DESIGNATED SUBSTANCES SURVEY

CITY OF WOODSTOCK

944 James Street
Woodstock, Ontario
N4S 0A7

Prepared for:

City of Woodstock
944 James Street
Woodstock, Ontario
N4S 0A7

December 20th, 2012

Project No.: 12-008

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APPENDICES

1.0 INTRODUCTION

OH Solutions Inc (OHS) was retained by the City of Woodstock to conduct a Designated Substances Survey within its facility located at 944 James Street in Woodstock, Ontario (the Site).

The sections below explain our survey methodology and summarize the Designated Substances found at the Site.

2.0 SURVEY METHODOLOGY

A thorough room by room inspection/walkthrough of the renovation area was conducted. Materials suspected of containing designated substances were visually identified, based on the surveyor's knowledge of the historic composition of building products. Mr. Jeff Doherty of OHS performed the fieldwork for this report. While on site OHS personnel conducted the following:

- Characterization the existing building data;
- Determined the approximate quantities, location and condition of accessible Designated Substances and;
- Conducted sampling of representative building materials and finishes

Concealed locations within the building such as areas above plaster or drywall ceilings, within block walls, chases and bulkheads were not included as part of the assessment. In addition, unless otherwise specified, OHS only recorded information on visible flooring product and therefore additional layers of flooring product may be present beneath multiple layers.

Sampling for suspected asbestos-containing materials was conducted in accordance with Ontario Regulation 278/05. The regulation outlines the minimum requirement to determine if a homogeneous building material does not contain asbestos (i.e. 1, 3, 5 or 7). The surveyor based the sampling strategy on the buildings age of construction, the buildings phases of construction and renovation information (if any) provided by the client.

Several samples of suspected asbestos-containing materials were collected and subsequently submitted for analysis. Preliminary identification was made using Polarized Light Microscopy (PLM), with confirmation of presence and type of asbestos made by dispersion staining optical microscopy following the U.S. Environmental Protection Agency's Test Method 600. This analytical procedure conforms to the requirements outlined in Ontario Regulation 278/05.

All samples collected by OHS were submitted to the International Asbestos Testing Laboratories (IATL) of Mt. Laurel, New Jersey, USA. This laboratory is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) to perform asbestos analysis.

OHS collected visually distinct paint samples suspected of containing lead. Where possible, OHS removed all layers of paint down to the buildings components unpainted surface.

Several samples of suspected lead-containing paint samples were collected and subsequently submitted for analysis. The suspected lead-containing paints were analyzed using flame atomic absorption spectroscopy (F.A.A.S.).

OHS submitted samples of suspected asbestos-containing lead paint to International Asbestos Testing Laboratories (IATL) of Mt. Laurel, New Jersey, USA.

All other designated substances were identified based on visual assessment and historical usage.

3.0 REGULATORY REQUIREMENTS

As outlined under Section 30 of the Occupational Health and Safety Act, the intent of the assessment is to fulfil the owner requirements to determine whether any Designated Substances are present at a project site during tendering and/or before beginning construction. This report should be issued by the constructor to each contractor and sub-contractor.

“Designated Substance" as defined by the Ontario *Occupational Health & Safety Act* (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.” Designated Substances include the following; asbestos, acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, lead, mercury, silica and vinyl chloride.

OHS targeted the following Designated Substances: asbestos, lead, mercury, and silica.

Designated Substances are regulated under Ontario Regulation 490/09. This regulation outlines the occupational exposure limits (OELs) for each Designated Substance. While construction projects are generally exempt, the OELs establish an Ontario standard for worker protection.

In addition to Ontario Regulation 490/09, Asbestos is regulated under O. Reg. 278/05, Asbestos on Construction Projects and in Buildings and Repair Operation, as amended. Disposal of asbestos waste is subject to waste management regulations under Ontario Regulation 347/90 as amended.

The MOL does not have a standard to state what percentage of lead or silica a material must have to be considered lead or silica-containing. Procedures that provide an equivalent level of protection should, therefore, be implemented on construction projects where exposure to lead and silica is possible.

The Ministry of Labour has issued drafted guidelines for control of lead and silica exposures on construction projects. The Guideline for Lead on Construction Projects and the Guideline for Silica on Construction Projects should be adhered to during construction projects in order to protect the health and safety of workers.

