



**TARGETED PRE-RENOVATION
DESIGNATED SUBSTANCE & HAZARDOUS MATERIALS SURVEY
R32 (YEO HALL) MASONRY REPAIRS PHASE 2, PHASE 3 AND PHASE 4
ROYAL MILITARY COLLEGE
CFB KINGSTON, ONTARIO**

**Submitted to:
Department of National Defence c/o Defence Construction Canada
5 Artisan Road, Rm 101
CFB Kingston, ON
K7K 7B4**

**Submitted by:
Amec Foster Wheeler Environment & Infrastructure,
a Division of Amec Foster Wheeler Americas Limited
Unit 10, 900 Maple Grove Road
Cambridge, Ontario
N3H 4R7
Phone: (519) 650-7100**

24 April 2017

Project No. SWC179086

Distribution:

- Client – 1 Electronic Copy; and,
- Amec Foster Wheeler - 1 Copy

EXECUTIVE SUMMARY

Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited (Amec Foster Wheeler) was retained by Defence Construction Canada (DCC) on behalf of the Department of National Defence (DND), hereafter referred to as 'DCC' or the 'Client', to conduct a targeted pre-renovation designated substance and hazardous materials survey (DSHMS) of Yeo Hall (Building R32) at the Royal Military College in Kingston, Ontario (Site). The targeted DSHMS is to be performed under the terms and conditions of DCC Ontario Regional Source List No. OR14SL02.

The objective of the targeted DSHMS was to identify and quantify where reasonably possible within the context of the project scope of work, building materials containing designated substances and selected hazardous building materials in the Area of Work as required by Section 30 of Ontario's Occupational Health Safety and Safety Act (OHSA).

Amec Foster Wheeler understands that the purpose of the survey is to support renovation activities by contractors. This survey is intended for pre-renovation purposes within the Area of Work only and may not provide sufficient detail for long-term management of asbestos-containing materials (ACM) that may be present outside the Area of Work as required in Section 8 (3) of Ontario Regulation 278/05 (as amended) – "*Designated Substance – Asbestos On Construction Projects And In Buildings And Repair Operations*" (O. Reg. 278/05).

Findings

The Area of Work included the locations as outlined in the statement of work (SOW), and identified on-site by the client as the areas that will be affected by the proposed renovations. Amec Foster Wheeler understands that the DSHMS is to support planned renovations of the following phases of Yeo Hall (Building R32) located at the Royal Military College in Kingston, Ontario (Reference Figure 1):

- Phase 2: 1957 Extension North and South Walls and Link to R31
- Phase 3: Original Building West, North and South Walls
- Phase 4: 1972 & 1995 Extensions

DCC provided Amec Foster Wheeler with access to the Area of Work on 21 March 2017. Based on the visual inspection of accessible areas in the Area of Work and laboratory bulk sample results, the following findings are provided.

Lead

- Three (3) bulk samples of mortar were collected and submitted for lead analysis
- Lead was detected in all samples above the method detection limit
- The three (3) mortar samples were also submitted for Schedule 4 Toxicity Characteristic Leaching Procedure (TCLP) leachate analysis for lead
 - Laboratory results indicate that the mortar sampled from each Phase was below the Schedule 4 criteria for lead
 - The mortar submitted for analysis is considered to be non-hazardous waste.
- Paint on the heritage door (refer to Section 4.3.1) is suspected to contain lead

Mercury

- Paint on the heritage door (refer to Section 4.3.1) is suspected to contain mercury
- Other suspected mercury-containing materials were not identified in the accessible areas of the Area of Work

Arsenic

- Paint on the heritage door (refer to Section 4.3.1) is suspected to contain arsenic
- Other suspected arsenic-containing materials were not identified in the accessible areas of the Area of Work

Silica

- Based on the visual inspection of accessible locations in the Area of Work, crystalline silica is presumed to be present in masonry products including concrete.

PCBs

- Paint on the heritage door (refer to Section 4.3.1) is suspected to contain PCBs
- Other, suspected PCB-containing paints, equipment, or products were not identified in the accessible areas of the Area of Work

Chromium

- Paint on the heritage door (refer to Section 4.3.1) is suspected to contain Chromium
- Other suspected chromium-containing materials were not identified in the accessible areas of the Area of Work

Recommendations

The following recommendations are provided based on the findings of the targeted pre-renovation DSHMS of the Area of Work:

- Materials containing a designated substance or hazardous material included in the scope of work were observed in accessible areas.
- Recommendations to support renovations of the Area of Work are summarized in Section 6 of this report.

This executive summary is **not** to be used alone and the report must be reviewed in its entirety. Should you have any questions or comments regarding this assessment, please do not hesitate to contact our office.

TABLE OF CONTENTS

	Page
1.0 INTRODUCTION.....	1
1.1 Purpose.....	1
1.2 Scope Of Work	1
2.0 REGULATORY REQUIREMENTS AND GUIDELINES	3
2.1 Designated Substances.....	3
2.1.1 Arsenic	3
2.1.2 Asbestos.....	4
2.1.3 Lead	5
2.1.4 Mercury	6
2.1.5 Silica.....	6
2.2 Hazardous Building Materials	7
2.2.1 Polychlorinated Biphenyls (PCBs)	7
2.2.2 Chromium.....	7
3.0 METHODOLOGY	7
3.1 Asbestos.....	8
3.1.1 Basis Of Evaluation	9
3.1.2 ACM Evaluation – Assessment Of Condition	10
3.1.3 Presumed ACM - Sampling Exclusions	10
3.2 Lead	10
3.2.1 Paint.....	10
3.2.2 Mortar.....	11
3.3 Arsenic	11
3.4 Mercury	11
3.5 Silica.....	11
3.6 PCBs	11
4.0 RESULTS	11
4.1 General Description Of Area of Work.....	12
4.2 Asbestos-Containing Materials (ACMs)	12
4.2.1 Caulking and Joint compound.....	13
4.2.2 Mortar.....	13
4.3 Lead-Containing Materials	14
4.3.1 Paint.....	14
4.3.2 Mortar.....	14
4.4 Arsenic	15
4.5 Mercury	15
4.6 Silica.....	15
4.7 Other Designated Substances	15
4.8 PCBs	15

4.9	Chromium.....	15
5.0	CONCLUSIONS	16
6.0	RECOMMENDATIONS	17
6.1	Worker Notification – Designated Substances	17
6.2	Asbestos-Containing Materials (ACM)	18
6.2.1	Demolition and Renovation Projects	18
6.3	Lead-Containing Materials	18
6.4	Arsenic	18
6.5	Mercury	19
6.6	Silica.....	19
6.7	Chromium.....	19
6.8	PCBs	19
7.0	SURVEY LIMITATIONS	20
8.0	CLOSURE.....	20

TABLES

Table 1	Bulk Sample Results - Materials Determined to be Non-Asbestos-Containing
Table 2	Bulk Sample Results - Lead in Mortar
Table 3	Bulk Sample Results - Leachate for Lead in Mortar

FIGURES

Figure 1	Area of Work and Bulk Sample Locations
----------	--

APPENDICES

Appendix A	Photographic Log
Appendix B	Laboratory Certificates of Analysis
Appendix C	Limitations

1.0 INTRODUCTION

1.1 PURPOSE

Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited (Amec Foster Wheeler) was retained by Defence Construction Canada (DCC) on behalf of the Department of National Defence (DND), hereafter referred to as 'DCC' or the 'Client', to conduct a targeted pre-renovation designated substance and hazardous materials survey (DSHMS) of Yeo Hall (Building R32) at the Royal Military College in Kingston, Ontario (Site). The targeted DSHMS is to be performed under the terms and conditions of DCC Ontario Regional Source List No. OR14SL02.

The objective of the targeted DSHMS was to identify and quantify where reasonably possible within the context of the project scope of work, building materials containing designated substances and selected hazardous building materials in the Area of Work as required by Section 30 of Ontario's Occupational Health Safety and Safety Act (OHSA).

Amec Foster Wheeler understands that the purpose of the survey is to support renovation activities by contractors. This survey is intended for pre-renovation purposes within the Area of Work only and may not provide sufficient detail for long-term management of asbestos-containing materials (ACMs) that may be present outside the Area of Work as required in Section 8 (3) of Ontario Regulation 278/05 (as amended) – "*Designated Substance – Asbestos On Construction Projects And In Buildings And Repair Operations*" (O. Reg. 278/05).

1.2 SCOPE OF WORK

Based on the DCC Statement of Work – Consulting Services (SOW), dated November 2016, Amec Foster Wheeler understands that the DSHMS is to support planned renovations of the following phases of Yeo Hall (Building R32) located at the Royal Military College in Kingston, Ontario (Reference Figure 1):

- Phase 2: 1957 Extension North and South Walls and Link to R31
- Phase 3: Original Building West, North and South Walls
- Phase 4: 1972 & 1995 Extensions

Specifically, repairs to the masonry are required and will consist of re-pointing masonry joints, stone replacement, crack repair in stone units worthy of salvage, sealing of skyward facing joints in capping or stringcourse units and repairs to ornamental stone units such as sills or those found in the bay windows. Window repairs / replacement, repainting of various building elements, along with re-caulking joints are also included in the planned renovations. The objective of the renovation project is to make the necessary repairs to the masonry and windows to ensure the heritage building envelope is protected, and to restore the building envelope to its original condition.

