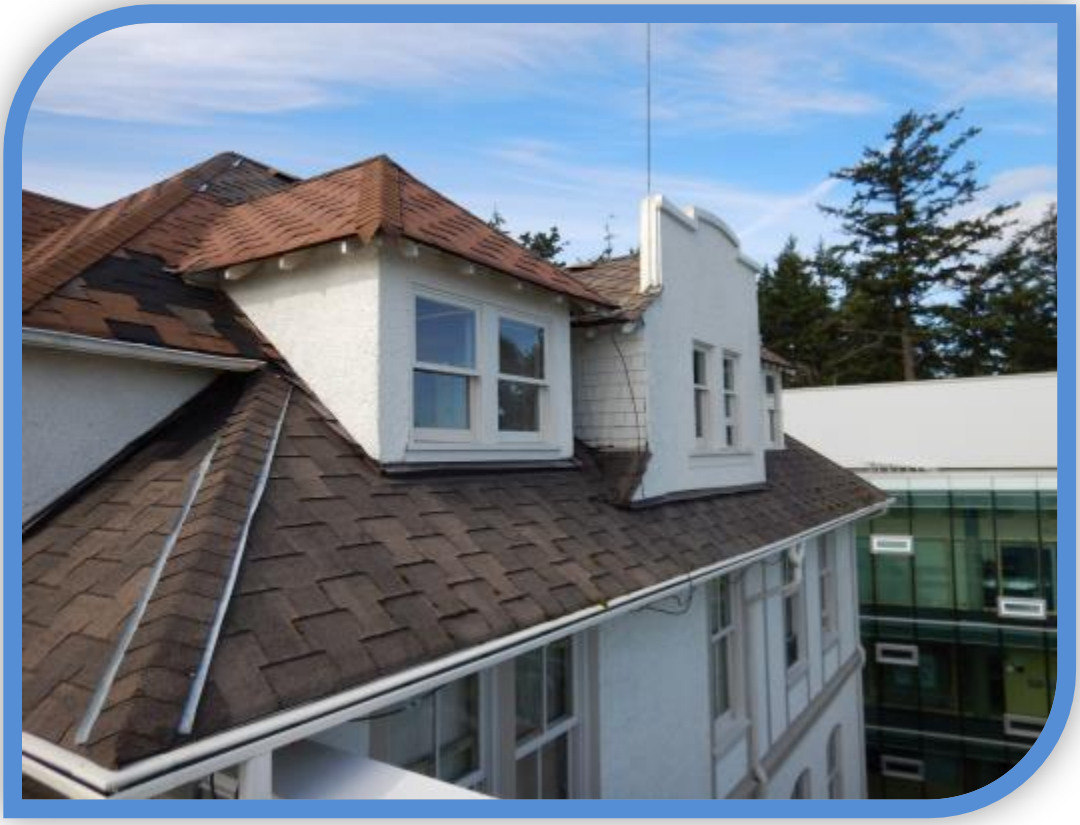
Prepared for:
National Research Council Canada
Herzberg Institute of Astrophysics
5071 West Saanich Road
Victoria, BC
V9E 2E7

Limited Hazardous Materials Assessment

Herzberg Institute of Astrophysics Admin Building 1916 Wing



Prepared by:

North West Environmental Group Ltd.
210-2950 Douglas Street
Victoria, British Columbia V8T 4N4

Project No. 27008 HMA V1.0
Date issued: October 22nd 2015

EXECUTIVE SUMMARY

North West Environmental Group Ltd. (NWest) conducted a limited project-specific hazardous materials assessment at the Hertzberg Institute of Astrophysics, Victoria, BC in accordance with the WorkSafeBC regulatory requirements outlined in the BC Occupational Health and Safety Regulation Section 20.112 – Hazardous Materials. The assessment was conducted by William Roff on October 13th 2015. Building fabric components suspected of containing hazardous materials were identified, logged and, where necessary, sampled and analyzed to confirm the presence or absence of hazardous materials.

The subject site is the original section of a four-wing administration building. The building has a concrete foundation and stucco exterior. Materials observed within the way of planned work included stucco siding, asphalt shingles and wood shake siding.

The client defined the assessment area as:

1916 Wing

- Roof
    - Replacing flashing (impacting stucco)
    - Replacing asphalt shingles
    - Removing wood siding

Sample results from a previous assessment conducted in 2013 (NWest Report 20120 Administration Building (1916) Hazmat Report V1.0) are incorporated into this report.

Invasive investigative techniques were not used as the building was occupied.

WorkSafeBC Regulation 20.112 requires that all hazardous materials found to be in the way of planned work, including asbestos, be identified prior to the commencement of construction and/or renovation work. These hazardous materials must be either safely contained or removed by a qualified contractor employing WorkSafeBC approved procedures. If materials that are suspected of containing hazardous components such as lead or asbestos, are encountered during deconstruction that differ from, or are in addition to those reported in the bulk sample collection report, then work must stop until the material content can be determined.

The purpose of this hazard assessment was to identify the locations of asbestos and other hazardous materials prior to planned renovation/demolition work. This report includes a list of building materials that are confirmed or suspected of containing hazardous materials.

The following table summarizes the observations and results of the assessment.

Table 0-1: Hazmat Assessment Observations and Results*

Hazardous Material	Type and Location	Recommendation
PCBs	• Fluorescent Light Ballasts not observed in the way of planned work	No action necessary
Asbestos* (confirmed)	• No asbestos containing materials were identified in the way of planned work at the time of this assessment*	No action necessary
Asbestos (may contain)	• Materials commonly found to contain asbestos were observed (not sampled) or are suspected to be present including: Electrical cables and inaccessible caulkings on roof equipment.	See Section 4
Mercury	• Fluorescent Light Tubes not observed in way of planned work • Mercury thermostats and other equipment such as manometers not observed in the way of planned work	No action necessary
Ozone Depleting Substances	• ODS not observed in the way of planned work	No action necessary
Radioactive Materials	• Smoke Detectors not observed in the way of planned work	No action necessary
Above Ground Storage Tanks (AST)	• AST not observed in the way of planned work	No action necessary
Lead	• Sample analysis confirmed the presence of lead containing paint on the building. • Lead containing paint did not exceed the leachable lead limit. • Elemental lead assumed to be present in seals on bell and spigot piping joints seals, solder on wiring, electrical equipment, roof exhaust venting and flashing, and copper pipe joints.	See Section 4
Hantavirus – Rodent Droppings	• Evidence of rodent presence not observed in the way of planned work	No action necessary
Silica	• Silica may be present in concrete, stucco and any other cementitious building materials.	See Section 4
Mould	• Mould was not observed in way of planned work	No action necessary
Flammables/Explosive Materials	• Not observed.	No action necessary

Where hazardous materials were found they can be presumed to be found in similar materials throughout the building.