4.0 RESULTS

4.1 Site Description

Several buildings are present at the Site. Construction dates for all building were not available at the time of the assessment; however, OHS was informed that the Engineering/Works building did undergo an addition so time in the 1990's. OHS conducted an assessment within the following buildings;

- Engineering/Work Building
- Works Garage
- Sand Storage
- Salt and Asphalt Storage
- Transit Building (no access to mechanical room or vault)
- Recycling Building

4.2 Asbestos-Containing Materials

The following is a summary of the asbestos-containing materials that were encountered during the survey of the renovation area.

4.2.1 Sprayed Fireproofing and Blown-in Insulation

Fireproofing was observed within the Works Garage and within the Engineering/Works buildings Lunch Room and Mechanical Room. Representative samples of each material were collected and subsequently submitted for analysis (Sample Groups 01 and 07). This material does not contain asbestos.

4.2.2 Texture Finishes

Texture coat finishes suspected to contain asbestos were not observed during the assessment.

4.2.3 Mechanical Insulation

Within the majority of buildings, piping was not insulated or insulated with non-asbestos fibreglass and PVC.

Cellulose pipe insulation is present on roof drains within the Engineering/Works building. This material was sampled and does not contain asbestos (Sample Group 05).

Tar is present on roof hoppers within the Engineering/Works building. This material was sampled and does not contain asbestos (Sample Group 06).

Samples of parging cement suspected to contain asbestos were collected and subsequently submitted for analysis from the Engineering/Work Building. This material contains between 60% and 70% chrysotile asbestos (Sample Groups 01 and 02).

A summary of locations within asbestos containing parging cement is presented below:

- Engineering/Works Upper Level File Storage
  3 parged fittings in good condition, accessible above ceiling by ladder.
- Engineering/Works Lower Level Men's Locker Room
  2 parged fittings in good condition, accessible by ladder.
- Engineering/Works Lower Level Storage Room @ Men's Locker Room
  10 parged fittings in good condition, 2 parged fittings in fair condition, accessible by ladder.
- Engineering/Works Lower Level Men's Washroom
  1 parged fitting in good condition, accessible by ladder.
- Engineering/Works Lower Level Maintenance Garage
  4 parged fittings in good condition, accessible by ladder.
- Engineering/Works Lower Level Maintenance Stores Area
  5 parged fittings in good condition, accessible by ladder.
- Engineering/Works Lower Level Maintenance Stores Area
  2 parged fittings in good condition, accessible to all occupants.
- Works Garage
  2 parged fittings in good condition, accessible by ladder.

4.2.4 Acoustic Ceiling Tiles

Both 1'x1' and 2'x4' ceiling tiles were observed during the assessment. A summary of our sampling results is provided below.

The 1'x1' ceiling tiles located within the Engineering/Works building upper level corridor was sampled and does not contain asbestos (Sample Group 12).

The 1'x1' cellulose ceiling tiles located within the Engineering/Works have been assumed to not contain asbestos.

The ceiling mastic used to adhere the 1'x1' ceiling tiles to the ceiling substrate was also sampled and does not contain asbestos (Sample Group 04).

Several visually distinct patterns of 2'x4' lay-in ceiling tiles were observed during the assessment of the buildings. A summary is provided below:

- Transit Office 2'x4' fissured pinhole ceiling tile
    - None Detected (Sample Group 08).
- Recycle Office 2'x4' fissured pinhole ceiling tile
    - None Detected (Sample Group 09).
- Engineering/Works building 2'x4' speckled pinhole ceiling tile
    - None Detected (Sample Group 10)
- Engineering/Works building 2'x4' fissured pinhole ceiling tile
    - **0.5% chrysotile, 1.8% Amosite (Sample Group 11)**

The asbestos-containing 2'x4' lay-in ceiling tiles were collected from the upper level engineering office area. These tiles are red on the backside and are currently in good condition. Over 7.5m^2 of asbestos-containing ceiling tiles are present within this area.

4.2.5 Plaster and Drywall

Plaster wall finishes were noted within the Engineering/Works building. The plaster was sampled and does not contain asbestos (Sample Group 13).