The targeted pre-renovation DSHMS was performed in general accordance with Amec Foster Wheeler's Proposal No. PSWC179105 dated 23 February 2017. The scope of work included the following activities:

- Perform a review of previous hazardous materials or designated substances sampling reports, abatement records and building construction plans, where made available by the Client at the time of the survey
- Conduct a visual survey of all building components in the Areas of Work to identify suspect designated substance and select hazardous materials limited to building materials as indicated by the DCC SOW;
 - The survey will determine the presence and extent (affected material types and estimated quantities where reasonable within the context of the project scope and budget) of designated substances or hazardous materials in accessible building materials, including condition of asbestos, lead, mercury, chromium, arsenic and PCB-containing materials and whether the confirmed ACM are friable or non-friable; and
 - The survey will be performed in accordance with the safety considerations and constraints as indicated in the DCC SOW and as noted, will include intrusive investigation where deemed necessary (such as into bulkheads and concrete block walls (if any) – to investigate for the presence of vermiculite and collection of mortar samples for asbestos and lead analysis).
- Digital photographs will be taken of the commonly identified or sampled building materials that contain or are suspected of containing designated substance or hazardous materials;
 - Photographs collected are presented in Appendix A of this report
- Collect bulk samples from the Work Area of suspected ACM; paint potentially containing lead, mercury, arsenic, chromium and PCBs; mortar for asbestos and lead content, and, submit to an accredited laboratory for analysis (type and quantity of asbestos; and, lead, mercury arsenic, chromium and PCB content);
- Prepare a draft DSHMS report for DCC review and a subsequent final report that will include a description of sampling and analytical methods, interpretation of the laboratory analytical results, locations, and estimated visual quantities of materials (wherever possible) that require removal and special handling prior to renovation activities, and recommendations for the appropriate abatement and disposal of the identified designated substances and/or hazardous materials
 - Location drawings with testing locations are also included

Amec Foster Wheeler will provide the above services using its commercially reasonable best efforts consistent with the level and skill ordinarily exercised by members of the profession currently practicing under similar conditions. The survey will be carried out as per current industry standards in Ontario and in accordance with current Provincial regulations. The DSHMS report will meet the employers due diligence requirements as generally outlined in Section 30 of the OHSA and will identify materials in the Areas of Work that must be removed prior to renovations.

2.0 REGULATORY REQUIREMENTS AND GUIDELINES

2.1 DESIGNATED SUBSTANCES

This designated substances report is made to fulfill the Owner's requirements under Section 30 of the OHSA. The building owner must provide this report, abatement work plans, and specifications to all contractors working on the Site. Subsequently, all contractors must furnish this information to their subcontractors. The designated substances defined under the OHSA and their corresponding regulations at the time of the survey are summarized below.

"Designated Substance" as defined by the OHSA means "*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.*" The OHSA has issued specific regulations under Section 30 of the Act for these substances. The Designated Substances Regulations identified under the Industrial Regulation of the OHSA, provide guidance on exposure and medical monitoring, permissible occupational exposure limits, etc.

There are eleven designated substances defined by the OHSA which are regulated in the work place by Ontario Regulation 490/09 (as amended) – "*Designated Substances*" (O. Reg. 490/09). During manufacturing processes and work within a workplace, hygiene air monitoring could be performed to assess worker exposure levels.

The Ontario Ministry of Labour (MOL) issued a regulation and / or guideline associated with construction related activities for only three of the eleven designated substances, including asbestos, lead, and silica.

2.1.1 ARSENIC

Arsenic compounds are used as wood preservatives (e.g., pressure-treated wood), insecticides, herbicides, and in metal alloys and are naturally present in certain minerals and soils. Arsenic has been known to be used as a paint pigment. Although the OHSA does not regulate the use of arsenic in paint, safety precautions must be taken to prevent arsenic-containing particulate from becoming airborne during demolition or renovation projects.

2.1.2 ASBESTOS

Asbestos is the name used for a group of fibrous minerals that occur naturally in soil and rock. There are over 3,000 products that may have contained asbestos, such as roofing shingles, ceiling tiles, floor tiles, asbestos cement products, gaskets, insulation, paper products, and other building and insulating products. ACM is divided into the following two broad categories:

- **Friable ACM:** materials that, (a) when dry, can be crumbled, pulverized or powdered by hand pressure, or (b) is crumbled, pulverized or powdered (as defined by O. Reg. 278/05). Typical friable materials include mechanical/thermal insulation, acoustical or decorative spray applications and fireproofing. ACM that is friable has a much greater potential than non-friable ACM to release airborne asbestos fibres when disturbed.
- **Non-friable ACM:** hard or manufactured products wherein the asbestos fibres are bound. Typical non-friable ACM includes tar/sealants, vinyl flooring, pre-formed manufactured cement products (e.g., piping, wallboard and siding). Though many non-friable ACM products are considered non-friable when intact, they can become friable during demolition or renovation activities.
- **Special considerations:** Some ACMs, such as plaster, compressed fibre ceiling tiles and drywall compound are considered non-friable materials when in-place and in good condition as the associated binding agents prevent the release of airborne fibres. These materials are non-friable in place, but can generate dust upon disturbance/removal. These materials are referred to as potentially friable materials (or miscellaneous friable materials). Therefore, these materials can be handled as a non-friable if in good condition and undisturbed. However, the binding agent can be relatively weak, and if disturbed or damaged in any way, the material may act as a friable material with an increased risk of asbestos fibre release. These materials must be handled as friable materials in the event of any disturbance or damage. Drywall compound is a non-friable building material, however due to general dust release and generation during removal, additional abatement control measures as regulated by O. Reg. 278/05 may be required. It is generally recommended that a competent asbestos professional be consulted and a site specific program be developed prior to any major disturbance.
- **Vermiculite insulation** is an unconsolidated material and asbestos fibres may not be uniformly distributed in the material. As such, the standard Phase Light Microscopy (PLM) analytical method is not recommended for quantification and is used solely to determine the presence or absence of asbestos fibres. Any observation of asbestos fibres in the sample is reported as positive for asbestos, or negative (non-detect) if not observed.

The handling, identification, documentation, and removal of ACM are regulated by O. Reg. 278/05. ACM is defined by O. Reg. 278/05 as being a material that contains 0.5 percent or more asbestos fibers by dry weight. As described in Section 8 of O. Reg. 278/05, a record of ACM must be developed as part of on-going asbestos management in buildings. The record of ACM includes, but is not limited to the location and condition of ACM and whether it is considered friable or non-friable.

2.1.3 LEAD

In building construction, lead was frequently used for roofs, cornices, tank linings, electrical conduits, as a main component of soft solder alloy used to seal pipe joints and in caulking, ceramic glazing and other such materials. Lead was also used extensively for pigmentation, sealing, and as a drying agent in oil based paints up until the early 1950s. Exterior paints typically contained up to 60% lead by weight.

The MOL issued the "*Lead on Construction Projects*" guideline in September 2004. The guideline includes legal requirements, health effects, control of the health hazard, classification of construction operations, and measures and procedures for working with the designated substance during operations that create lead dust or fumes.

The United States Department of Housing and Urban Development (US HUD) guideline of 1 milligram per square centimeter (mg/cm^2), 0.5 percent lead by weight, or 5,000 parts per million (ppm) lead is used in the United States as a guideline for determining whether the use of safety precautions would be required during operations that create lead dust or fumes.

In 1976, the Canadian Federal Government introduced the Liquid Coating Materials Regulations under the Federal Hazardous Products Act (HPA), restricting the maximum total lead content of paints and other liquid coating materials used in or around premises attended by children or pregnant women to 0.5% by weight (5,000 mg/kg). In January 1991, Health Canada negotiated a voluntary reduction of lead content in all Canadian produced consumer paint to a maximum of 0.06%. Recently the Canadian Federal Government revoked Part 1 of the HPA and enacted the Surface Coating Materials Regulations (SOR/2005-109) under the Canada Consumer Product Safety Act (S.C. 2010) that reduce the maximum total lead content of any new surface coatings for consumer products to 0.009% (90 mg/kg). This reduction does not generally apply to surface coating applied to buildings or other structures used for agricultural or industrial purposes or as an anti-weathering or anti-corrosive coating.

The OHSA does not set a regulatory limit on the concentration of lead in paint (or other materials) and based on discussions with the MOL, any concentration of lead in paint (or other materials) applications should be considered to be lead-containing. For this report, all paints with a lead

concentration greater than the laboratory RDL (Reliable Detection Limit) for the analytical test method have been discussed.

For the purposes of this survey where occupational exposures are considered during demolition or renovation, a surface coating containing greater than 0.5% or 5,000 mg/kg (5,000 µg/g) is considered by Amec Foster Wheeler as presenting an increased potential for worker exposure and subject to controls. However, materials with content of lead in any concentration may require special handling procedures and worker protection.

2.1.4 MERCURY

Mercury can be used in fluorescent, compact fluorescent and high intensity discharge (HID) lamps, electrical switches, thermostats, thermometers, and batteries. All fluorescent and compact fluorescent lights contain mercury regardless of the date of manufacture.

The Canadian Council of Ministers of the Environment (CCME) "*Canada-Wide Standard for Mercury-Containing Lamps*" (2001) is largely geared towards reducing the amount of mercury in lamps at the manufacturing stage; however, they do recommend that the release of mercury can be minimized through the proper recycling and disposal of mercury-containing lamps.

Mercury was also commonly added to leaded paints as a fungal retardant; however, it is not commonly tested for as the proper handling and disposal of lead-containing paints would typically minimize any safety or disposal issues for mercury.

In January 1991, under the voluntary industry program negotiated by Health Canada, the intentional addition of mercury to Canadian produced consumer paints for interior use ceased. Under the Federal Surface Coating Materials Regulations (SOR/2005-109), the maximum total mercury concentration of paints and other surface coatings is restricted to 10 mg/kg (0.001%) when a dried sample is tested in accordance with a method that conforms to good laboratory practices.

For the purposes of this survey, Amec Foster Wheeler defines mercury-containing paint (MCP) as a surface coating containing greater than 0.001% mercury by dry weight.

2.1.5 SILICA

Silica is used in the manufacture of glass, ceramics, abrasives, water treatment products and filtration systems. Crystalline silica materials also are used in the production of concrete or mortar-based building materials, cement, acoustic ceiling tiles, and ceramic tiles which are used for construction purposes. Common construction sand contains free crystalline silica and is present in ceiling tiles, concrete products, mortar, and brick.

The MOL issued the "*Silica on Construction Projects*" guideline in September 2004. The guidelines include legal requirements, health effects, control of the health hazard, classification of

construction operations, and measures and procedures for working with silica during operations that create silica dust.

2.2 HAZARDOUS BUILDING MATERIALS

2.2.1 POLYCHLORINATED BIPHENYLS (PCBs)

PCB-containing products were manufactured for use in applications where stable, fire-resistant, and heat-transfer properties were demanded between 1926-29 and 1977. Most PCBs were sold for use as dielectric fluids (insulating liquids) in electric transformers and capacitors. Other uses included heat transfer fluid, hydraulic fluid, dye carriers in carbonless copy paper, plasticizers in paints, adhesives, and caulking compounds. In Canada, PCBs were prohibited from being used in products, equipment, machinery, electrical transformers and capacitors that were manufactured or imported into the country after July 1980. However, older equipment in use after this date may still contain PCBs if the equipment's fluid has not been changed, or if there was sufficient inventory of such equipment.