***Warning:** in the event any additional suspect hazardous materials are encountered during renovation or demolition activities, work on those materials must STOP immediately and remain undisturbed until testing confirms the presence or absence of asbestos or other hazardous material. If any material suspected of containing asbestos or another hazardous material is disturbed during the work, all work shall STOP until the area is contained, the hazard evaluated by a qualified professional and the hazardous materials, if indeed present, is safely managed by a qualified contractor.*

Limitations

Following conditions/materials were not included in this assessment:

- Radon testing is not included in the scope of this project.
- Underground systems and personal contents were not assessed for hazardous materials.
- A Stage I Environmental Site Assessment is beyond the scope of this project.
- Personal and/or occupant contents were not assessed.
- Roofing materials (caulkings, mastics) which were not available for inspection/sampling were not evaluated. These materials should be assumed to contain asbestos until safe access permits sampling.

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1 INTRODUCTION

North West Environmental Group Ltd. (NWest) conducted a limited project-specific hazardous materials assessment at the Hertzberg Institute of Astrophysics, Victoria, BC in accordance with WorkSafeBC regulatory requirements outlined in the BC Occupational Health and Safety Regulation Section 20.112 – Hazardous Materials. The assessment was conducted by William Roff on October 13th, 2015. This is a project-specific assessment intended to identify building materials and equipment containing hazardous materials that may be impacted by the renovation or demolition work planned for the building. The scope of the assessment was limited to areas impacted by proposed work identified to NWest by the client.

WorkSafeBC Regulations require that all hazardous materials including asbestos be removed prior to demolition or protected from damage prior to the commencement of construction and/or demolition/renovation work. Removal or disturbance of hazardous materials must be undertaken by a qualified contractor employing WorkSafeBC approved procedures. If materials are encountered during deconstruction that differ from, or are in addition to those described in this report, then work must stop until the material content can be determined and appropriate precautionary measures employed to protect workers and others at or near the worksite.

2 SITE CONDITION AND SCOPE OF WORK

Age of Construction	1916
Number of Storeys	4
Foundation	Concrete
Structural Frame	Wood
Exterior Finishes	Flashing, Stucco, Wood Shake
Insulation	Mineral fibre (Fibreglass-type)
Structural Floor	Not assessed
Roofing	Asphalt Shingle (Multiple types)

The area assessed included:

1916 Wing

- Roof
    - Replacing flashing (impacting stucco)
    - Replacing asphalt shingles
    - Removing wood siding

Sample results from a previous assessment conducted in May 27 and June 28, 2013 (NWest Report 20120 Administration Building (1916) Hazmat Report V1.0) are incorporated into this report.

2.1 Limitations

As per WorkSafeBC requirements all accessible areas of this building in the assessment area were visually assessed for the presence of asbestos-containing materials, mould, lead, radioactive sources, ozone depleting substances, mercury, flammables and explosives, PCBs and above-ground fuel storage tanks.

Invasive investigative techniques were not used as the building was occupied.

Following conditions/materials were not included in this assessment:

- Radon testing is not included in the scope of this project.
- Underground systems and personal contents were not assessed for hazardous materials.
- A Stage I Environmental Site Assessment is beyond the scope of this project.
- Roofing materials (caulkings, mastics) which were not available for inspection/sampling were not evaluated. These materials should be assumed to contain asbestos until safe access permits sampling.

Hazardous materials may be present at the subject site that were not visible, accessible or available for inspection during the assessment and are therefore not described in this report.

3 FINDINGS

Refer to Section 4.0 for handling and disposal recommendations relating to the findings in this report. Photographs of representative materials are located in Appendix A. Copies of the analytical laboratory reports are provided in Appendix B. Drawings outlining sample locations are included Appendix C, and regulatory criteria for hazardous materials handling and disposal are found in Appendix 5.

3.1 Polychlorinated Biphenyls (PCB)

Fluorescent light fixtures were not observed in the way of planned work.

3.2 Asbestos

3.2.1 Bulk Samples

All accessible areas of the building that could be disturbed by planned work were inspected for building materials suspected of containing asbestos. Bulk samples of building materials were collected in accordance with WorkSafeBC requirements and analyzed to determine the type and approximate content of asbestos.

No asbestos was detected in the samples collected during this assessment.

Roofing shingles and stucco in the way of planned work were tested in a previous assessment conducted in 2013 (NWest Report 20120 Administration Building (1916) Hazmat Report V1.0) are incorporated into this report (not found to contain asbestos).

See Appendix B for a complete list of materials analyzed for asbestos content. See Appendix C for a site plan showing sample locations.

Vermiculite was not observed in the attic space during the aforementioned previous assessment.

Note 1: In the event that suspected hazardous materials are encountered during demolition activities, work on those materials must STOP immediately and the materials must remain undisturbed until testing determines their status. In the event that the materials have been damaged or otherwise impacted, all work shall STOP until appropriate controls can be put in place to protect workers and the public.

3.3 Mercury

Mercury-containing thermostats, fluorescent light tubes and/or compact fluorescent light (CFL) bulbs were not observed in the way of planned work.

3.4 Ozone-depleting Substances (CFCs/ODS)

Equipment that may use chlorofluorocarbons (CFCs) or ozone-depleting substances (ODS) was not observed in the way of planned work.

3.5 Radioactive Materials

Smoke detectors containing sealed 241Americium sources were not observed in the way of planned work.

Radon was not tested for as it was beyond the scope of this project.

3.6 Aboveground Storage Tanks

No aboveground tanks were observed near the area of the site where the planned work will be undertaken.

3.7 Lead

3.7.1 Lead Paint

Lead-containing interior and exterior paints were commonly used during the era of construction (pre 1976) for these buildings and all original surface coatings should be considered to be lead containing unless analysis indicates otherwise – see table below.

Exterior paint coatings may contain lead regardless of the construction era of the building. Coatings on structural steel likely contain elevated concentrations of lead.

The following table summarizes the lead content found in paint chips sampled during the assessment.

Table 3-1: Lead Containing Coatings

Sample #	Location/Description	Lead Concentration % by Weight	Lead Concentration mg/kg
Surface Coating Materials Regulation Threshold		**0.009**	**90**
27008-01	Exterior – Roof Stucco (White)	<0.0056	<56
27008-03	Exterior – Roof Wood Shake Siding (White)	**2.7**	**27 000**

***Bolded** concentrations shown in the table above meet or exceed the criteria for paint considered lead-containing. Special handling may be required in order to protect workers from lead exposure, depending on planned work procedures.

* Red highlighted concentrations shown in the table above meet or exceed 100 mg/kg (100 ppm), the threshold limit which triggers a requirement for leachate (TCLP) analysis prior to disposal (Reference US Environmental Protection Agency (US EPA) Analysis Method EPA SW846-(1311) TCLP, Section 1.2.).