Plaster was also identified on the exterior of the Engineering/Works building. This material was also sampled and does not contain asbestos (Sample Group 14).

Drywall finishes suspected to contain asbestos were noted in the Recycling Office and Engineering/Works building. A summary of the sampling results is provided below.

- Recycle Office - None Detected (Sample Group 16).
- Engineering/Works building (1990's area) - None Detected (Sample Group 15)
- **Engineering/Works building (1990's area) – 1.2% Chrysotile (Sample Group 17)**

The asbestos-containing drywall joint compound was collected from Design and Drafting area (Sample 17-04) within the Engineering/Works building. Based on the laboratory results, a mixture of non-asbestos (17-01, 17-02 and 17-03) and asbestos-containing drywall joint compound is present within the building. The asbestos-containing drywall joint compound was noted to be in good condition at the time of the assessment.

4.2.6 Asbestos Cement Products

Asbestos cement or "Transite" roof drains are present within the Engineering/Works building and Works Garage. A small piece (1 linear foot) of transite is also present on the ground near the Salt/Asphalt Storage. This material has been assumed to contain asbestos and is currently in good condition.

4.2.7 Vinyl Floor Tiles

Historically, 9"x9" floor tiles have contained asbestos. Where observed, these floor tiles have been assumed to contain asbestos. 9"x9" floor tiles are present in the following locations:

- Engineering Building, Utility Room adjacent to Design & Drafting – 100ft^2, in good condition.
- Engineering Building, Lower Level Storage – 80ft^2, in good condition.

12”x12” floor tiles suspected to contain asbestos were observed in several locations. Samples of each were collected and subsequently submitted for analysis. Of the samples submitted for analysis, none were noted to contain asbestos. A summary of floor tiles submitted for analysis is provided below:

- Recycling Office (Sample Group 18)
- Engineering/Works building -Building Inspection (White) - (Sample Group 19)
- Engineering/Works building - Design Area (Green) - (Sample Group 20)
- Engineering/Works building – Corridor (White) - (Sample Group 21)
- Engineering/Works building – Lower Level (Green) - (Sample Group 22)
- Engineering/Works building – Lower Level Lunchroom - (Sample Group 23)
- Engineering/Works building – Upper Level W/R - (Sample Group 24)
- Engineering/Works building – Front Entrance - (Sample Group 25)

4.2.8 Vinyl Sheet Flooring

Vinyl sheet flooring suspected to contain asbestos was not observed during the assessment of the building.

4.2.9 Asbestos Paper Products

Paper products suspected to contain asbestos were not observed during the assessment.

4.2.10 Roofing, Caulking and Sealant Products

Roofing, caulking and sealants were not included as part of the assessment.

4.2.11 Vermiculate

OHS did not observe vermiculate within the accessible areas of the buildings. Historically, vermiculate can be present within concrete block walls and attic spaces. OHS did not perform destructive testing during the assessment of the buildings.

4.3 Lead

Several paint samples were collected and subsequently submitted for laboratory analysis. Concentrations of lead within the submitted samples ranged from none detected to 0.26%. A summary of the current sampling is outlined below:

Sample #	Location	% Lead
P1	Bus Bay - White on Concrete Block	<0.013
P2	Asphalt Shed - Exterior White	0.26
P3	Truck Bay – Blue	<0.0098
P4	Engineering/Works Building – Exterior Brown (white under)	0.016
P5	Engineering/Works Building – Exterior White	<0.01
P6	Engineering/Works Building – Lower Level Parts Taupe	0.11
P7	Engineering/Works Building - Olive Engineering Area	0.032
P8	Engineering/Works Building – Teal (CAD Area)	<0.014
P9	Engineering/Works Building – Peach/Taupe (Upper Level)	0.011
P10	Recycle Office- White Paint	<0.013
P11	Engineering/Works Building – Men's Locker Room Grey Floor Paint	<0.0099

Lead is also suspected to be a component of the following:

- Solder on copper plumbing fixtures
- Mortar at brick veneer
- Lead wool or caulking in bell/spigot fittings on cast iron piping systems
- Lead-acid batteries

Sampling of the above was not conducted.

