its length with 1-1/2 inch (38 mm) thick walls
- voids are approximately 5 inches (127 mm) in length by 2-1/2 inches (64 mm) in depth

6.0 ELEVATOR SHAFT FIRE-RESISTANCE EVALUATION

The evaluation of the elevator shaft involves the review of the construction of the wall assemblies present in the elevator shaft.

The individual masonry unit will be evaluated with respect to its equivalent thickness under Appendix D, "Fire Performance Ratings"¹ of the NBCC. Equivalent thickness of a hollow masonry unit is calculated as follows:

$$\frac{\text{Actual Thickness of unit} \times \text{Net Volume of unit}}{\text{Gross Volume of unit}}$$

Where,

Gross volume is the actual length X actual height X actual thickness

Net volume equals gross volume minus volume of voids

For comparison purposes, the existing clay block has also been evaluated using the "Guideline on Fire Ratings of Archaic Materials and Assemblies"², 2000 edition.

6.1 CLAY TILE BLOCK WALL ASSEMBLY

Appendix D, "Fire Performance Ratings"¹ of the NBCC:

The equivalent thickness of the clay tile block is calculated as follows:

$$\text{Gross volume: } 305 \text{ mm} \times 305 \text{ mm} \times 152 \text{ mm} = 14139800 \text{ mm}^3$$

$$\text{Net volume: } 14139800 \text{ mm}^3 - 3 \text{ voids } (85 \text{ mm} \times 305 \text{ mm} \times 127 \text{ mm}) = 4262375 \text{ mm}^3$$

$$\text{Equivalent thickness: } 152 \text{ mm} \times 4262375 \text{ mm}^3 / 14139800 \text{ mm}^3 = 45.8 \text{ mm}$$

In accordance with Table D-1.7.1, the contribution of the plaster parging is based on a factor of 0.75, if we consider the parging to consist of a Portland cement-sand plaster. The parging has been classified as Portland cement plaster since this will result in the most conservative thickness. Based on a total thickness of approximately 13 mm, the equivalent thickness of the plaster parging is:

$$\text{Equivalent thickness: } 0.75 \times 13 \text{ mm} = 9.8 \text{ mm}$$

In accordance with Table D-2.1.1., the equivalent thickness required by a hollow tile unit to achieve a 2 hr fire resistance rating is **102 mm**. The calculated equivalent thickness of the sample clay tile block is 55.6 mm (45.8 mm + 9.8 mm). Therefore, based on the calculation noted above, the clay tile block does

not achieve a 2 hr fire-resistance rating. The clay tile block assembly achieves a 30 minute fire resistance rating.

That being said, if the parging were a gypsum-sand plaster, the contribution of the type of plaster would be based on a factor of 1. In this case, the equivalent thickness of the parging would be 13 mm and the overall equivalent thickness of the entire clay block assembly would be 58.8 mm (45.8 mm + 13 mm). Based on the calculation noted above, the clay tile block assembly would approximately achieve a 45 minute fire-resistance rating if the parging consisted of gypsum-sand plaster.

Guideline on Fire Ratings of Archaic Materials and Assemblies²:

Based on the review of the available construction details included in this guideline, the existing clay tile block is not specifically addressed.

Table 1.1.3, "Masonry Walls" for blocks that are 6 inches to less than 8 inches thick was chosen for this review.

The block is composed of approximately 30% solid material. Parging is applied to one side of the block (i.e. fire exposed side) and is a ½ inch thick. The existing clay tile block with parging is 6 ½ inches thick.

The thickness of the block identified in the Table that best matches the existing conditions is 6-5/8 inches. The block is 6 inches thick plus 5/8 inch parging.

The wall type that best matches the construction details of the existing clay tile block is:

W-6-M-27, which is 6-5/8 inches thick, consists of one cell thickness, dense hard-burned clay, units of not less than 30% solid material, and a parging thickness not less than 5/8 of an inch thick located on the exposed side only of the block wall. This block achieves a 1 hr fire-resistance rating.

The construction details of the block type noted above exceeds the percentage of solid material and parging thickness of the existing clay tile block.

For this reason, the clay tile block cannot be suitably evaluated using these guidelines.