PCBs are also regulated under the Federal Canadian Environmental Protection Act (EPA), 1999, PCB Regulation SOR/2008-273 which came into force September 2008 and subsequent amendment regulation SOR 2010-57. The Federal PCB regulations generally establish deadlines for ending the use and long term storage of PCBs and products containing PCBs. PCB-containing equipment or any PCB-containing substance with a PCB concentration at or in excess of 2 parts per million (ppm) for liquids and 50 ppm for solids are subject to the above Federal regulations.

For the purposes of this survey, only paints suspected to contain PCBs were included for sampling as necessary. Equipment or other products suspected to contain PCBs were visually identified only if present. This survey is intended for pre-renovation purposes only, and may not provide sufficient detail for long term management of PCBs or to determine end-of-use inventories as required in SOR/2008-273-PCB Regulation.

2.2.2 CHROMIUM

Chromium compounds are added to paints and primers to provide corrosion protection and reflective properties. Although the OSHA does not specifically regulate the use of chromium in paint, safety precautions must be taken to prevent chromium-containing particulate from becoming airborne during demolition or renovation projects.

3.0 METHODOLOGY

The targeted pre-renovation DSHMS included a survey of readily accessible and known areas in the Area of Work. The extent of the survey was limited to the Area of Work as defined by the DCC SOW and where identified on-site by the client (refer to Section 1.2 and Figure 1 of this report).

Suspected designated substances and hazardous materials included in this report were visually identified by appearance, age, and knowledge of current and historical uses of building materials. Information was recorded where suspected designated substances and hazardous materials included in this survey were observed, including: friability and condition of ACM; approximate visual estimates of quantities where possible within the confines of the scope of work, locations, sample information and sample locations.

For the purpose of the survey and this report, designated substances are defined as those containing the following substances: arsenic, asbestos, lead, mercury and silica (free crystalline). The following designated substances are not typically found in building materials in a composition or state that are in a hazardous form for worker exposure during general renovation and / or demolition activities and therefore, these materials were not addressed in this survey: acrylonitrile, benzene, coke oven emissions, ethylene oxide, isocyanates and vinyl chloride (monomer).

The destructive survey was limited to accessible areas in the Area of Work. Accessible locations include only those entries not prohibited by security or other restrictions, and do not present an unacceptable health or safety risk to the surveyor. Reasonable effort was used to identify potential hazardous materials in areas not readily accessible. Bulk sampling and analysis may not be performed for materials that may not be accessible without substantial damage to building components.

The survey excluded materials located outside the Areas of Work (e.g., any other interior rooms), underground equipment and materials (e.g., drums, vessels, underground storage tanks, pipes, etc.).

3.1 ASBESTOS

The survey included a detailed description of suspected ACM identified in accessible locations of the Area of Work. Details of location, type of building material, friability, a visual estimate of quantity where possible, condition, and accessibility were recorded.

Bulk samples of suspected ACM were collected in sample sets in compliance with the requirements of O. Reg. 278/05. Table 1 of O. Reg. 278/05 indicates the minimum number of samples to be collected and analyzed (1, 3, 5, or 7 depending on quantity, application and friability) from each homogeneous material, in order for the material to be considered non-asbestos. A homogeneous material is defined in O. Reg. 278/05, as one that is uniform in colour and texture. The surveyor used information obtained on Site by visual examination and available information on the phases of the construction and reported renovations, to determine the extent of each homogeneous area and the number of samples required. In addition, visual differences in applications were noted, where possible.

In areas where finished surfaces required partial removal to inspect hidden materials (e.g., concrete block wall cores, etc.), a small opening was cut/punched to allow for inspection and sampling of the underlying materials. All openings were re-sealed with industrial adhesive tape.

Bulk samples of suspected ACM were submitted under chain of custody protocol to EMC Scientific Inc. (EMC) of Mississauga, Ontario. EMC is accredited for bulk asbestos fiber analysis by the National Voluntary Laboratory Accreditation Program (NVLAP). Samples were analyzed using polarized light microscopy (PLM) methodology (EPA/600/R-93/116). This method is specified by O. Reg. 278/05 for establishing whether the material is asbestos-containing and defining the content and type of asbestos. The laboratory followed a "positive-stop" analysis methodology and stop analyzing a sample set if any one of the series of samples proves to be positive for the presence of asbestos. Therefore, duplicate samples taken in order to satisfy the requirements of O. Reg. 278/05 were not analyzed if the initial sample was identified as asbestos-containing.

Only one (1) result of 0.5% or greater asbestos content is required to determine that a material is asbestos-containing, but all samples must be analyzed to conclusively determine that a material is non-regulated/non-asbestos as defined by O. Reg. 278/05. Where building materials are described in this report as non-asbestos, or described as containing no asbestos, this is subject to the limitations of the analytical method used, and should be understood to mean no asbestos was detected by the laboratory but may remain bound in compounds or in a smaller size than detectable by the specified method.

3.1.1 BASIS OF EVALUATION

The condition and the potential for disturbance of identified ACM were visually evaluated. The evaluation criteria were based on the existing O. Reg. 278/05 and professional experience involving the management of ACM in buildings.

An ACM was considered damaged if it is sprayed material that is delaminating, mechanical insulation with damaged or missing insulation or jacketing; or, non-friable materials that have been pulverized or damaged so that they may have become friable.

The priority for remedial action is not only based on the evaluation of condition, but also on several other factors that include the following:

- Accessibility or potential for direct contact and disturbance
- Practicality of repair (e.g., will damage to the ACM continue after it is repaired)
- Visibility/accessibility of the material
- Efficiency of the work (e.g., if damaged ACM is being removed in an area, it may be most practical to remove all ACM in the area even if it is in good condition)

3.1.2 ACM EVALUATION – ASSESSMENT OF CONDITION

In evaluating the condition of friable ACM, the following criteria are used:

- GOOD** Material is completely adhered to substrate and/or exhibits no evidence of damage or deterioration. Exposed sprayed fireproofing (thermal insulation) is considered to be in good condition, where no fallout or debris is present below. Painted texture finishes are in good condition (unpainted texture is considered to be in fair condition).
- FAIR** Minor penetration damage to paint covered surface (cracks, dents, nicks, deterioration, water damage or delamination). Friable ACM is exposed but not showing surface disintegration. The extent of missing material should be minor to none and the damage should be readily repairable. Fireproofing is either Good or Poor condition.
- POOR** Materials is delaminating, falling or hanging from applied surface.

Non-friable ACM was considered to be in poor condition if they have been pulverized or damaged so that they have become friable. Broken, cracked or loose materials are considered to be in fair condition.

3.1.3 PRESUMED ACM - SAMPLING EXCLUSIONS

A number of materials that may contain asbestos in the Area of Work were not sampled during this survey and includes, but is not limited to the following:

- Sampling the materials may cause consequential damage to the property or inaccessible without major demolition
- Sampling the material may have been hazardous to the surveyor

Where materials are suspected to be asbestos-containing are present, these materials must be presumed to be asbestos-containing and sampling immediately prior to commencing renovation is typically the best practice.

3.2 LEAD

3.2.1 PAINT

The survey included a description of building materials suspected to contain lead (e.g., paint, etc.). During the Site inspection there was no paint visible or accessible for samples to be collected within the Area of Work.

It was not the intent to sample minute colours (i.e. one random trim colour). Building materials with prefinished coating (e.g., metal siding), where a sample could not be obtained without extensive

damage, where substrate interference may pose and issue or if the paint coating was inaccessible (e.g., located at an elevated height) were not collected.

3.2.2 MORTAR

The survey included the collection of three (3) mortar samples to be analyzed for lead. Suspected lead samples were submitted to an independent NVLAP accredited laboratory for lead analysis. Samples were analyzed using EPA method 3050/6010.

Samples were also submitted for Toxicity Characteristic Leaching Procedure (TCLP) leachate analysis for lead. The leachate samples were submitted for Schedule 4 TCLP testing under Ontario Regulation 347/90 (as amended) – “*General – Waste Management*” (O. Reg. 347/90).

3.3 ARSENIC

Arsenic has been known to be used as a paint pigment. During the Site inspection there was no paint visible or accessible for samples to be collected within the Area of Work.

3.4 MERCURY

The survey included the visual identification of suspected mercury sources in the Area of Work including paint. There was no paint visible or accessible for samples to be collected within the Area of Work. No additional potential sources of mercury were identified in the Area of Work.

3.5 SILICA

Silica may be present in many building materials and is therefore expected to be present in the Area of Work. The survey included the visual identification of suspected silica sources (e.g. concrete block, etc.). As such, the scope of work excluded bulk sampling of suspected silica-containing products.

3.6 PCBs

The survey included the visual identification of suspected PCB sources in the Areas of Work that may include paint.

3.6 Chromium

The survey included the visual identification of suspected chromium sources in the Areas of Work that may include paint.

4.0 RESULTS

Ms. Laura Riffel of Amec Foster Wheeler performed the targeted pre-renovation DSHMS of the Areas of Work on 21 March 2017. The following previous DSHMS reports and abatement records were made available by DCC for review at the time of the survey:

- “Consulting Services – (KN159908) Building R32 – Roof Sampling, Royal Military College, Kingston, Ontario” completed by XCG Consultants Ltd. and dated August 26, 2015; and
- “Consulting Services – (KN149948) Building R32, Designated Substance and Hazardous Materials Survey Related to Masonry Repairs, Royal Military College, Kingston, Ontario” completed by XCG Consultants Ltd. and dated May 9, 2016.

The following sections provide an overview of the individual designated substances and hazardous materials included in the DSHMS scope of work and the presence of such substances in accessible locations of the Areas of Work identified during the time of the survey.

4.1 GENERAL DESCRIPTION OF AREA OF WORK

The Area of Work included the locations as outlined in the SOW and locations identified by the client as the areas that will be affected by the planned renovations.