4.4 Mercury

Mercury is present in fluorescent light tubes and thermostats within the Engineering/Work building and Works Garage.

4.5 Silica

Common construction sand contains free crystalline silica and is present in concrete products, mortar, brick, etc. These construction products are typically found throughout building structures.

4.6 Acrylonitrile, Benzene, Isocyanates, Arsenic, Ethylene Oxide, Vinyl Chloride and Coke Oven Emissions

Evidence suggesting the presence of acrylonitrile, benzene, isocyanates, arsenic, ethylene oxide, vinyl chloride monomer or coke oven emissions was not observed at the Site.

5.0 RECOMMENDATIONS

5.1 Asbestos Management Plan

Asbestos-containing materials have been identified within the facility and therefore are subject to the requirement for an Asbestos Management Program, as specified under Ontario Regulation 278/05.

Where an owner knows that asbestos-containing materials has been used in the building, the owner shall,

(a) Prepare and maintain on the premises a record of the location of the material,

(b) Give any other person who is an occupier of the building written notice of any information in the record that relates to the area occupied by the person,

(c) Give any employer with whom the owner arranges or contracts for work written notice of the information in the record, if the work,

  (i) may involve material mentioned in the record, or

  (ii) may be carried on in close proximity to such material and may disturb it;

(d) Advise the workers employed by the owner who work in the building of the information in the record, if the workers may do work that,

  (i) involves material mentioned in the record, or

  (ii) is to be carried on in close proximity to such material and may disturb it;

(e) Establish and maintain, for the training and instruction of every worker employed by the owner who works in the building and may do work;

(f) Inspect the material mentioned and update the survey at reasonable intervals (annually) or whenever the owner becomes aware of new information relating to the matters within the survey.

5.2 Specific Recommendations

5.2.1 Mechanical Insulation

Asbestos-containing mechanical insulation is present within the building. While the majority of this material is in good condition OHS did observe some asbestos-containing mechanical insulation in fair condition or accessible to all occupants and therefore should be repaired or removed.

Any activity, which will disturb asbestos-containing mechanical insulation, is governed by the procedures outlined in Ontario Regulation 278/05. The disturbance of less than one (1) square metre of asbestos-containing mechanical insulation may be performed as a Type 2 operation, while any greater disturbance requires Type 3 precautions.

5.2.2 Drywall Joint Compound

Based on the sampling results, asbestos-containing drywall joint compound is present within the original phase of construction of the Engineering/Works buildings. Unless of known recent installation, OHS recommends that all drywall within this area be assumed to contain asbestos.

In accordance with Ontario Regulation 278/05, drywall with asbestos-containing drywall joint compound may be removed following Type 1 procedures if less than $1m^2$ is disturbed. Any greater disturbance will require Type 2 abatement procedures.

5.2.3 Vinyl Floor Tiles

The 9”x9” asbestos-containing vinyl floor tiles (assumed) are considered non-friable products and are currently in good condition. Non-friable products may be removed following Type 1 abatement procedures if the material is wetted and removed using non-powered tools. Deviations from this will require alternate abatement procedures.

5.2.4 Transite

The asbestos-containing Transite roof drains are considered non-friable materials.

Non-friable materials may be removed, with manually powered tools, following Type 1 procedures outlined in Ontario Regulation 278/05. The use of powered equipment on non-friable asbestos materials, an activity which could result in the release of airborne fibres, must be performed under Type 3 precautions.

5.3 Lead

Lead was detected in the sampled submitted for laboratory analysis. In addition, lead may be present or is suspected to be a component in solder on copper plumbing fixtures within the building.

Elevated airborne lead levels can result when uncontrolled work procedures such as drilling, cutting, removing, grinding, etc. are used on lead-based materials. The control of dust levels during the demolition of the buildings can be accomplished through proper work practices to reduce overall dust levels and providing workers with proper personal protective equipment.

OHS recommends the work procedures and personal protective equipment outlined within the MOL document 'Guideline – Lead on Construction Projects' (2004) be utilized during the disturbance or handling of the material.

5.4 Mercury

Mercury is present in florescent light tubes and thermostats within some of the buildings on Site. In the event of future renovations or demolition, light tubes and thermostat tubes should be removed intact to prevent the mercury vapour from escaping.