6.2 CONCRETE BLOCK WALL ASSEMBLY

The equivalent thickness of the concrete block is calculated as follows:

Gross volume: $390 \text{ mm} \times 190 \text{ mm} \times 190 \text{ mm} = 14079000 \text{ mm}^3$

Net volume: $14079000 \text{ mm}^3 - 3 \text{ voids } (127 \text{ mm} \times 64 \text{ mm} \times 190 \text{ mm}) = 9446040 \text{ mm}^3$

Equivalent thickness: $190 \text{ mm} \times 9446040 \text{ mm}^3 / 14079000 \text{ mm}^3 = 127 \text{ mm}$

In accordance with Table D-2.1.1., the equivalent thickness required by a hollow concrete unit to achieve a 2 hr fire-resistance rating is dependent on the type of concrete used. Type S or N concrete corresponds with the most conservative thickness of 113 mm. The calculated equivalent thickness of the sample concrete block is 127 mm.

Therefore, based on the calculation noted above, the concrete block achieves a 2 hr fire-resistance rating.

6.3 SUMMARY

The existing clay tile block does not achieve a 2 hr fire-resistance rating based on the evaluation under Appendix D¹ of the NBCC or the evaluation of the wall type based on the "Guideline on Fire Ratings of Archaic Materials and Assemblies"², 2000 edition. This is based on a conservative evaluation of the existing parging, which is based on a visual evaluation only.

A detailed evaluation of the parging may be considered to determine if the parging is a gypsum-sand plaster which will provide a greater contribution to the equivalent thickness of the block. Based on our analysis, the overall contribution will be such that the clay tile block wall assembly will achieve a 45 min fire-resistance rating if a gypsum-sand plaster has been used or a minimum 30 min fire resistance rating if gypsum-sand plaster has not been used.

The method of applying a layer of Type X gypsum wallboard to the office side of the shaft (i.e. anticipated fire exposed side) directly over the existing parging of the clay tile block assembly is not considered a final solution, but may be considered as part of a solution. Based on Appendix D, Table 2.3.4.A, the maximum contribution to the fire-resistance rating using this method is 40 minutes using 15.9 mm Type X gypsum wallboard. Additional layers cannot be used to increase the fire-resistance rating on one side of the shaft only.

One option available to provide the required 2 hr fire separation is to provide shaft wall construction to the office side of the shaft (i.e. anticipated fire exposed side). The shaft wall construction will be required to achieve a minimum 1.5 hr fire-resistance rating based on the most conservative evaluation of a 30 minute fire-resistance rating of the clay tile block assembly.

Other options involving the application of fire separations on both sides of each shaft wall have been reviewed, but are not considered feasible due to the construction difficulties posed by the existing tolerances and equipment located within the elevator shaft.

As per previous concerns cited by Human Resources and Skills Development Canada (HRSDC), samples of the existing mortar supporting the clay tile block assemblies should be tested to ensure structural integrity of the mortar.

The typical concrete block wall assembly achieves a 2 hr fire resistance rating, and therefore meets the required fire-resistance rating under new construction.

7.0 PROVISIONS FOR FIRE FIGHTING

7.1 FIRE DEPARTMENT ACCESS

The primary fire department access point is the existing 55 St. Clair Ave East principal entrance located on the north side of the building and accessible from St. Clair Ave East.

The fire department access route is within 15 m of the principal entrance but not closer than 3 m to building.

A fire alarm control panel is located at the security desk accessible from the east core elevator lobby on the ground floor.

The fire safety plan is located at the security desk.

7.2 FIRE HYDRANT LOCATION

The existing fire department connections (i.e. two in total) are located on the north side of the building between the two principal entrances. The fire department connection located closest to the principal entrance of 55 St. Clair Ave East serves the basement and parking garage sprinkler system. The fire department connection located closest to the principal entrance of 25 St. Clair Ave East serves the standpipe system of the entire building. These fire department connections are located in proximity to the principal entrances of the building and are within 45 m of a municipal fire hydrant.

Municipal fire hydrants are located on the north side of St. Clair Ave East directly across from each principal entrance. A total of two municipal fire hydrants are considered to serve the building. Each fire hydrant is located within 45 m of at least one Siamese connection.

In accordance with Sentence 3.2.5.7.(2), fire hydrants are required to be located within 90 m horizontally of any portion of the building perimeter required to face a street.

7.3 ELEVATOR OPERATIONS

In consideration that the building is a high-rise building, elevator cars are required to be provided with in-car emergency service switches, and are considered as mandatory firefighters' elevators. Additionally, the OBC does require elevators to be designed with manual recall to the ground floor level.

In accordance with CAN/CSA-B44 07 and as regulated by TSSA, it is understood elevator cars are required to be provided with fire fighter controls such as in-car services, and automatic recall in consideration that the elevators rise more than 2000 mm.

The existing elevator cars are provided with emergency recall switches. The elevator lobbies are equipped with emergency recall keys.