3.7.2 Elemental Lead

Sources of elemental lead may be present in the way of planned work in the form of:

- Exhaust vents and flashing on roof
- Electrical solder

Lead within the copper water pipes/fittings was not tested for lead content however lead content in solder, especially from buildings of this vintage, is known to reach levels up to 98% lead.

3.7.3 Leachable Lead

The following table summarizes the leachate testing of painted materials sampled during the assessment.

Table L-2: Toxicity Characteristic Leaching Procedure (TCLP) (SW846, 1311/7420) Results

Sample #	Location/Description (Paint)	Lead Concentration mg/L
BC Hazardous Waste Regulation Maximum Permissible Leachate Concentration		5.0
27008-01	Exterior – Roof - Stucco (White)	N/A
27008-03	Exterior – Roof - Wood Shake Siding (White)	2.4

3.8 Hantavirus – Rodent Droppings

Visual evidence of rodent presence was not observed in the way of planned work.

3.9 Silica

All concrete, stucco and any other cementitious building materials are suspected of containing silica in crystalline and non-crystalline forms.

3.10 Mould

Mould was not observed in the way of planned work.

3.11 FLAMMABLES AND EXPLOSIVES

Flammables and explosive were not observed.

Personal items were not assessed.

4 RECOMMENDATIONS

Based on the findings, the recommendations are:

1. Provide copies of this report to site personnel, including contractors. A copy of the assessment must be immediately available at the site whenever workers are present. Site personnel need to have read and understood the content of this report prior to commencement of any work which may disturb building materials and contents.

2. The contractor shall have an exposure control plan in place for each hazardous substance identified in this report as being in way of the planned work.

3. Work must STOP if previously unidentified suspected hazardous materials are encountered during renovations and/or demolition activities. These suspect materials must be left undisturbed until testing determines their status. Work must also STOP in the event that these suspect materials have been damaged or otherwise impacted. Contact NWest for further direction.

4. **Asbestos:** All asbestos containing materials with the potential to be impacted by the work must be removed or protected from damage prior to the commencement of construction and/or demolition work. This work, called asbestos abatement, must be undertaken by trained personnel following procedures acceptable to WorkSafeBC which comply with the BC Occupational Health and Safety Regulation and conform to the WorkSafeBC document, "Safe Practices for Handling Asbestos".

5. **Lead:** Analytical results confirm the presence of lead in the renovation area. Ensure work impacting the paint coatings, paint debris and other lead containing materials proceeds in a manner that will contain fumes or paint dust and be in full compliance with WorkSafeBC Regulations. An occupational lead in air sample must be collected at beginning of the project to ensure proper worker PPE is being worn and work procedures are effective in controlling lead dust.

6. Elemental **lead** is assumed to be present in materials as outlined in the Findings section above. Lead products and metals coated with lead paint can be recycled as metal construction waste. Workers should exercise caution if heat is to be used to melt any lead found as means of facilitating its extraction. Molten lead can produce significant quantities of inhalable lead fume which can pose a severe health hazard. As per WorkSafeBC regulation 12.115 - "coating on metal which could emit harmful contaminants (such as lead, chromium, organic materials, or toxic combustion products) must be removed from the base metal, whenever practicable, before welding or cutting begins."

7. **Silica** (crystalline): Safe Work Procedures including the use of adequate personal protective equipment (PPE) must be in place prior to commencing the work. Workers must use caution to avoid creating airborne silica dust while working on, otherwise disturbing or removing concrete, stucco or any other cementitious material. Use wetting techniques and/or HEPA equipped extraction systems attached to drills and other power equipment where possible in order to decrease dust levels.

8. **See Appendix D** – Regulatory Criteria for further information regarding the safe handling or management practices for hazardous materials.

5 CLOSURE

This assessment and assessment report has been prepared exclusively for the client. It is a statement of the presence of the listed hazardous materials as outlined in the report and as observed on the date of this assessment. The conclusions and recommendations contained in this assessment report are based upon professional opinions with regard to the subject matter. These opinions are in accordance with accepted hygiene assessment standards and practices applicable to these locations and are subject to the following inherent limitations:

- The data and findings presented in this report are valid as of the date of the investigation. The passage of time, hidden or inaccessible conditions, manifestation of latent conditions or occurrence of future events may warrant further exploration at the properties, analysis of the data, and re-evaluation of the findings, observations, and conclusions expressed in this report.

- The data reported and the findings, observations and conclusions expressed in this report are limited by the Scope of Work. The Scope of Work was defined by the request of the client, the time and budgetary constraints imposed by the client, and availability of access to the properties.

Because of the limitations stated above, the findings, observations and conclusions expressed by NWest in this report are not, and should not be, considered an opinion concerning compliance of any past or present owner or operator of the site with any federal, provincial or local laws or regulations.

No warranty or guarantee, whether expressed or implied, is made with respect to the data or the reported findings, observations, and conclusions, which are based solely upon site conditions in existence at the time of this assessment.

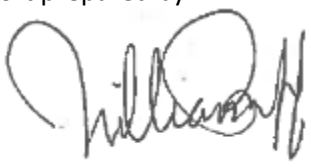
This report may not be used, relied upon, copied, published, or quoted by any party without the written consent of NWest. Other parties reading this report must independently verify the completeness and accuracy of this report and its contents.

This report is not intended for use as a scope of work for removal or as a specification section for inclusion in Tender Documents. Any unauthorized use of this report in that fashion is at the sole discretion and liability of the Owner.

North West Environmental Group Ltd.

Report reviewed by:

Report prepared by:



William Roff, B.Sc.
Occupational Hygiene Technologist

Kathy Muirhead, B.Sc. EP (OHS)
Senior Project Manager
Qualified person as per OHS Reg 6.1

Appendix A. PHOTO PLATES

The following photo plates provide a general documentation of the building materials that were sampled and analyzed during the assessment. It is meant to summarize the results of analysis and observations and is not intended to include all hazardous materials, or their locations, observed during the assessment.

	
Sample: 27008-01; 20120-30,31,32 Location: Exterior - Roof Description: Stucco Asbestos: None detected Lead: <56 mg/kg	Sample: 27008-02 Location: Exterior - Roof Description: Building Paper Behind Stucco Asbestos: None detected.
	
Sample: 27008-03 Location: Exterior - Roof Description: Wood Shake Lead Content: 27 000 mg/kg	Sample: 20120-28 Location: Exterior - Roof Description: Lower Shingle Asbestos: None detected

Sample: 20120-29
Location: Exterior - Roof
Description: Red Shingle
Asbestos: None detected

Appendix B. SAMPLE ANALYSIS REPORT

North West
Environmental Group Ltd.