Based on conditions as observed during the time of the Site visit, the general building details in the Areas of Work were as follows (Reference Figure 1):

- Phase 2: 1957 Extension North and South Walls and Link to R31
- Phase 3: Original Building West, North and South Walls
- Phase 4: 1972 & 1995 Extensions

As noted above in Section 1.2, the purpose of this DSHMS is to support planned masonry/window renovations of Yeo Hall (Building R32) to ensure the heritage building envelope is protected, and to restore the building envelope to its original condition.

4.2 ASBESTOS-CONTAINING MATERIALS (ACMs)

At the time of the survey, a total of thirty-five (35) bulk samples were collected of suspected ACM from accessible homogeneous building materials within the Area of Work and submitted for laboratory analysis. A copy of the laboratory Certificate of Analysis Reports is provided in Appendix B.

The following sections provide findings of the survey in regards to suspected ACMs and organized based on the more common types of materials where ACM was historically known to have been readily used. The location plan for the Area of Work with sample locations and sample IDs are shown on Figure 1.

4.2.1 CAULKING AND JOINT COMPOUND

Eight (8) samples of caulking and joint compound were sampled from each Phase as follows;

- Phase 2
 - Dark grey caulking (Sample 1A-C) was sampled from the window of the bridge to R31 and was found to be non-asbestos-containing as per O. Reg. 278/05
 - Light grey caulking (Sample 2A-C) was sampled from the south exterior wall and was found to be non-asbestos-containing as per O. Reg. 278/05
 - White expansion joint compound (Sample 4A-C) was sampled from the north exterior wall and was found to be non-asbestos-containing as per O. Reg. 278/05
 - Black caulking (Sample 6A-C) was sampled from the north exterior wall and was found to be non-asbestos-containing as per O. Reg. 278/05
- Phase 3
 - Light grey caulking (Sample 2A-C) was sampled from the north exterior wall and was found to be non-asbestos-containing as per O. Reg. 278/05
 - Dark grey caulking (Sample 3A-C) was sampled from the east exterior wall window and was found to be non-asbestos-containing as per O. Reg. 278/05
- Phase 4
 - White expansion joint compound (Sample 2A-C) was sampled from west exterior wall and was found to be non-asbestos-containing as per O. Reg. 278/05
 - Dark grey caulking (Sample 3A-C) was sampled from the west exterior window and was found to be non-asbestos-containing as per O. Reg. 278/05

A summary of samples found to be non-asbestos-containing are presented in Table 1. The tables include a general description of the material sampled, sample locations, and the reported analytical results. A copy of the laboratory Certificate of Analysis Reports is provided in Appendix B.

4.2.2 MORTAR

Four (4) samples of mortar were sampled from each Phase as follows;

- Phase 2
 - Mortar (Sample 3A-G) was sampled from the west exterior wall of the bridge to R31 and was found to be non-asbestos-containing as per O. Reg. 278/05
 - Mortar (Sample 5A-G) was sampled from the north exterior wall and was found to be non-asbestos-containing as per O. Reg. 278/05

- Phase 3
 - Mortar (Sample 1A-G) was sampled from the east exterior wall and was found to be non-asbestos-containing as per O. Reg. 278/05
- Phase 4
 - Mortar (Sample 1A-G) was sampled from the south exterior wall and was found to be non-asbestos-containing as per O. Reg. 278/05

A summary of samples found to be non-asbestos-containing are presented in Table 1. The table includes a general description of the material sampled, sample locations, and the reported analytical results. A copy of the laboratory Certificate of Analysis Report is provided in Appendix B.

4.3 LEAD-CONTAINING MATERIALS

4.3.1 PAINT

Suspect lead-containing paint was identified on a heritage door located in the area of the proposed renovations. Due to the heritage status of the door, it was discussed with and agreed to by DCC representatives at the site that sampling of the paint would potentially result in undue damage to the door structure and as such, sampling of the paint was not undertaken as part of this assessment.

With the exception of the above-noted heritage door, suspect lead-containing paint was not identified in accessible locations of the Area of Work during the Site inspection.

4.3.2 MORTAR

Three (3) mortar samples suspected to contain lead was submitted to an independent NVLAP accredited laboratory for lead analysis. Samples were analyzed using EPA method 3050/6010.

Based on laboratory analysis, the mortar was found to contain lead levels between 7.1 – 32.1 mg/kg lead.

The three (3) mortar samples were also submitted for Schedule 4 Toxicity Characteristic Leaching Procedure (TCLP) leachate analysis for lead as per Schedule 4 TCLP testing under O. Reg. 347/90.

Laboratory results indicate that the mortar sampled from each Phase was below the Schedule 4 criteria for lead. The mortar submitted for analysis is considered to be non-hazardous waste.

A summary of mortar samples found to be lead-containing are presented in Tables 2. A summary of TCLP results is presented in Table 3. The tables include a general description of the

material sampled, sample locations, and the reported analytical results. A copy of the laboratory Certificate of Analysis Reports is provided in Appendix B.

4.4 ARSENIC

Paint on the above-noted heritage door (refer to Section 4.3.1) is suspected to contain arsenic. Other significant potential sources of arsenic were not identified in accessible locations of the Area of Work during the Site inspection.

4.5 MERCURY

Paint on the above-noted heritage door is (refer to Section 4.3.1) suspected to contain mercury. Other significant potential sources of mercury were not identified in accessible locations of the Area of Work during the Site inspection.

4.6 SILICA

Based on the visual inspection of accessible locations in the Area of Work, crystalline silica is presumed to be present in masonry products including concrete

4.7 OTHER DESIGNATED SUBSTANCES

No evidence suggesting the significant presence of acrylonitrile, arsenic, benzene, ethylene oxide, isocyanates, vinyl chloride, or coke oven emissions was observed in the Area of Work during the time of the survey and none were reported by the client. These designated substances are not typically found in building materials in a composition or state that is hazardous during general renovation activities.

4.8 PCBs

Paint on the above-noted heritage door (refer to Section 4.3.1) is suspected to contain PCBs, Other suspected PCB-containing paint, equipment, or products were not identified in the accessible areas of the Area of Work.

4.9 CHROMIUM

Paint on the above-noted heritage door (refer to Section 4.3.1) is suspected to contain Chromium. Other significant potential sources of chromium were not identified in accessible locations of the Area of Work during the Site inspection.

5.0 CONCLUSIONS

The targeted pre-renovation DSHMS of the specified Area of Work completed at Yeo Hall (Building R32) located at the Royal Military College in Kingston, Ontario in general accordance with the DCC SOW and Amec Foster Wheeler's Proposal No. PSWC179105.

Based on the visual inspection of accessible areas in the Area of Work, bulk sampling and laboratory sample analysis results, the following findings are provided.

Lead

- Three (3) bulk samples of mortar were collected and submitted for lead analysis
- Lead was detected in all samples above the method detection limit
- The three (3) mortar samples were also submitted for Schedule 4 Toxicity Characteristic Leaching Procedure (TCLP) leachate analysis for lead
 - Laboratory results indicate that the mortar sampled from each Phase was below the Schedule 4 criteria for lead
 - The mortar submitted for analysis is considered to be non-hazardous waste.
- Paint on the heritage door (refer to Section 4.3.1) is suspected to contain lead.

Mercury

- Paint on the heritage door (refer to Section 4.3.1) is suspected to contain mercury,
- Other suspected mercury-containing materials were not identified in the accessible areas of the Area of Work

Arsenic

- Paint on the heritage door (refer to Section 4.3.1) is suspected to contain arsenic,
- Other suspected arsenic-containing materials were not identified in the accessible areas of the Area of Work

Silica

Based on the visual inspection of accessible locations in the Area of Work, crystalline silica is presumed to be present in masonry products including concrete.

PCBs

- Paint on the heritage door (refer to Section 4.3.1) is suspected to contain PCBs,

- Other suspected PCB-containing materials were not identified in the accessible areas of the Area of Work

Chromium

- Paint on the heritage door (refer to Section 4.3.1) is suspected to contain chromium,
- Other suspected chromium-containing materials were not identified in the accessible areas of the Area of Work

6.0 RECOMMENDATIONS

The following recommendations are provided based on the findings of the targeted pre-renovation DSHMS of the specified Area of Work for Yeo Hall (Building R32) located at the Royal Military College in Kingston, Ontario, as outlined in this report.

The presence of designated substances during renovations or demolition projects require protective measures to be employed to minimize potential worker exposure in accordance with the OHSA, O. Reg. 278/05 and relevant guidelines, as outlined in this report. All waste handling is regulated by O. Reg. 347/90.

6.1 WORKER NOTIFICATION – DESIGNATED SUBSTANCES

The building owner must notify all employees and contractors involved with building maintenance, renovations, and/or demolition activities, of the presence of designated substances, as required by the OHSA. A copy of this report should also be made available to the Joint Occupational Health and Safety Committee (JOHSC). Note that no designated substances were identified during this assessment.

This report, along with abatement work plans and specifications must be given to the constructor. In turn the constructor must provide this report to contractors and sub-contractors.

Prior to tendering project work in the building, the building owner or owner's agent must provide this report, work plan and abatement specifications to constructors bidding on the project work. In turn, the constructor must provide this to contractors and subcontractors prior to requesting bids. This report also fulfills the requirements of Section 10 of O. Reg. 278/05. This requires that owners report the presence of both friable and non-friable ACMs to constructors as part of the tendering process or prior to arranging for work.

Constructors/contractors must use the information when filing a Notice of Project Form with the MOL. In Section 6 of the form, check all Designated Substances listed in this report that will be disturbed. The type of asbestos abatement operation (Type 1, 2, or 3 operations) must be selected in Section 5 of the form (where applicable).

6.2 ASBESTOS-CONTAINING MATERIALS (ACM)

6.2.1 DEMOLITION AND RENOVATION PROJECTS

ACMs were not identified in the Area of Work during this assessment. If previously unidentified materials suspected to be asbestos-containing are identified during renovation activities, work in the immediate area should be halted immediately and the suspect material assessed.