Details with respect to elevator emergency power have been confirmed by H.H. Angus and are outlined below:

The elevator remote control panel is located in 25 St. Clair Ave E behind the security desk. It was observed that there are emergency power reselection strip switches associated with the passenger cars in 25 and 55 St. Clair. Elevator emergency power operation was not observed, however, the presence of these switches suggest that there is capacity on the emergency power system to run one passenger elevator in both groups simultaneously.

The four passenger cars located in 25 St. Clair Ave E, did not appear to be equipped with an "Elevator Emergency Power" indicator at the main lobby which is a requirement of the CSA B44 "Safety Code for Elevators & Escalators" to identify when elevators are being supplied from the emergency source. It is speculated that these cars are fed from the emergency generator. It is proposed that this can be further clarified with SNC Lavalin.

The three passenger cars located in 55 St. Clair Ave E are equipped with an "Elevator Emergency Power" indicator at the main lobby which is a requirement of the CSA B44 "Safety Code for Elevators & Escalators". It was further noted that there was a new ASCO 7000 Power Transfer Switch in the elevator machine room. SNC Lavalin is to confirm that only one of the elevators in this group functions on emergency power.

The single freight elevator located in 25 St. Clair Ave E. is equipped with an "Elevator Emergency Power" indicator at the main lobby, which is a requirement of the CSA B44 "Safety Code for Elevators & Escalators". On that basis it is speculated that the emergency generator has capacity to allow this unit to continue to operate although this can be further clarified with SNC Lavalin.

8.0 INTEGRITY OF SHAFT FIRE SEPARATION

The existing fire separation integrity of the elevator shafts has been reviewed with respect to Part 2 "Fire Safety" under Subsection 2.2 "Fire Separations"³ of the NFCC.

The visual inspection was conducted by both LRI and HHA Angus and was not intended as a detailed review. The summary below identifies high level

observations for purposes of identifying areas of concern, which will require repair in order to maintain the integrity of the elevator shaft fire separation.

Further investigation will be required by a qualified contractor in order to provide a more detailed account of the repairs required based on the observations of the major areas of concern identified below in order to fully restore the integrity of the elevator shaft fire separation.

8.1 WEST CORE ELEVATOR SHAFT (ELEVATORS 1 TO 4)

1. Clay tile block has been damaged on the side wall of the hoist way serving elevator #4 and sidewall of hoist way serving elevator #1 at Level 7. These openings are required to be filled with concrete in order to maintain the fire separation. (Refer to Photo No. 16 and 18)
2. An open duct is located on the south wall of elevator #4 below ground level. Confirmation as to where the duct is routed and what it serves is required to ensure that a breach in fire separation has not occurred. (Refer to Photo No. 17, Appendix A)
3. Elevator machine room contains service penetrations located above the egress door, which are required to be fire stopped. (Refer to Photo No. 31, Appendix A).

8.2 EAST CORE ELEVATOR SHAFT (ELEVATORS 5 TO 7)

1. There is a gap between the masonry wall/brick wall assembly and the concrete beam located on the front hoist way wall (west side). The brick is required to be removed and replaced with concrete block and tightly fitted with concrete or fire stopped with a listed material providing a 2 hr fire-resistance rating. (Refer to Photo No. 22, Appendix A).
2. There is a gap between the masonry block wall assembly and the concrete beam located in the middle of the shaft. This gap is required to be fire-stopped with a listed material providing a 2 hr fire resistance rating. (Refer to Photo No. 24, Appendix A).
3. Open ducts are located on the north wall of elevator #5 below ground level. Confirmation as to where the duct is routed and what it serves is required to ensure that a breach in fire separation has not occurred. (Refer to Photo No. 19 and 26, Appendix A).
4. A masonry block has been dislodged from the front hoist way wall immediately above the basement wall. The masonry block is required to be removed and repositioned with new mortar in order to maintain the integrity of the fire separation. (Refer to Photo No. 25, Appendix A).

9.0 REFERENCES

The following references have been used in the evaluation of construction requirements, equivalent thickness, and maintenance of fire separations in this report:

1. National Research Council of Canada (2010) National Building Code of Canada, Volume 2, Appendix D, "Fire Performance Ratings", Ottawa.
2. U.S. Department of Housing and Urban Development made available through the Ministry of Municipal Affairs and Housing. 'Guideline on Fire Ratings of Archaic Materials and Assemblies', 2000 edition, Washington, D.C.
3. National Research Council of Canada (2010) National Fire Code of Canada 2010, Division B, Part 2, "Fire Safety", Ottawa.