Unit 210 - 2950 Douglas Street
Victoria, B.C. V8T 4N4

Tel: 250-384-9695
Fax: 250-384-9865
e-mail: northwest@nwest.bc.ca

Bulk Sample Report

Asbestos Analysis of Bulk Materials using Polarized Light Microscopy

Client: National Research Council Canada
Contractor: National Research Council Canada
Project: NRC - 1916 Admin - Roof Assessment

Date: October 14, 2015
Client Job or PO#:
Project number: 27008

Sample No	Location	Date Analysed	Analyst	Description	Phase	%	Asbestos	%	Other Materials	%
27008-2	Exterior - Roof (Behind Stucco)	Oct-14-2015	LR	Building Envelope Paper (Black)	Black	100	None Detected	0	Cellulose (85%) Non-Fibrous (15%)	100

Note: Samples were analyzed by method: EPA/600/R-93/116" Bulk Asbestos Analysis by Polarized Light Microscopy". For heterogenous materials the concentration may vary.

AIHA Proficiency Analytical Testing Programs, LLC

IATL International Asbestos Testing Laboratories

9000 Commerce Parkway Suite B Mt. Laurel, NJ 08054
Telephone: 856-231-9449 Fax: 856-231-9818

CERTIFICATE OF ANALYSIS

Client: North West Environmental Group
2950 Douglas Street; Unit 210
Victoria BC V8T 4N4

Report Date: 10/20/2015
Report Number: 376594
Project: NRC-1916 Admin
Project No.: 27008

LEAD TCLP SAMPLE ANALYSIS SUMMARY

Lab No.	Client No.	Location / Description	Total Lead (mg / kg)	TCLP Lead (mg / L)
5765116	27008-1	White Stucco Paint Exterior Roof	<56	NA
5765117	27008-3	White Wood Paint Exterior Roof	27000	2.4

NATIONAL LEAD LABORATORY ACCREDITATION PROGRAM (NLLAP)

NYSDOH-ELAP 11021

Analysis Method: EPA SW846-(1311) TCLP "Toxicity Characteristic Leaching Procedure"
EPA SW846-(7000B) "Standard Method To Test For Low Concentrations Of Lead In Soils, Sludges And Sediments By AAS"

Comments: IATL assumes that all of the sampling methods and data upon which these results are based, have been accurately supplied by the client. Method Detection Limit (MDL) per EPA Method 40 CFR Part 136 Appendix B. Reporting Limit (RL) based upon Lowest Standard Determined (LSD) in accordance with AIHA-ELLAP policies. LSD=0.2 ppm MDL=3.2 mg/kg RL=10 mg/kg (based upon 1000 mg sampled). Mg/kg=ppm Sample results are not corrected for contamination by field or analytical blanks.
* Samples containing 100 ppm total lead or more require TCLP analysis (Ref. 1311 Sec 1.2). TCLP threshold value is 5.0 mg/L.

Date Received: 10/15/2015
Date Analyzed: 10/20/2015
Analyst: C. Shaffer

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

North West
Environmental Group Ltd.

Chain Of Custody
Lead

Unit 210 - 2950 Douglas Street
Victoria, B.C. V8T 4N4

Tel: 250-384-9695
Fax: 250-384-9865
e-mail: northwest@nwest.bc.ca

Client: National Research Council Canada
Project Number: 27008
Project Name: NRC - 1916 Admin - Roof Assessment

Matrix: Bulk
Method: TCLP - SW-846-1311/7420

Relinquished By: Roff, Will
wroff@nwest.bc.ca

Laboratory: iATL International Asbestos Testing Laboratories
Lab Reference #:
Purchase Order #:

Turn Around Time: 3 Days
Date: October 14, 2015

Invoice To: Kemp, Donna
dkemp@nwest.bc.ca

Signature:

Sample No	Location	Description	Date Sampled	Sampled By
27008-1	Exterior - Roof	Stucco (White)	Oct-13-2015	Roff, Will
27008-3	Exterior - Roof	Wood Shake Siding (White)	Oct-13-2015	Roff, Will

5765116
5765117

E-MAILED
10/20/15 NS

(R) NS 10/19/15
10/19/15

RECEIVED
OCT 15 2015
iATL - BY

10/15/15

IATL International Asbestos Testing Laboratories

9000 Commerce Parkway, Suite B, Mt. Laurel, NJ 08054
Telephone: 856-231-9449 Fax: 856-231-9818
INFO@IATL.COM

DAILY QUALITY CONTROL DATA

LEAD SAMPLE ANALYSIS

(DATE: 10 / 20 / 15)

Standard	Total Lead (mg)	Percent Recovery **
Reagent Blank	0.000	< LOQ
Blank Spike	0.500	102
Lab Control Std	1.320	94
Matrix Spike - LBP *	0.33	101
Matrix Spike - Wipe *	0.29	101
Matrix Spike - Soil *	0.319	104
Matrix spike - Air *	0.050	108
2.5 ppm Standard	0.25	103
10.0 ppm Standard	1.0	102
40.0 ppm Standard	4.0	95

AIHA-LAP, LLC No. 100188 **NYSDOH-ELAP No. 11021**

Analysis Method: ASTM D3335-85A
NIOSH 7082
EPA SW846 3050B 7000B

Comments: IATL assumes that all sampling complies with accepted methods.
All client supplied sampling data is assumed to be correct when calculating results.
Detection limit based upon 0.2 mg/L reporting limit and sample size.
* NIST Traceable.
** 80-120% acceptable limits.

Analyzed By: R. Chad Shaffer
Date: 10/20/15

Approved By: Frank E. Ehrenfeld, III
Laboratory Director

North West
Environmental Group Ltd.

Unit 210 - 2950 Douglas Street
Victoria, B.C. V8T 4N4

Tel: 250-384-9695
Fax: 250-384-9865
e-mail: northwest@nwest.bc.ca

Bulk Sample Report

Asbestos Analysis of Bulk Materials using Polarized Light Microscopy

Client: National Research Council Canada
Contractor: National Research Council Canada
Project: NRC - 1916 Wing Build