Exposure to airborne mercury is regulated under the Designated Substances regulation titled, *Ontario Regulation 490/09, Designated Substances*. Mercury waste must be handled and disposed of according to Ontario Regulation 347, as amended, and may be subject to Leachate Criteria (Schedule 4) of this regulation.

5.5 Silica

Disturbance of materials containing silica will occur during demolition activities. Elevated airborne silica levels can result when uncontrolled work procedures such as drilling, cutting, removing, grinding, etc. are used on silica-containing materials.

OHS recommends the work procedures and personal protective equipment outlined within the MOL document 'Guideline – Silica on Construction Projects' (2004) be utilized during the disturbance or handling of the material.

6.0 LIMITATIONS AND WARRANTY

OHS has prepared this report for the exclusive use of the Client in evaluating the Site at the time of OHS's assessment. OHS will not be responsible for the use of this report by any third party, or reliance on or any decision to be made based on it without the prior written consent of OHS. OHS accepts no responsibility for damages, if any, by any third party because of decisions or actions based on this report.

The findings contained in this report are based upon conditions as they were observed at the time of investigation. No assurance is made regarding changes in conditions subsequent to the time of investigation.

If new information is developed in future work, OHS should be contacted to re-evaluate the conclusions of this report and to provide amendments as required.

Respectfully submitted,

OH Solutions Inc.
Jeff Doherty, BSc
Senior Occupational Hygienist

APPENDIX I

ASBESTOS AND LEAD SAMPLING RESULTS

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: O H Solutions
233 Mitchell Ave
Dorchester ON N0L 1G3

Report Date: 10/5/2012
Report Number: 287235
Project: Engineering Buildings
Project No.: 12-008

LEAD PAINT SAMPLE ANALYSIS SUMMARY

Lab No.	Client No.	Location / Description	Concentration Lead By Weight (%)
4804944	1	White Paint/Concrete Block Bus Bay	<0.013*
4804945	2	Exterior White Paint Asphalt Shed	0.26
4804946	3	Blue Paint Truck Bay	<0.0098
4804947	4	Exterior Brown Over White Paint Main Building	0.016*
4804948	5	Exterior White Paint Main Building	<0.01*
4804949	6	Taupe Paint Main Building-Lower Level Parts	0.11*
4804950	7	Olive Paint Main Building-Engineering Area	0.032*
4804951	8	Teal Paint Main Building-CAD Area	<0.014*
4804952	9	Peach/Taupe Paint Main Building-Upper Level	0.011***
4804953	10	White Paint Recycle Office	<0.013*

Accreditations: **NATIONAL LEAD LABORATORY ACCREDITATION PROGRAM (NLLAP)**
AIHA-LAP, LLC No. 100188 NYSDOH-ELAP No. 11021

Analytical Methods: ASTM D3335-85A "Standard Method To Test For Low Concentrations Of Lead In Paint By Atomic Absorption Spectrophotometry"
EPA SW846-(3050B:7000B) "Standard Method To Test For Low Concentrations Of Lead In Soils, Sludges and Sediments By AAS"

Comments: Regulatory limit is 0.5% lead by weight (EPA/HUD guidelines). Recommend multiple sampling for all samples less than regulatory limit for confirmation. All results are based on the samples as received at the lab. IATL assumes that appropriate sampling methods have been used and the data upon which these results are based have been accurately supplied by the client. Method Detection Limit (MDL) per EPA Method 40CFR Part 136 Apendix B. Reporting Limit (RL) based upon Lowest Standard Determined (LSD) in accordance with AIHA-ELLAP policies. LSD=0.2 ppm MDL=0.0044% by weight. RL= 0.010% by weight (based upon 100 mg sampled). * Insufficient sample provided to perform QC reanalysis (<200 mg) ** Not enough sample provided to analyze (<50 mg) *** Matrix / substrate interference possible. Sample results are not corrected for contamination by field or analytical blanks. This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA or any government agency. This report shall not be reproduced except in full, without written approval of the laboratory.