6.3 LEAD-CONTAINING MATERIALS

Lead-containing products disturbed during construction/demolition may result in worker exposure to lead. Cutting, grinding, drilling, removing, stripping or demolition of materials containing or coated with lead should be completed only with respiratory protection, as outlined, and worker safety precautions as outlined in the *Ministry of Labour Guideline – Lead on Construction Projects, 2004* (MOL Guideline). The MOL has not established a lower limit for concentrations of lead in paint (or other materials) below which precautions do not need to be considered. Therefore, the precautions and details of worker safety will need to be assessed on a project-by-project basis. We recommend that the building owner and contractor obtain advice to develop a site-specific safety plan that considers the factors that would affect potential lead exposure of workers. Paints and materials with concentrations lower than 0.5% lead may require modified or reduced procedures than those outlined in the Guideline; however, airborne lead exposures at any level may be a concern.

The building owner and/or contractor should develop (or have developed) site specific procedures for the MOL designated lead operations. These lead operations and procedures and practices are outlined in the MOL Guideline; however, site specific procedures should be considered.

The disposal of construction waste containing lead is controlled under O. Reg. 347/90 and may be subject to lead leachate analysis prior to disposal (Leachate Criteria, Schedule 4 of O. Reg. 347/90).

6.4 ARSENIC

With the exception of paint on the heritage door (refer to Section 4.3.1), arsenic-containing paints were not identified in the Area of Work during this assessment. If previously unidentified materials suspected to contain arsenic are identified during renovation activities, work in the immediate area should be halted immediately and the suspect material assessed. Typically a worker's exposure to arsenic is considered low if material surfaces and coatings remain intact (in good physical condition).

Although there are no specific criteria for arsenic content in paint, appropriate dust and worker protection procedures are required to control exposure to arsenic-containing particulate during renovation or demolition projects.

6.5 MERCURY

Mercury-containing paints were not identified in the Area of Work during this assessment. If previously unidentified materials suspected to contain mercury are identified during renovation activities, work in the immediate area should be halted immediately and the suspect material assessed.

Typically a worker's exposure to mercury is considered low if material surfaces and coatings remain intact (in good physical condition). Although there are no specific criteria for mercury content in paint, appropriate dust and worker protection procedures must be taken to limit exposure to mercury-containing particulate during renovation or demolition projects.

6.6 SILICA

Crystalline silica is presumed to be present in concrete and other masonry products. Construction disturbance of silica-containing products may result in exposures to airborne silica, especially if performed indoors and/or while dry. Cutting, grinding, drilling or demolition of silica-containing materials should be completed with proper respiratory protection and worker safety precautions as outlined in the *Ministry of Labour Guideline – Silica on Construction Projects, 2004*.

6.7 CHROMIUM

With the exception of paint on the heritage door (refer to Section 4.3.1), chromium-containing paints were not identified in the Area of Work during this assessment. If previously unidentified materials suspected to contain chromium are identified during renovation activities, work in the immediate area should be halted immediately and the suspect material assessed.

Typically a worker's exposure to chromium is considered low if material surfaces and coatings remain intact (in good physical condition). Although there are no specific criteria for chromium content in paint, appropriate dust and worker protection procedures must be taken to limit exposure to chromium-containing particulate during renovation or demolition projects.

6.8 PCBs

With the exception of paint on the heritage door (refer to Section 4.3.1), PCB-containing paints, equipment, or products were not identified in the Area of Work during this assessment. If previously unidentified materials suspected to contain PCBs are identified during renovation activities, work in the immediate area should be halted immediately and the suspect material assessed.

Where maintenance alteration, renovation, or demolition activities undertaken at a Site may result in the generation of more than 1.0 kg of PCB waste, it will be necessary to establish a secure

licensed PCB storage facility at the Site or dispose of the wastes at an approved PCB disposal or destruction facility. PCB wastes totalling less than 1.0 kg may be disposed as non-hazardous waste at any licensed waste disposal site in accordance with applicable regulations.

7.0 SURVEY LIMITATIONS

Within the limitations of the agreed-upon scope of work, the field observations, measurements and analysis are considered sufficient to form a general inventory of hazardous materials in the Areas of Work. It should be noted that the data presented herein were collected at specific sampling locations, and depending on the homogeneity of the samples, the data may vary between these locations. Some inherent limitations exist as to the thoroughness of this assessment due to the nature of building construction. For example it may not be practical to test all pipe insulation for asbestos content or all paint for lead content at the Site due to the amount and locations and being located under existing materials. Some reasonable extrapolation (e.g., sampling of similar materials) was required from the findings of the assessment. For example, samples of suspect ACM were not collected in each homogeneous area of the building when homogeneous materials of a similar nature, composition, and color were sampled in other homogeneous areas.

Within the limitations of the agreed-upon scope of work, the survey included building materials found within or forming part of accessible locations of the sloped asphalt shingled roofs. The inspection excluded the identification of suspected designated substances located in the flat roof sections or attic spaces of the buildings. Amec Foster Wheeler is not responsible for the repairs of building materials that were sampled during the survey.

Within the limitations of the agreed-upon scope of work, this assessment has been undertaken and performed in a professional manner in accordance with generally accepted practices, using the degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. Due to physical limitations inherent to this assessment, Amec Foster Wheeler expressly does not warrant that the Site is free of designated substances or that all designated substances have been identified. No other warranties, expressed or implied, are made. Refer to Appendix C.

8.0 CLOSURE

Amec Foster Wheeler has prepared this report for the express use of the Client and may be relied upon by the Client. No other person or organization is entitled to rely upon any part of this report without the prior written consent of Amec Foster Wheeler. The Client may release all or part(s) of this report to third parties; however, such third party in using this report agrees that it shall have no legal recourse against Amec Foster Wheeler or its subsidiaries, and shall indemnify and defend Amec Foster Wheeler or its subsidiaries from and against all claims arising out of or in conjunction with such use or reliance. This report does not constitute legal advice. In addition, Amec Foster

Wheeler makes no determination or recommendation regarding the decision to purchase, sell or provide financing for this property.

This report presents an overview of issues of concern with the specified designated substances, and included hazardous building materials reflecting Amec Foster Wheeler's best judgment using information reasonably available at the time of Amec Foster Wheeler's Site survey. In preparing this report, Amec Foster Wheeler has relied upon certain information and representations provided by the Client. Amec Foster Wheeler did not attempt to independently verify the accuracy or completeness of that information. To the extent that the conclusions in this report are based in whole or in part on such information, those conclusions are contingent on its accuracy and validity. Amec Foster Wheeler assumes no responsibility for any consequence arising from any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to Amec Foster Wheeler. No other warranty, expressed or implied, is made.

If you require any assistance or have any question, please contact the undersigned at (519) 681-2400.

Respectfully Submitted,

**Amec Foster Wheeler Environment & Infrastructure
a Division of Amec Foster Wheeler Americas Limited**

Prepared by:



Laura Riffel, B.A.
Environmental Technician
laura.riffel@amecfw.com

Reviewed by:



David Penney, MES, CIH, CRSP, CET
Senior Industrial Hygienist
david.penney@amecfw.com



[Rita Korczynski PhD, CIH, CRSP](#)
Senior Industrial Hygienist
Rita.Korczynski@amecfw.com

TABLES

TABLE 1
Bulk Sample Results - Materials Determined to be Non-Asbestos-Containing
R32 (Yeo Hall) Masonry Repairs Phase 2, Phase 3 and Phase 4
Royal Military College Kingston, Ontario

Amec Foster Wheeler Sample No. (Phase)	Lab Sample ID No.	Sample Location	Sample Description	Laboratory Results	
				Type & % Asbestos Fibres	Regulatory Limit
1A (Phase 2)	A30069-1	Phase 2 – Bridge to R31 Window	Dark Grey Caulking	None Detected	0.5%
1B (Phase 2)	A30069-2	Phase 2 – Bridge to R31 Window	Dark Grey Caulking	None Detected	0.5%
1C (Phase 2)	A30069-3	Phase 2 – Bridge to R31 Window	Dark Grey Caulking	None Detected	0.5%
2A (Phase 2)	A30069-4	Phase 2 – South Exterior Wall	Light Grey Caulking	None Detected	0.5%
2B (Phase 2)	A30069-5	Phase 2 – South Exterior Wall	Light Grey Caulking	None Detected	0.5%
2C (Phase 2)	A30069-6	Phase 2 – South Exterior Wall	Light Grey Caulking	None Detected	0.5%
3A (Phase 2)	A30069-7	Phase 2 – West Exterior Wall	Mortar	None Detected	0.5%
3B (Phase 2)	A30069-8	Phase 2 – West Exterior Wall	Mortar	None Detected	0.5%
3C (Phase 2)	A30069-9	Phase 2 – West Exterior Wall	Mortar	None Detected	0.5%
3D (Phase 2)	A30069-10	Phase 2 – West Exterior Wall	Mortar	None Detected	0.5%
3E (Phase 2)	A30069-11	Phase 2 – West Exterior Wall	Mortar	None Detected	0.5%
3F (Phase 2)	A30069-12	Phase 2 – West Exterior Wall	Mortar	None Detected	0.5%
3G (Phase 2)	A30069-13	Phase 2 – West Exterior Wall	Mortar	None Detected	0.5%
4A (Phase 2)	A30069-14	Phase 2 – North Exterior Wall	White Expansion Joint Compound	None Detected	0.5%
4B (Phase 2)	A30069-15	Phase 2 – North Exterior Wall	White Expansion Joint Compound	None Detected	0.5%
4C (Phase 2)	A30069-16	Phase 2 – North Exterior Wall	White Expansion Joint Compound	None Detected	0.5%
5A (Phase 2)	A30069-17	Phase 2 – North Exterior Wall	Mortar	None Detected	0.5%
5B (Phase 2)	A30069-18	Phase 2 – North Exterior Wall	Mortar	None Detected	0.5%
5C (Phase 2)	A30069-19	Phase 2 – North Exterior Wall	Mortar	None Detected	0.5%
5D (Phase 2)	A30069-20	Phase 2 – North Exterior Wall	Mortar	None Detected	0.5%
5E (Phase 2)	A30069-21	Phase 2 – North Exterior Wall	Mortar	None Detected	0.5%