Date: October 22, 2015
Client Job or PO#:
Project number: 20120

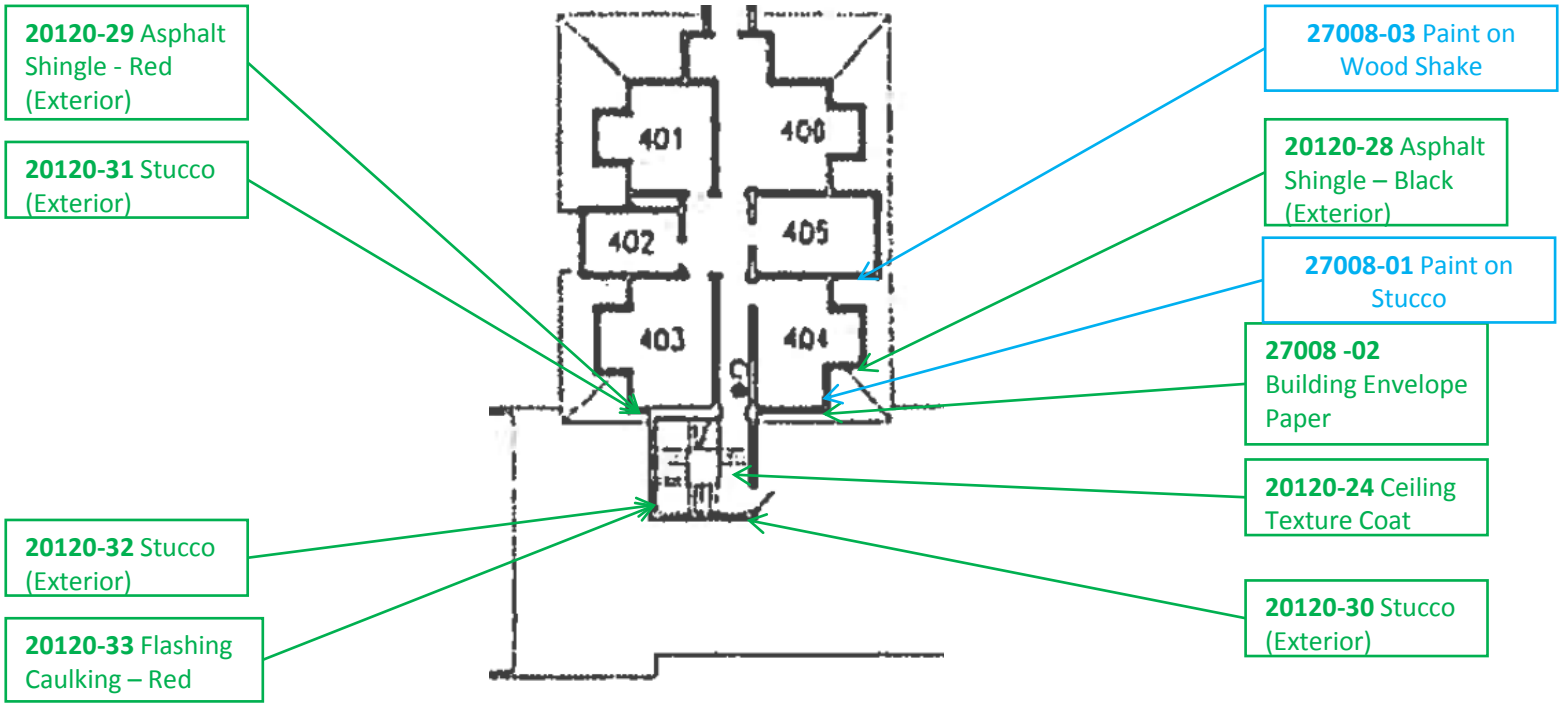
Sample No	Location	Date Analysed	Analyst	Description	Phase	%	Asbestos	%	Other Materials	%
20120-28	Roof	Jun-13-2013	EMSL	Black Asphalt Shingle	Black	100	None Detected	0	Fibrous (Other) (30%) Non-Fibrous (70%)	100
20120-29	Roof	Jun-13-2013	EMSL	Red Asphalt Shingle	Black	100	None Detected	0	Fibrous (Other) (25%) Non-Fibrous (75%)	100
20120-30	Exterior - 4th Floor	Jun-13-2013	EMSL	Stucco	Grey	100	None Detected	0	Non-Fibrous	100
20120-31	Exterior - 4th Floor	Jun-13-2013	EMSL	Stucco	Grey	100	None Detected	0	Non-Fibrous	100
20120-32	Exterior - 4th Floor	Jun-13-2013	EMSL	Stucco	Grey	100	None Detected	0	Non-Fibrous	100
20120-33	Exterior - 4th Floor	Jun-13-2013	EMSL	Caulking - Flashing (White)	White	100	None Detected	0	Non-Fibrous	100

Note: Samples were analyzed by method: EPA/600/R-93/116" Bulk Asbestos Analysis by Polarized Light Microscopy". For heterogenous materials the concentration may vary. No reproduction without permission.

AIHA Proficiency Analytical Testing Programs, LLC

Appendix C. SAMPLE LOCATIONS

LEGEND
DWJC – *Drywall Joint Compound*



DRAWING NOT TO SCALE

LEGEND **ASBESTOS**

123 None Detected

123 Material Contains Asbestos

123 Lead Sample

ADDRESS/LOCATION:

Herzberg Institute of Astrophysics

DRAWING TITLE:
Administration Building
1916 Wing - Roof

PROJECT NO.:27008

DATE: 05/06/2013; Oct 13th 2015

SURVEYED BY: WR

DRAWING NO.: 001

North West Environmental Group Ltd.

#210 – 2950 Douglas St.

Victoria, BC V8T 4N4

Appendix D. REGULATORY CRITERIA

As per WorkSafeBC requirements, the building was assessed for the presence of several different types of hazardous materials including:

- Polychlorinated biphenyls
- Asbestos
- Mercury
- Ozone Depleting Substances
- Radioactive Materials
- Above or Underground Storage Tanks
- Lead
- Hantavirus – rodent droppings
- Silica
- Mould

Polychlorinated Biphenyls (PCB)

Polychlorinated biphenyls (PCB) are regulated under both federal (Canadian Environmental Protection Act; PCB Regulations SOR/2008-273) and the BC Ministry of Environment Hazardous Waste Regulation and must be treated as PCB waste and be stored and disposed of accordingly. Energized fluorescent light fixtures were not disassembled to examine ballasts during this assessment.

Each fluorescent light fixture removed during renovation or demolition should have the ballast checked to determine if it contains PCB. Ballasts containing PCB must be removed, sorted and transported to a licensed facility. Although rare, paints have been known to contain PCBs.

Asbestos

Materials that contain at least 0.5% or more asbestos if tested in accordance with one of the following methods:

(a) (i) Asbestos, Chrysotile by XRD, Method 9000 (Issue 2, dated August 15, 1994) in the NIOSH Manual of Analytical Methods, published by the United States National Institute for Occupational Safety and Health, Centre for Disease Control;

(ii) Asbestos (bulk) by PLM, Method 9002 (Issue 2, dated August 15, 1994) in the NIOSH Manual of Analytical Methods, published by the United States National Institute for Occupational Safety and Health, Centre for Disease Control;

(iii) Test Method for the Determination of Asbestos in Bulk Building Materials (EPA/600/R-93/116, dated July 1993) published by the United States Environmental Protection Agency;

(b) vermiculite insulation that would be determined to contain **any** asbestos if tested in accordance with the Research Method for Sampling and Analysis of Fibrous Amphibole in Vermiculite Attic Insulation (EPA/600/R-04/004, dated January 2004) published by the United States Environmental Protection Agency;

The asbestos-containing material can also be characterized as friable and non-friable. Friable asbestos “means any material which, when dry, can be easily crumbled or powdered by hand pressure, or a material that is crumbled or powdered” as defined under the BC Occupational

Health and Safety Regulation. The condition of the asbestos and classifications would be used in assessing the level of action required with respect to re-use of the building.