Date Received: 9/28/2012

Date Analyzed: 10/5/2012

Analyst: C. Shaffer

Approved By: _____

Frank E. Ehrenfeld, III
Laboratory Director

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:	O H Solutions			**Report Date:**	10/5/2012
	233 Mitchell Ave			**Report Number:**	287235
	Dorchester	ON	N0L 1G3	**Project:**	Engineering Buildings
				Project No.:	12-008

LEAD PAINT SAMPLE ANALYSIS SUMMARY

Lab No.	Client No.	Location / Description	Concentration Lead By Weight (%)
4804954	11	Grey Floor Paint Main Building-Men's Locker Room	<0.0099
4804955	12	Sample Not Received	NotRecv'd

Accreditations: **NATIONAL LEAD LABORATORY ACCREDITATION PROGRAM (NLLAP)**
AIHA-LAP, LLC No. 100188 NYSDOH-ELAP No. 11021

Analytical Methods: ASTM D3335-85A "Standard Method To Test For Low Concentrations Of Lead In Paint By Atomic Absorption Spectrophotometry"
EPA SW846-(3050B:7000B) "Standard Method To Test For Low Concentrations Of Lead In Soils, Sludges and Sediments By AAS"

Comments: Regulatory limit is 0.5% lead by weight (EPA/HUD guidelines). Recommend multiple sampling for all samples less than regulatory limit for confirmation. All results are based on the samples as received at the lab. IATL assumes that appropriate sampling methods have been used and the data upon which these results are based have been accurately supplied by the client. Method Detection Limit (MDL) per EPA Method 40CFR Part 136 Apendix B. Reporting Limit (RL) based upon Lowest Standard Determined (LSD) in accordance with AIHA-ELLAP policies. LSD=0.2 ppm MDL=0.0044% by weight. RL= 0.010% by weight (based upon 100 mg sampled). * Insufficient sample provided to perform QC reanalysis (<200 mg) ** Not enough sample provided to analyze (<50 mg) *** Matrix / substrate interference possible. Sample results are not corrected for contamination by field or analytical blanks. This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA or any government agency. This report shall not be reproduced except in full, without written approval of the laboratory.

Date Received: 9/28/2012

Date Analyzed: 10/5/2012

Analyst: C. Shaffer

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: O H Solutions
233 Mitchell Ave
Dorchester ON N0L 1G3

Report Date: 9/27/2012
Report No.: 286324
Project: Engineering (Outbuilding)
Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4795399 **Description / Location:** Tan Insulation
Client No.: 1-01 Fireproofing

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	10	Cellulose	60
		30	Fibrous Glass	

Lab No.: 4795400 **Description / Location:** Tan Insulation
Client No.: 1-02 Fireproofing

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	10	Cellulose	60
		30	Fibrous Glass	

Lab No.: 4795401 **Description / Location:** Tan Insulation
Client No.: 1-03 Fireproofing

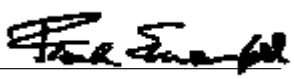
% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	20	Cellulose	60
		20	Fibrous Glass	

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

Comments: Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

Analysis Performed By: R. Kennedy

Approved By: 

Date: 9/27/2012

Frank E. Ehrenfeld, III
Laboratory Director

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: O H Solutions
233 Mitchell Ave
Dorchester ON N0L 1G3

Report Date: 10/8/2012
Report No.: 286852
Project: Engineering
Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804872 **Description / Location:** White Insulation
Client No.: 2-01 Parging Cement Lower Level

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
70	Chrysotile	None Detected	None Detected	30

Lab No.: 4804873 **Description / Location:** Off-White Insulation
Client No.: 3-01 Parging Cement Lower Level Storage

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
60	Chrysotile	None Detected	None Detected	40

Lab No.: 4804874 **Description / Location:** Brown Mastic
Client No.: 4-01 Above 1x1 Engineers Office

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804875 **Description / Location:** Brown Mastic
Client No.: 4-02 Above 1x1 Engineers Office

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

Comments: Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

Analysis Performed By: M. Mirza

Approved By:

Date: 10/8/2012

Frank E. Ehrenfeld, III
Laboratory Director

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: O H Solutions
233 Mitchell Ave
Dorchester ON N0L 1G3

Report Date: 10/8/2012
Report No.: 286852
Project: Engineering
Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804876 **Description / Location:** Brown Mastic
Client No.: 4-03 Above 1x1 Engineers Office