Amec Foster Wheeler Sample No. (Phase)	Lab Sample ID No.	Sample Location	Sample Description	Laboratory Results	
				Type & % Asbestos Fibres	Regulatory Limit
5F (Phase 2)	A30069-22	Phase 2 – North Exterior Wall	Mortar	None Detected	0.5%
5G (Phase 2)	A30069-23	Phase 2 – North Exterior Wall	Mortar	None Detected	0.5%
6A (Phase 2)	A30069-24	Phase 2 – North Exterior Wall	Black Caulking	None Detected	0.5%
6B (Phase 2)	A30069-25	Phase 2 – North Exterior Wall	Black Caulking	None Detected	0.5%
6C (Phase 2)	A30069-26	Phase 2 – North Exterior Wall	Black Caulking	None Detected	0.5%
1A (Phase 3)	A30069-27	Phase 3 – East Exterior Wall	Mortar	None Detected	0.5%
1B (Phase 3)	A30069-28	Phase 3 – East Exterior Wall	Mortar	None Detected	0.5%
1C (Phase 3)	A30069-29	Phase 3 – East Exterior Wall	Mortar	None Detected	0.5%
1D (Phase 3)	A30069-30	Phase 3 – East Exterior Wall	Mortar	None Detected	0.5%
1E (Phase 3)	A30069-31	Phase 3 – East Exterior Wall	Mortar	None Detected	0.5%
1F (Phase 3)	A30069-32	Phase 3 – East Exterior Wall	Mortar	None Detected	0.5%
1G (Phase 3)	A30069-33	Phase 3 – East Exterior Wall	Mortar	None Detected	0.5%
2A (Phase 3)	A30069-34	Phase 3 – North Exterior Wall	Light Grey Caulking	None Detected	0.5%
2B (Phase 3)	A30069-35	Phase 3 – North Exterior Wall	Light Grey Caulking	None Detected	0.5%
2C (Phase 3)	A30069-36	Phase 3 – North Exterior Wall	Light Grey Caulking	None Detected	0.5%
3A (Phase 3)	A30069-37	Phase 3 – East Exterior Wall Window	Dark Grey Caulking	None Detected	0.5%
3B (Phase 3)	A30069-38	Phase 3 – East Exterior Wall Window	Dark Grey Caulking	None Detected	0.5%
3C (Phase 3)	A30069-39	Phase 3 – East Exterior Wall Window	Dark Grey Caulking	None Detected	0.5%
1A (Phase 4)	A30069-40	Phase 4 – South Exterior Wall	Mortar	None Detected	0.5%
1B (Phase 4)	A30069-41	Phase 4 – South Exterior Wall	Mortar	None Detected	0.5%
1C (Phase 4)	A30069-42	Phase 4 – South Exterior Wall	Mortar	chrysotile <0.5%	0.5%
1D (Phase 4)	A30069-43	Phase 4 – South Exterior Wall	Mortar	None Detected	0.5%
1E (Phase 4)	A30069-44	Phase 4 – South Exterior Wall	Mortar	None Detected	0.5%
1F (Phase 4)	A30069-45	Phase 4 – South Exterior Wall	Mortar	None Detected	0.5%
1G (Phase 4)	A30069-46	Phase 4 – South Exterior Wall	Mortar	chrysotile <0.5%	0.5%
2A (Phase 4)	A30069-47	Phase 4 – West Exterior Wall	White Expansion Joint Compound	None Detected	0.5%
2B (Phase 4)	A30069-48	Phase 4 – West Exterior Wall	White Expansion Joint Compound	None Detected	0.5%

Amec Foster Wheeler Sample No. (Phase)	Lab Sample ID No.	Sample Location	Sample Description	Laboratory Results	
				Type & % Asbestos Fibres	Regulatory Limit
2C (Phase 4)	A30069-49	Phase 4 – West Exterior Wall	White Expansion Joint Compound	None Detected	0.5%
3A (Phase 4)	A30069-50	Phase 4 – West Exterior Wall Window	Dark Grey Caulking	None Detected	0.5%
3B (Phase 4)	A30069-51	Phase 4 – West Exterior Wall Window	Dark Grey Caulking	None Detected	0.5%
3C (Phase 4)	A30069-52	Phase 4 – West Exterior Wall Window	Dark Grey Caulking	None Detected	0.5%

Table 1 represents a summary of bulk sample laboratory results and must be used in conjunction with the detailed findings and recommendations provided in the targeted DSHMS report. The regulatory limit of 0.5% is considered to be a non-ACM as per O. Reg. 278/05

TABLE 2
Lead in Mortar

*R32 (Yeo Hall) Masonry Repairs Phase 2, Phase 3 and Phase 4
Royal Military College Kingston, Ontario*

Amec Foster Wheeler Sample No.	Sample Location	Sample Description	Parameter	Laboratory Results (mg/Kg)
L1 (P2)	Phase 2 – Composite Sample	Mortar	Lead	7.1
L1 (P3)	Phase 3 – East Exterior Wall	Mortar	Lead	32.1
L1 (P4)	Phase 4 – South Exterior Wall	Mortar	Lead	9.0

Table 2 represents a summary of bulk sample laboratory results and must be used in conjunction with the detailed findings and recommendations provided in the targeted DSHMS report.

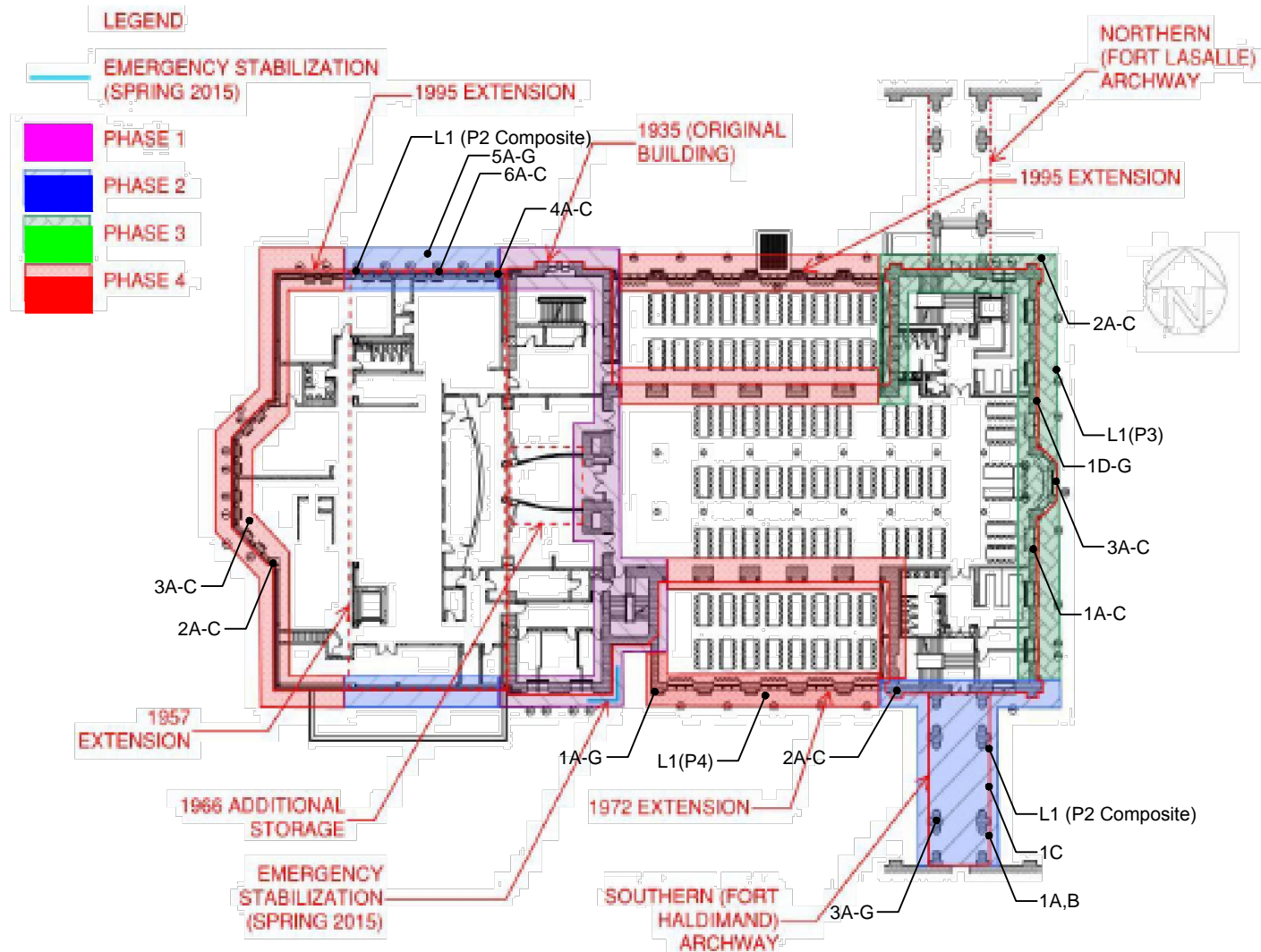
TABLE 3
Lead Leachate Analysis in Mortar

*R32 (Yeo Hall) Masonry Repairs Phase 2, Phase 3 and Phase 4
Royal Military College Kingston, Ontario*

Amec Foster Wheeler Sample No.	Sample Location	Sample Description	Parameter	Laboratory Results (mg/L)	Schedule 4 Leachate Criteria (mg/L)
L1 (P2)	Phase 2 – Composite Sample	Mortar	Lead	<0.001	5
L1 (P3)	Phase 3 – East Exterior Wall	Mortar	Lead	<0.001	5
L1 (P4)	Phase 4 – South Exterior Wall	Mortar	Lead	<0.001	5


Table 3 represents a summary of bulk sample laboratory results and must be used in conjunction with the detailed findings and recommendations provided in the targeted DSHMS report

FIGURE
LAYOUT PLANS & SAMPLE LOCATIONS



NOTES:
THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC FOSTER
WHEELER ENVIRONMENT & INFRASTRUCTURE REPORT No. SWC179086

ALL LOCATIONS ARE APPROXIMATE.