Worker exposure to asbestos fibres is also regulated by the BC Occupational Health and Safety Regulation. The WorkSafeBC eight-hour time-weighted average (TWA) for asbestos fibres (all forms) is 0.1 fibre/cm^3. Exposure to these substances must be kept as close to zero as is reasonably practicable.

Bulk samples are collected in accordance with NIOSH Analytical Method 9002 and the WorkSafeBC guideline document, Safe Work Practices for Handling Asbestos.

Asbestos is designated as an ALARA substance; worker exposure to this product must be kept "as low as reasonably achievable" (ALARA). Employers are required under Section 5.54 (Exposure control plan) of the Occupational Health and Safety Regulation (OHSR) to develop an exposure control plan (ECP) when workers are or may be exposed to airborne concentrations of this material in excess of 50% of the exposure limit.

Mercury

Mercury is a hazardous substance, and any maintenance or abatement involving materials containing mercury or mercury compounds must be done in compliance with the BC Occupational Health and Safety Regulations (BCOHSR).

Employers with workers who have a risk of exposure must have an exposure control plan (ECP) in place prior to allowing their workers to come into contact with this material. As with all other hazardous substances, all personnel working around or with such materials must be made aware of their presence and be supplied with training in the potential health effects and means of avoiding exposures.

As a hazardous substance, transportation and disposal of this substance must be done in compliance with the federal Transportation of Dangerous Goods (TDG) Regulations and the BC Hazardous Waste Regulation. Mercury is found in fluorescent light bulbs, thermostats, manometers, and equipment such as electrical switches.

Mercury is designated as an ALARA substance; worker exposure to this product must be kept "as low as reasonably achievable" (ALARA). Employers are required under Section 5.54 (Exposure control plan) of the Occupational Health and Safety Regulation (OHSR) to develop an exposure control plan (ECP) when workers are or may be exposed to airborne concentrations of this material in excess of 50% of the exposure limit.

Ozone-depleting Substances (CFCs/ODS)

Chlorofluorocarbons (CFCs) are ozone-depleting substances (ODS) and a type of halocarbon. ODS are regulated by the Canadian *Environmental Protection Act* under the Ozone-Depleting Substances Regulations 1998 SOR/99-7 and the Federal Halocarbon Regulations (FHR) SOR/2003-289. Compounds that contain only chlorine, fluorine and carbon are called CFCs. These materials are used in refrigeration systems and in fire suppression systems. The other main refrigerants are hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs) and blends of fluorocarbons (designated by "R").

While the regulations allow the continued use of halocarbon refrigerants, they strictly prohibit any person from releasing into the environment any halocarbon.

In the case of demolition, these materials will require proper recovery and disposal. The BC Ozone-Depleting Substances Regulations would also apply to any CFC/ODS abatement procedures. These regulations require that all ODS must be collected, stored and recycled, or collected and disposed appropriately by a licensed professional.

A good source for determining if the compound is ozone depleting is found at the following link: http://www.ec.gc.ca/Air/default.asp?lang=En&n=4CA440F8-1

Radioactive Materials

Many buildings contain smoke alarms which contain small sealed radioactive sources in the form of ^{241}Americium. The Canadian Nuclear Safety Commission (CNSC) and the Canadian *Nuclear Safety Act* regulate radioactive materials. These materials are sealed into a metal case within the smoke detector and must not be damaged or tampered with. Smoke detectors intended for disposal must be handled in accordance with CNSC regulations.

Ceramic tiles and some forms of granite sometimes contain radioactive materials. These materials should be checked prior to work being carried out on them to determine if radioactive materials are present.

Radon gas is a by-product of radioactive decay of certain naturally occurring radioactive materials. While Victoria has long been assumed to have low levels, a recent Health Canada nationwide study (March 2012) shows that in the Interior and east of the Coast Mountain Range, anywhere from 5 to 40 per cent of dwellings may have radon levels of more than 200 Bq/m3, depending on the community.

http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/survey-sondage/index-eng.php#a1

Radon levels vary widely not only from area to area, but even from house to house. A home is more likely to have high radon levels if:

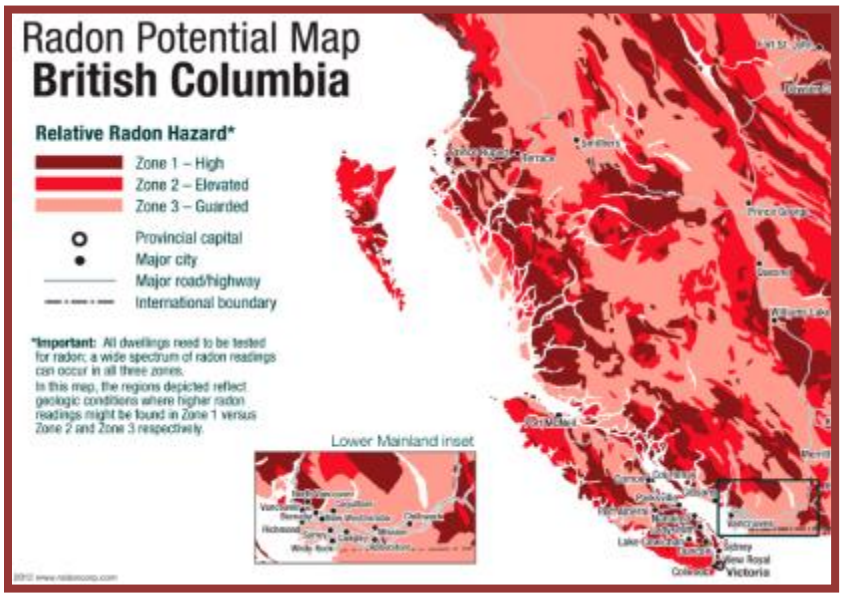
- It is built on dry porous soil.
- It has bare soil in the basement or crawlspace; or the building site was once a riverbed, a glacial outwash, or a slide area.
- There is high natural radioactivity in the area.

Newer dwellings that are tightly sealed tend to have higher radon levels. In homes with more than one floor, radon levels are often about twice as high in the basement as on the main floor.