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804877 **Description / Location:** Tan Fibrous
Client No.: 5-01 Roof Drain Main Building

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	100	Cellulose	None Detected

Lab No.: 4804877 **Description / Location:** Black Tar Paper **Layer No.:** 2
Client No.: 5-01 Roof Drain Main Building

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	80	Cellulose	20

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

Comments: Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

Analysis Performed By: M. Mirza

Date: 10/8/2012

IATL **International Asbestos Testing Laboratories**

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CERTIFICATE OF ANALYSIS

Client: O H Solutions
233 Mitchell Ave
Dorchester ON N0L 1G3

Report Date: 10/8/2012
Report No.: 286852
Project: Engineering
Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804878 **Description / Location:** Tan Fibrous
Client No.: 5-02 Roof Drain Main Building

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	100	Cellulose	None Detected

Lab No.: 4804878 **Description / Location:** Black Tar Paper **Layer No.:** 2
Client No.: 5-02 Roof Drain Main Building

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	80	Cellulose	20

Lab No.: 4804879 **Description / Location:** Tan Fibrous
Client No.: 5-03 Roof Drain Main Building

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	100	Cellulose	None Detected

Lab No.: 4804879 **Description / Location:** Black Tar Paper **Layer No.:** 2
Client No.: 5-03 Roof Drain Main Building

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	80	Cellulose	20

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

Comments: Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

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Project: Engineering
Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804880 **Description / Location:** Black Tar
Client No.: 6-01 Roof Hopper-Main Building

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804881 **Description / Location:** Black Tar
Client No.: 6-02 Roof Hopper-Main Building

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804882 **Description / Location:** Black Tar
Client No.: 6-03 Roof Hopper-Main Building

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804883 **Description / Location:** Tan Insulation; Sprayed Fireproofing
Client No.: 7-01 Lunch Room Main Building

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	20	Cellulose	75
		5	Fibrous Glass	

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

Comments: Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

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Project: Engineering
Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804884 **Description / Location:** Tan Insulation; Sprayed Fireproofing
Client No.: 7-02 Mechanical Room (Main)

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	20	Cellulose	75
		5	Fibrous Glass	

Lab No.: 4804885 **Description / Location:** Tan Insulation; Sprayed Fireproofing
Client No.: 7-03 Mechanical Room (Main)

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	20	Cellulose	75
		5	Fibrous Glass	

Lab No.: 4804886 **Description / Location:** White/Tan Ceiling Tile; 2x4
Client No.: 8-01 Transit Office

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	30	Cellulose	40
		30	Mineral Wool	

Lab No.: 4804887 **Description / Location:** White/Tan Ceiling Tile; 2x4
Client No.: 8-02 Transit Office

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	30	Cellulose	40
		30	Mineral Wool	

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

Comments: Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

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Project: Engineering
Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804888 **Description / Location:** White/Tan Ceiling Tile; 2x4
Client No.: 8-03 Transit Office

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	30	Cellulose	40
		30	Mineral Wool	

Lab No.: 4804889 **Description / Location:** White/Tan Ceiling Tile; 2x4
Client No.: 9-01 Recycle Office

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	40	Cellulose	40
		20	Mineral Wool	

Lab No.: 4804890 **Description / Location:** White/Tan Ceiling Tile; 2x4
Client No.: 9-02 Recycle Office

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	40	Cellulose	40
		20	Mineral Wool	

Lab No.: 4804891 **Description / Location:** White/Tan Ceiling Tile; 2x4
Client No.: 9-03 Recycle Office

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	40	Cellulose	40
		20	Mineral Wool	

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

Comments: Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

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Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804892 **Description / Location:** White/Tan Ceiling Tile; 2x4
Client No.: 10-01 Main Building-Lower Level Lunch Room

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	55	Cellulose	40
		5	Mineral Wool	

Lab No.: 4804893 **Description / Location:** White/Tan Ceiling Tile; 2x4
Client No.: 10-02 Main Building-Upper Level

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	55	Cellulose	40
		5	Mineral Wool	

Lab No.: 4804894 **Description / Location:** White/Tan Ceiling Tile; 2x4
Client No.: 10-03 Main Building-Upper Level

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	55	Cellulose	40
		5	Mineral Wool	