CLIENT:		DWN BY:	BM	PROJECT:	DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS ASSESSMENT (DSHMS)	DATE:	APRIL 2017
DEFENSE CONSTRUCTION CANADA 5 ARTISAN ROAD, RM101 CFB Kingston, Ontario, K7K 7B4		CHK'D BY:	LR			PROJECT No:	SWC179086
Amec Foster Wheeler Environment & Infrastructure 1940 OXFORD STREET EAST, UNIT 7 LONDON, ONTARIO N5V 4L8 519-681-2400		DATUM:				REV. No:	0
		PROJECTION:		TITLE:		FIGURE No:	1
		SCALE:	N.T.S.	R32 (YEO HALL) MASONRY REPAIRS PHASE 2, PHASE3 AND PHASE 4 ROYAL MILITARY COLLEGE			

**APPENDIX A
PHOTOGRAPHIC LOG**



Photo 1: Phase 2 – Mortar from the west exterior wall was found to be non-asbestos-containing



Photo 2: Phase 2 – White Expansion Joint Compound from the north exterior wall was found to be non-asbestos-containing



Photo 3: Phase 3 – Light Grey Caulking from the north exterior wall was found to be non-asbestos-containing



Photo 4: Phase 4 – Dark Grey Window Caulking from the west exterior wall was found to be non-asbestos-containing

APPENDIX B
LABORATORY CERTIFICATES OF ANALYSIS

Laboratory Analysis Report

To:

Laura Riffel
AMEC Foster Wheeler
Environment & Infrastructure
1940 Oxford Street E, Unit 7
London, Ontario
N5V 4L8

EMC LAB REPORT NUMBER: A30069

Job/Project Name: Yeo Hall DSS

Analysis Method: Polarized Light Microscopy – EPA 600

Date Received: Mar 23/17

Date Analyzed: Mar 28/17

Analyst: Arabee Sathiaselan, *Analyst*

Reviewed By: Malgorzata Sybydlo, *Laboratory Manager*

Job No: SWC179086

Number of Samples: 52

Date Reported: Mar 29/17



Client's Sample ID	Lab Sample No.	Description/Location	Sample Appearance	SAMPLE COMPONENTS (%)			
				Asbestos Fibres		Non-asbestos Fibres	Non-fibrous Material
1A	A30069-1	Dark grey caulking (window) phase 2	Grey, caulking	ND			100
1B	A30069-2	Dark grey caulking (window) phase 2	Grey, caulking	ND			100
1C	A30069-3	Dark grey caulking (window) phase 2	Grey, caulking	ND			100
2A	A30069-4	Light grey caulking – south ext. wall, phase 2	Grey, caulking	ND			100
2B	A30069-5	Light grey caulking – south ext. wall, phase 2	Grey, caulking	ND			100
2C	A30069-6	Light grey caulking – south ext. wall, phase 2	Grey, caulking	ND			100
3A	A30069-7	Mortar phase 2, west ext. wall (bridge to R31)	Grey, cementitious material	ND			100
3B	A30069-8	Mortar phase 2, west ext. wall (bridge to R31)	Grey, cementitious material	ND			100
3C	A30069-9	Mortar phase 2, west ext. wall (bridge to R31)	Grey, cementitious material	ND			100
3D	A30069-10	Mortar phase 2, west ext. wall (bridge to R31)	Grey, cementitious material	ND			100
3E	A30069-11	Mortar phase 2, west ext. wall (bridge to R31)	Grey, cementitious material	ND			100
3F	A30069-12	Mortar phase 2, west ext. wall (bridge to R31)	Grey, cementitious material	ND			100

EMC Scientific Inc. 5800 Ambler Drive • Suite 100 • Mississauga • Ontario • L4W 4J4 • T. 905 629 9247 • F. 905 629 2607

EMC Scientific Inc. is Accredited by NVLAP (NVLAP Code 201020-0) for Bulk Asbestos Analysis

Laboratory Analysis Report

EMC LAB REPORT NUMBER: A30069

Client's Job/Project No.: SWC179086

Analyst: Arabee Sathiaselam, *Analyst*

Client's Sample ID	Lab Sample No.	Description/Location	Sample Appearance	SAMPLE COMPONENTS (%)			
				Asbestos Fibres		Non-asbestos Fibres	Non-fibrous Material
		to R31)					
3G	A30069-13	Mortar phase 2, west ext. wall (bridge to R31)	Grey, cementitious material	ND			100
4A	A30069-14	White expansion joint compound, north ext. wall	White, caulking	ND			100
4B	A30069-15	White expansion joint compound, north ext. wall	White, caulking	ND			100
4C	A30069-16	White expansion joint compound, north ext. wall	White, caulking	ND			100
5A	A30069-17	Mortar phase 2, north wall ext.	Grey, cementitious material	ND			100
5B	A30069-18	Mortar phase 2, north wall ext.	Grey, cementitious material	ND			100
5C	A30069-19	Mortar phase 2, north wall ext.	Grey, cementitious material	ND			100
5D	A30069-20	Mortar phase 2, north wall ext.	Grey, cementitious material	ND			100
5E	A30069-21	Mortar phase 2, north wall ext.	Grey, cementitious material	ND			100
5F	A30069-22	Mortar phase 2, north wall ext.	Grey, cementitious material	ND			100
5G	A30069-23	Mortar phase 2, north wall ext.	Grey, cementitious material	ND			100
6A	A30069-24	Black calking north ext. wall, phase 2	Black, caulking	ND		1	99
6B	A30069-25	Black calking north ext. wall, phase 2	Black, caulking	ND		1	99

Laboratory Analysis Report

EMC LAB REPORT NUMBER: A30069

Client's Job/Project No.: SWC179086

Analyst: Arabee Sathiaselam, *Analyst*

Client's Sample ID	Lab Sample No.	Description/Location	Sample Appearance	SAMPLE COMPONENTS (%)			
				Asbestos Fibres		Non-asbestos Fibres	Non-fibrous Material
6C	A30069-26	Black caulking north ext. wall, phase 2	Black, caulking	ND		1	99
1A	A30069-27	Mortar east ext. wall, phase 3	Grey, cementitious material	ND			100
1B	A30069-28	Mortar east ext. wall, phase 3	Grey, cementitious material	ND			100
1C	A30069-29	Mortar east ext. wall, phase 3	Grey, cementitious material	ND			100
1D	A30069-30	Mortar east ext. wall, phase 3	Grey, cementitious material	ND			100
1E	A30069-31	Mortar east ext. wall, phase 3	Grey, cementitious material	ND			100
1F	A30069-32	Mortar east ext. wall, phase 3	Grey, cementitious material	ND			100
1G	A30069-33	Mortar east ext. wall, phase 3	Grey, cementitious material	ND			100
2A	A30069-34	Light grey caulking, north wall, phase 3	Grey, caulking	ND			100
2B	A30069-35	Light grey caulking, north wall, phase 3	Grey, caulking	ND			100
2C	A30069-36	Light grey caulking, north wall, phase 3	Grey, caulking	ND			100
3A	A30069-37	Dark grey window caulking, east ext. wall, phase 3	Grey, caulking	ND			100
3B	A30069-38	Dark grey window caulking, east ext. wall, phase 3	Grey, caulking	ND			100
3C	A30069-39	Dark grey window caulking, east ext. wall, phase 3	Grey, caulking	ND			100

Laboratory Analysis Report

EMC LAB REPORT NUMBER: A30069

Client's Job/Project No.: SWC179086

Analyst: Arabee Sathiaselan, *Analyst*

Client's Sample ID	Lab Sample No.	Description/Location	Sample Appearance	SAMPLE COMPONENTS (%)			
				Asbestos Fibres		Non-asbestos Fibres	Non-fibrous Material
1A	A30069-40	Mortar south ext. wall phase 4	Off-white and grey, cementitious material	ND			100
1B	A30069-41	Mortar south ext. wall phase 4	Off-white and grey, cementitious material	ND			100
1C	A30069-42	Mortar south ext. wall phase 4	Off-white and grey, cementitious material	Chrysotile	<0.5		100
1D	A30069-43	Mortar south ext. wall phase 4	Off-white and grey, cementitious material	ND			100
1E	A30069-44	Mortar south ext. wall phase 4	Off-white and grey, cementitious material	ND			100
1F	A30069-45	Mortar south ext. wall phase 4	Off-white and grey, cementitious material	ND			100
1G	A30069-46	Mortar south ext. wall phase 4	Off-white and grey, cementitious material	Chrysotile	<0.5		100
2A	A30069-47	White expansion joint compound phase 4, west ext. wall	Grey, caulking	ND			100
2B	A30069-48	White expansion joint compound phase 4, west ext. wall	Grey, caulking	ND			100
2C	A30069-49	White expansion joint compound phase 4, west ext. wall	Grey, caulking	ND			100
3A	A30069-50	Dark grey window caulking, phase 4, west ext.	Grey, caulking	ND			100
3B	A30069-51	Dark grey window caulking, phase 4, west ext.	Grey, caulking	ND			100

Laboratory Analysis Report

EMC LAB REPORT NUMBER: A30069

Client's Job/Project No.: SWC179086

Analyst: Arabee Sathiaselam, *Analyst*

Client's Sample ID	Lab Sample No.	Description/Location	Sample Appearance	SAMPLE COMPONENTS (%)		
				Asbestos Fibres	Non-asbestos Fibres	Non-fibrous Material
3C	A30069-52	Dark grey window caulking, phase 4, west ext.	Grey, caulking	ND		100

Note:

1. Bulk samples are analyzed using Polarized Light Microscopy (PLM) and dispersion staining techniques. The analytical procedures are in accordance with EPA 600/R-93/116 method.
2. The results are only related to the samples analyzed. **ND** = None Detected (no asbestos fibres were observed), **NA** = Not Analyzed (analysis stopped due to a previous positive result).
3. This report may not be reproduced, except in full without the written approval of EMC Scientific Inc. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. Government.
4. The Ontario Regulatory Threshold for asbestos is 0.5%. The limit of quantification (LOQ) is 0.5%.

Final Analytical Report



Attention: David Penney

Amec Foster Wheeler Environment & Infrastructure
7-1940 Oxford St. E
London, ON N5V 4L8

Results for File: EC-72485

Project Number: SWC179086

Project Name: Yeo Hall DSS

Date Received: 2017/03/23

Date of Report: 2017/03/30

Report reviewed by:

A handwritten signature in blue ink, appearing to read "Jesse Dang".

Jesse Dang, B.Sc.
Manager
Laboratory Services

A handwritten signature in blue ink, appearing to read "Kristine Connor".