The only way to establish the concentration of radon gas is to have it tested. The BC Centre for Disease Control (BCCDC) and Health Canada recommend that B.C. residents are encouraged to have their homes tested, especially those homes that are in the interior of the province.

New construction and renovations should meet requirements of the BC Building Code.

Figure 5-1: Radon Concentrations and Terrestrial Background Radiation in British Columbia



Radon Potential Map extract from Radon Corp (under copyright)

Aboveground / Underground Storage Tanks

Storage tanks containing fuels have the ability to leak over time and can result in soil and groundwater contamination. These tanks must be observed and checked over time to ensure they do not leak. Evidence of leaks must be investigated and any potential contamination remediated. The Canadian Council of Ministers of the Environment (CCME) publishes a Code of Practice for the safe management of aboveground and underground storage tanks.

Lead

Defined by the federal Ministry of Health, under the Hazardous Products Act, as a paint or other similar material that dries to a solid film that contains over 90 mg/kg (0.009%) dry weight of lead.

The Consumer Product Safety Act, Surface Coating Materials Regulation (SOR/2005-109) (SCMR) permits the advertising, sale and labeling of surface coatings (including paint) that meet the following criteria set out below. Quantities of lead and mercury are specifically limited. Other heavy metals are not addressed in this regulation.

Paints often contain heavy metals as pigments and/or preservatives. Under specific circumstances, persons may be exposed to these metals by ingestion, skin absorption and/or inhalation.

Most buildings built before 1950 have had lead-based paint applied to the interior or exterior surfaces, often up to 40% lead by weight. Paints made between 1950 and till present day usually contained smaller amounts of lead but can still pose risks to workers when disturbed.

There has been confusion in the past regarding the limits for lead and other heavy metals in paint and how that relates to worker safety and disposal. An explanation of the SCMR limits for paint and mercury are included in this report to help alleviate this confusion. Although a given paint sample may have concentrations of lead and mercury lower than the limits specified within the SCMR, worker exposure may still occur if sufficient quantities of lead and/or mercury

are inhaled, ingested or absorbed through the skin. The risk to workers posed by heavy metal containing coatings is proportional to the work undertaken. Heavy metal laden coatings that are not disturbed pose little risk to non-pre-school aged building occupants.

Other than during the application process, the primary mechanism of exposure for workers would be the inhalation of dusts through activities such as sanding, scraping, drilling, crushing, heating, burning or other processes likely to damage the coatings themselves. Paints containing heavy metals pose little risk to workers when in good condition and when undisturbed.

In 2005 the federal Surface Coating Materials Regulation was amended to reduce this threshold from 5,000 mg/kg to 600 mg/kg and then to 90 mg/kg in 2010. As paints under this concentration of lead are acceptable for use in residential settings today, such coatings do not pose a significant hazardous material issue unless rendered airborne within a worker's breathing zone by fine dust generating processes. Mercury is also limited to a level of 10 mg/kg. If a worker is, or may be, exposed to potentially harmful levels of lead, the employer must ensure that a risk assessment is conducted by a qualified person. Where a worker may be exposed to airborne lead concentrations in excess of 50% of the exposure limit of 0.05 mg/m^3 or where exposure through any route of entry could cause elevated blood levels, the employer must develop and implement an exposure control plan (ECP) which meets the requirements of section 5.54 of the BC Occupational Health and Safety Regulation. As an ALARA substance, worker exposure must be kept as low as reasonably achievable.

Table 5-1: ACGIH / WorkSafeBC Exposure Limits

Substance [CAS No.]	TWA
Lead - elemental and inorganic compounds, as Pb [7439-92-1]	0.05 mg/m3

Appropriate precautions for protecting workers from lead exposure should be implemented during any work involving lead or lead paint including the use of personal protective equipment, localized ventilation and/or dust suppression methods.

Toxicity Characteristic Leaching Procedure (TCLP) testing of positively identified lead paint applications is typically required to determine if the painted applications are classified as a hazardous waste as outlined in the Ministry of Environment's Hazardous Waste Regulation.

Note that lead residue on "cleaned" structural steel (from which lead-containing coatings have been removed) should not exceed 40 ug/sf prior to welding, cutting or burning.

Table 5-2: Recommended lead clearance criteria for surfaces

	Floor	Sill/ledge	Trough
Residences, schools, daycare centres, and other public buildings	0.43 mg/m^2 (40 $\mu g/ft^2$)	2.7 mg/m^2 (250 $\mu g/ft^2$)	4.3 mg/m^2 (400 $\mu g/ft^2$)
Commercial buildings, including retail stores, offices (administrative), and laboratories (other than lead assay laboratories)	2.2 mg/m^2 (200 $\mu g/ft^2$)	5.4 mg/m^2 (500 $\mu g/ft^2$)	8.6 mg/m^2 (800 $\mu g/ft^2$)

Reference: WorkSafeBC, Lead-Containing Paints and Coatings – Preventing Exposure in the Construction Industry, 2011

Hantavirus – Rodent Droppings

The Hantavirus is a virus associated with Hantavirus Pulmonary Syndrome, a disease caught through contact with the urine or droppings, or by being bitten or scratched by infected rodents. The disease starts off like a cold or flu (fever, sore muscles, headaches, nausea, vomiting), but progresses to pneumonia-like conditions within a few days. The change in intensity of the symptoms is very rapid and can result in fluid build-up in the lungs and respiratory failure.

Possible exposure to Hantavirus is regulated under the BC Occupational Health and Safety Regulation. Employers with workers who have a risk of exposure must have an exposure control plan (ECP) in place prior to allowing their workers to come into contact with this material. As with all other hazardous substances, all personnel working around or with such materials must be made aware of their presence and be supplied with training in the potential health effects and means of avoiding exposures.

Silica

Silica is a hazardous substance and as such is regulated under the BC Occupational Health and Safety Regulation. Airborne exposure criteria, respirator requirements and mandatory worker testing requirements are also outlined under this regulation. As with all other designated substances, all personnel working around or with such materials must be made aware of their presence and be supplied with training in the potential health effects and means of avoiding exposures.

Employers with workers who have a risk of exposure must have an exposure control plan (ECP) in place prior to allowing their workers to come into contact with this material. As with all other hazardous substances, all personnel working around or with such materials must be made aware of their presence and be supplied with training in the potential health effects and means of avoiding exposures.

Crystalline silica dust can cause a disabling, sometimes fatal disease called silicosis. The fine particles are deposited in the lungs, causing thickening and scarring of the lung tissue. The scar tissue restricts the lungs' ability to extract oxygen from the air. This damage is permanent, but symptoms of the disease may not appear for many years.

Employers have a duty to protect their workers from silica dust exposure on construction projects. Studies show that when common construction work tasks involving the sanding, drilling, chipping, grinding, cutting, sawing, sweeping, and blasting of concrete and concrete products are conducted without using dust controls, workers are exposed to airborne silica concentrations at levels far above the occupational exposure limits.