Kristine Connor
Director of QA/QC
Laboratory Services

** All samples will be disposed of after 30 days following analysis. Please contact the lab if you require additional sample storage time. (Samples deemed hazardous will be returned to the client at their own expense or disposal will be arranged.) **

Amec Foster Wheeler Environment & Infrastructure, Edmonton Chemistry
5667 - 70 Street, Edmonton, Alberta, Canada T6B 3P6
Tel: (780) 436-2152
www.amecfw.com

ANALYTICAL REPORT



Leachate Analysis - Metals

Project No. SWC179086

Final
File No. EC-72485

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Lab #:	17-2450	17-2456	17-2458
					Client ID:	TCLP-Mortar P2Comp N Ext	TCLP1-MortarE ExtWallP3	TCLP1-MortarS ExtWallP4
					Sample Date:	2017/03/21 13:00	2017/03/21 13:00	2017/03/21 13:00
					DL			
LL	2017/03/23	Leachable Lead	mg/L (ppm)	EPA 1311/6010C	0.001	< 0.001	< 0.001	< 0.001

ANALYTICAL REPORT



Soil Analysis - Metals

Project No. SWC179086

Final
File No. EC-72485

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Lab #:	17-2449	17-2455	17-2457	
					Client ID:	Mortar P2Comp N ExtWall	L1-Mortar E Ext Wall P3	L1-Mortar S Ext Wall P4	
					Sample Date:	2017/03/21 13:00	2017/03/21 13:00	2017/03/21 13:00	
TY	2017/03/23	Lead	mg/kg (ppm)	EPA 3050/6010	DL	0.5	7.1	32.1	9.0

Quality Control Standard

Project No. SWC179086

File No. EC-72485

Leachate Analysis - Metals

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Analyzed Value	Advisory Range	Target Value	Reference No.
LL	2017/03/23	Leachable Lead	mg/L (ppm)	EPA 1311/6010C	0.734	0.633-1.10	0.867	ERA D090-544

Soil Analysis - Metals

Analyst	Date of Analysis (yyyy/m/d)	Analytical Parameter	Units	Reference Method	Analyzed Value	Advisory Range	Target Value	Reference No.
TY	2017/03/23	Lead	µg/g (ppm)	EPA 3050/6010	102	74.6-125	99.6	Metal-1

Analytical Comments

Project No. SWC179086

File No. EC-72485

All Analytical results pertain to samples analyzed as received.

DL - Detection Limit

EPA

EPA: U.S. Environmental Protection Agency. 1997. Test Methods of Evaluation of Solid Waste 3rd Ed through Update III. Office Solid Waste Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

APPENDIX C LIMITATIONS

Amec Foster Wheeler Environment and Infrastructure
STATEMENT OF GENERAL CONDITIONS - ENVIRONMENTAL SERVICES

1. **STANDARD OF CARE** - In the performance of professional services, Amec Foster Wheeler uses that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession practicing in the same or similar localities. No warranty, either expressed or implied, is made or intended by this Agreement or by furnishing oral or written reports of the findings. Amec Foster Wheeler is to be liable only for damage proximately caused by the negligence of Amec Foster Wheeler. The CLIENT recognizes that subsurface conditions may vary from those encountered at the location where borings, surveys or explorations are made by Amec Foster Wheeler and that the data, interpretations and recommendation of Amec Foster Wheeler are based solely on the information available to him. Amec Foster Wheeler will not be responsible for the interpretation by others of the information developed.

2. **SITE INFORMATION** - The CLIENT has agreed to make available to Amec Foster Wheeler all relevant information and documents under his control regarding past, present and proposed conditions of the site. The information shall include, but not be limited to, plot plans, topographic surveys, hydrologic data and previous soil and geologic data including borings, field or laboratory tests and written reports. The CLIENT shall immediately transmit to Amec Foster Wheeler any new information that becomes available or any change in plans. The CLIENT also ensured uninterrupted site access for Amec Foster Wheeler throughout performance of this Agreement.

Amec Foster Wheeler agrees to include a review of all historical information obtained by the CLIENT or provided by the Client to assist in the investigation of the Site unless and except to the extent that such a review is limited or excluded from the scope of work to be performed by Amec Foster Wheeler.

3. **FULL DISCLOSURE** - The CLIENT acknowledges that in order for Amec Foster Wheeler to properly advise and assist the CLIENT in respect of the investigation of the Site, Amec Foster Wheeler has relied upon full disclosure by the CLIENT of all matters pertinent to an investigation of the Site.

4. **DELAYS AND INTERRUPTIONS** - Should Amec Foster Wheeler have been delayed or interrupted by others in the performance of its services or be required to perform additional services as a result of any delay or interruption caused by others, Amec Foster Wheeler shall be equitably compensated by the CLIENT for all costs, charges and expenses which it may incur as a result of such delay or interruption and any such additional services to be performed and any and all consequences resulting from such delay or interruption.

5. **USE OF WORK PRODUCT** - Amec Foster Wheeler agrees to provide to the CLIENT interim reports outlining the progress of the investigation of the Site on a periodic basis and a final comprehensive report upon the completion of the investigation of the Site.

6. **COMPLETE REPORT** - This document being a part of the Report is of a summary nature and is not intended to stand alone without reference to the instructions given to Amec Foster Wheeler by the CLIENT, communications between Amec Foster Wheeler and the CLIENT, and to any other reports, writings or documents prepared by Amec Foster Wheeler for the CLIENT relative to the specific Site described herein, all of which constitute the Report. Wherever the word "Report" is used herein, it shall refer to any and all of the documents referred to herein.

In order to properly understand the suggestions, recommendations and opinions expressed herein, reference must be made to the whole of the Report. Amec Foster Wheeler cannot be responsible for use by any part of portions of the report without reference to the whole report.

7. **LIMITATIONS ON SCOPE OF INVESTIGATION AND WARRANTY DISCLAIMER**
There is no warranty, expressed or implied, by Amec Foster Wheeler that:

- a) The investigation shall uncover all potential contaminants, including asbestos, on the Site; or
- b) The Site will be entirely free of all Targeted Contaminants or other contaminants as a result of any cleanup work undertaken on the Site, since it is not possible, even with exhaustive sampling, testing and analysis, to document all potential contaminants on the Site.

Classification and identification of soils, rocks, geological units, contaminated materials and contaminant quantities have been based on commonly accepted practices in environmental consulting practice in this area.

The CLIENT acknowledges that:

- a) The investigation findings are based solely on the information generated as a result of the specific scope of the investigation authorized by the CLIENT;
- b) any assessment regarding the presence of contamination of the Site is based on the interpretation of conditions determined at specific sampling locations and depths and that conditions may vary between sampling locations;
- c) there can be no assurance that isolated pockets of contaminants are not located on the Site;
- d) any assessment is also dependent on and limited by the accuracy of the analytical data generated by the sample analyses;
- e) any assessment is also limited by the scientific possibility of determining the presence of contaminants for which scientific analyses have been conducted; and
- f) the analytical parameters selected are limited to those outlined in the CLIENT's authorized scope of investigation (in the absence of any evidence of potential contamination sources on the Site, which may warrant expanding the analytical parameters).

8. **REMEDIATION COST ESTIMATES** - Estimates of remediation costs can only be based on the specific information generated and the technical limitations of the investigation authorized by the CLIENT. Accordingly, estimated costs for remediation only represent the cost to clean up known contaminants that have been identified during the course of the investigation. As remediation of a Site is often an iterative exercise, estimated costs for remediation should only be interpreted to cover the first stage of any Site remediation until such time as verification samples indicate that the Site has been fully remediated and Amec Foster Wheeler shall therefore not be liable for the accuracy of any estimates of remediation costs provided.

9. **CONTROL OF WORK AND JOBSITE SAFETY** - Amec Foster Wheeler is only responsible for the activities of its employees on the jobsite. The presence of Amec Foster Wheeler personnel on the Site shall not be construed in any way to relieve the CLIENT or any contractors on Site from their responsibilities for Site safety. The CLIENT undertakes to inform Amec Foster Wheeler of all hazardous conditions, or possible hazardous conditions which are known to him. The CLIENT also recognizes that the activities of Amec Foster Wheeler may uncover previously unknown hazardous materials and that such a discovery may result in the necessity to undertake emergency procedures to protect Amec Foster Wheeler employees as well as the public at large and the environment in general. The CLIENT also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the CLIENT agrees that notification to such bodies by Amec Foster Wheeler will not be a cause of action or dispute.

10. **LIMITATION OF RESPONSIBILITY**

Limitation of Liability - The CLIENT has agreed that, notwithstanding any other provision negotiated as part of Amec Foster Wheeler's contract, the total liability of Amec Foster Wheeler, its officers, directors and employees for liabilities, claims, judgments, demands and causes of action arising under or related to this Agreement, whether based in contract or tort, shall be limited to the total compensation actually paid to Amec Foster Wheeler for the services hereunder or \$50,000, whichever is less. All claims by the CLIENT shall be deemed relinquished unless filed within one (1) year after substantial completion of the services hereunder.

No Special or Consequential Damages - CLIENT and Amec Foster Wheeler agree that to the fullest extent permitted by law that Amec shall not be responsible for any consequential, incidental or indirect damages.

Indemnification - Because CLIENT owns and/or operates the site where work is being performed, CLIENT has and shall retain all responsibility and liability associated with the environmental conditions at the site. Unless specifically identified elsewhere, CLIENT'S responsibility and liability includes the handling and disposal of any samples or hazardous materials generated on the site as a result of Amec Foster Wheeler's performance hereunder. To the fullest extent permitted by law, the CLIENT agrees to defend, indemnify and hold Amec Foster Wheeler, its agents, subcontractors, and employees harmless from and against any and all claims, defense costs, including attorney's fees, damages, and other liabilities arising out of or in any way related to CONSULTANT's reports or recommendations concerning this Agreement, Amec Foster Wheeler 's presence on the project property, or the presence, release, or threatened release of asbestos, hazardous substances, or pollutants on or from the project property; provided that the CLIENT shall not indemnify Amec Foster Wheeler against liability for damages to the extent caused by the negligence or intentional misconduct of Amec Foster Wheeler, its agents, subcontractors, or employees..