Crystalline silica is an ALARA substance; worker exposure to this product must be kept "as low as reasonably achievable" (ALARA). Employers are required under Section 5.54 (Exposure control plan) of the Occupational Health and Safety Regulation (OHSR) to develop an exposure control plan (ECP) when workers are or may be exposed to airborne concentrations of these materials in excess of 50% of the exposure limit.

Mould

Within the BC Occupational Health and Safety Regulations, there are no established permissible exposure levels for mould spores in air. This means that there are no published concentrations above which worker exposure is deemed to be hazardous and under which workers would not need respiratory protection. WorkSafeBC does, however, provide guidance on protocols for protecting workers from the hazards of airborne mould and bacteria within the section(s) of the Regulation guidelines addressing Indoor Air Quality.

Other guidelines for addressing mould in Canada include:

- The Canadian Construction Association document, "Mould Guidelines for the Canadian Construction Industry," CCA82-2004.
- The Institute of Inspection, Cleaning and Restoration and Certification (IICRC) standard S500 governing both water damage restoration and entitled: Standard for Professional Water Damage Restoration – S500. This document is approved by the American National Standards Institute (ANSI)
- Health Canada: Fungal contamination in public buildings: A guide to recognition and management, 1995
- Health Canada. Fungal Contamination in Public Buildings: Health Effects and Investigation Methods, 2004

These guidelines also state that any non-porous (metal, glass and hard plastics) and semi-porous (wood and concrete) materials that are structurally sound and visibly mouldy can be cleaned and re-used. However, porous materials such as ceiling tiles, wallpaper, insulation, drywall, and carpets with more than a small area of contamination, should be removed and discarded.

Flammables and Explosives

WorkSafeBC regulates Flammable and Combustible Substances and Substances Under Pressure according to the BC Occupational Health and Safety Regulations: Part 5 Chemical Agents and Biological Agents. Sections 5.27 to 5.47 include criteria for condition, handling and storage of these materials. Please contact NWest for detailed information regarding specific substances.

Appendix E. METHODOLOGY

As per WorkSafeBC requirements, the buildings/areas were assessed for the presence of several different types of hazardous materials. Sampling and analysis methodologies are detailed below.

If samples for hazardous contents are not indicated above, the Client may assume they were not collected and/or analysed.

Asbestos

The asbestos assessment methodology and sampling procedure are outlined in the following sections.

Assessment

This assessment was designed to determine the type and extent of asbestos containing material (ACM) presence within the subject site. The assessment is normally non-destructive, however, even with the most invasive assessment techniques the possibility remains for other concealed materials to be found during the demolition process.

Specific building material components were examined within the building and include, where applicable:

- Structural – all visible structural components including walls, roofs (invasive sampling may have been conducted) and supporting members,
- Mechanical systems – insulation, domestic hot and cold water, and caulks.
- Architectural systems including – texture coats, sheet flooring, vinyl floor tile, ceiling tile, wall board, drywall joint compound, sheet products.

Roofing core samples may have been collected with a roofing contractor on site to make good any damage made during sampling.

Bulk Sampling Procedures

Sampling procedures for various building materials vary somewhat depending on the exact conditions at each sample location. In all cases standardized protocols are used for collecting samples for asbestos analysis. All accessible suspect materials that were visually unique were sampled. Visually similar materials were only sampled once unless known to be heterogeneous such as drywall joint compound.

Where materials were observed that were suspected of containing asbestos, representative samples were collected. Where practicable, sample volumes were minimized to avoid unnecessary damage to building systems.

Sampled materials were cut down to the base substrate to ensure that a representative sample was collected. Samples were sent to an accredited laboratory and analysed following the EPA/600/R-93/116 method for analysis of asbestos in bulk materials by polarized light microscopy.

Lead

Paint Bulk Sampling Procedures

Painted surfaces were scraped to the base substrate to ensure that all layers of paint were included. Paint samples were tested using one or more of the following methods:

1. EMSL (SW-846-7420) Lead in Paint Chips by Flame Atomic Absorption Spectrophotometer,
2. EMSL (SW-846-6010) Inductively Coupled Plasma-Atomic Emission Spectrometry, and/or
3. EMSL (SW-846-1311/7420) Toxicity Characteristic Leaching Procedure.

Elemental Lead Assessment

The subject site was inspected for the presence of materials containing elemental lead. These materials were documented so that they can be removed prior to demolition activities. Samples were not collected.

Polychlorinated Biphenyls (PCB)

PCB-Containing Electrical Equipment

The subject site was visually assessed for the presence of polychlorinated biphenyls (PCBs) in electrical equipment such as fluorescent light ballasts. An in-depth review of each ballast is to be reserved for the deconstruction. Dismantling of in-service electrical equipment to observe individual ballasts was not feasible due to risk of electric shock and damage to the operating fixtures.

PCB-Containing Materials

Paints were not tested for PCB-content as testing was beyond the scope of this assessment.

Ozone Depleting Substances (CFCs/ODS)

The subject site was inspected for the presence of devices that are known or suspected of containing to contain Ozone Depleting Substances (ODS) or other halocarbons. Devices that contain ODS include refrigeration and air conditioning equipment. Devices suspected of containing these materials were documented so that the refrigerant gases may be removed prior to demolition or disposal of the equipment.

Labeling on the equipment will describe the type of refrigerant gases stored utilized within its compressor(s). In-use units were not opened to access labels.

Mercury-Containing Equipment

The subject site was inspected for the presence of mercury containing equipment. Devices suspected of containing mercury were documented so they can be removed prior to demolition. These devices typically include fluorescent light tubes, high efficiency light bulbs, thermostats, and manometers.

Radioactive Materials

Where observed, radioactive sources such as smoke detectors were noted by the NWest technicians. Testing for radioactive materials was outside the scope of this assessment.

Silica

Testing for crystalline silica in dust was not completed/conducted as part of this assessment however it is known to be a component of concrete, plaster, ceramic tile and stucco.

Observations were made on site to determine the presence of potential silica-containing materials.

Mould

Observations were made to identify the presence of mould and water damage within the subject site along with any obvious indoor air quality issues. Non-invasive or invasive investigation techniques were used, depending on the agreement with the Client.

Hantavirus – Evidence of Rodent Presence

Visual inspections were conducted for evidence of rodent presence including, droppings, nests, damage, carcasses, traps and tracks.

Flammable and/or Explosive Materials

Visual inspections were conducted for the presence of materials that may contain flammable and/or explosive contents. These typically include old drums, Jerry cans, cylinders with compressed contents and miscellaneous vessels. An assessment of the contents, if present, was beyond the scope of this project.

End of report.