Lab No.: 4804895 **Description / Location:** Tan Ceiling Tile; 2x4
Client No.: 11-01 Main Building-Engineers Office

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
PC 0.5	Chrysotile	80	Mineral Wool	PC 17.7
PC 1.8	Amosite			

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

Comments: Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

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Project: Engineering
Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804896 **Description / Location:** Sample Not Analyzed
Client No.: 11-02

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
Sample Not Analyzed		Sample Not Analyzed		

Lab No.: 4804897 **Description / Location:** Sample Not Analyzed
Client No.: 11-03

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
Sample Not Analyzed		Sample Not Analyzed		

Lab No.: 4804898 **Description / Location:** White/Tan Ceiling Tile; 1x1
Client No.: 12-01 Main Building-(Upper Corridor)

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	80	Mineral Wool	20

Lab No.: 4804899 **Description / Location:** White/Tan Ceiling Tile; 1x1
Client No.: 12-02 Main Building-(Upper Corridor)

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	80	Mineral Wool	20

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

Comments: Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

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Report Date: 10/8/2012
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Project: Engineering
Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804900 **Description / Location:** White/Tan Ceiling Tile; 1x1
Client No.: 12-03 Main Building-(Upper Corridor)

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	80	Mineral Wool	20

Lab No.: 4804901 **Description / Location:** White Plaster
Client No.: 13-01 Main Building-Custodial Room

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804901 **Description / Location:** Grey Plaster **Layer No.:** 2
Client No.: 13-01 Main Building-Custodial Room

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

Comments: Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

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Project: Engineering
Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804902 **Description / Location:** White Plaster
Client No.: 13-02 Main Building-Lower Level Bulkhead

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804902 **Description / Location:** Grey Plaster **Layer No.:** 2
Client No.: 13-02 Main Building-Lower Level Bulkhead

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804903 **Description / Location:** White Plaster
Client No.: 13-03 Main Building-Above DW Showers

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804903 **Description / Location:** Grey Plaster **Layer No.:** 2
Client No.: 13-03 Main Building-Above DW Showers

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

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BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804904 **Description / Location:** White Plaster
Client No.: 14-01 Main Building-Exterior

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804905 **Description / Location:** White Plaster
Client No.: 14-02 Main Building-Exterior

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804906 **Description / Location:** White Plaster
Client No.: 14-03 Main Building-Exterior

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804907 **Description / Location:** White Joint Compound
Client No.: 15-01 Main Building-Drawing Storage DWC (05)

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

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BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804908 **Description / Location:** White Joint Compound
Client No.: 15-02 Main Building-By-Law DWC (05)

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804909 **Description / Location:** White Joint Compound
Client No.: 15-03 Main Building-Adjacent To DWC (05)

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804910 **Description / Location:** White Joint Compound
Client No.: 16-01 Recycle Office-Lunch Room DWC

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804911 **Description / Location:** White Joint Compound
Client No.: 16-02 Recycle Office-Women's DWC

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

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Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804912 **Description / Location:** White Joint Compound
Client No.: 16-03 Recycle Office-Men's DWC

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804913 **Description / Location:** White Joint Compound
Client No.: 17-01 Main Building-Corridor @ Mens DWC

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804914 **Description / Location:** White Joint Compound
Client No.: 17-02 Main Building-Corridor @ Engineers DWC

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804915 **Description / Location:** White Joint Compound
Client No.: 17-03 Main Building-Upper Thames Office DWC

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

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Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804916 **Description / Location:** White Joint Compound
Client No.: 17-04 Main Building-CAD Room DWC

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
PC 1.2	Chrysotile	None Detected	None Detected	PC 98.8

Lab No.: 4804917 **Description / Location:** Sample Not Analyzed
Client No.: 17-05

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
	Sample Not Analyzed		Sample Not Analyzed	

Lab No.: 4804918 **Description / Location:** Sample Not Analyzed
Client No.: 17-06

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
	Sample Not Analyzed		Sample Not Analyzed	

Lab No.: 4804919 **Description / Location:** Sample Not Analyzed
Client No.: 17-07

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
	Sample Not Analyzed		Sample Not Analyzed	

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

Comments: Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

Analysis Performed By: M. Mirza

Date: 10/8/2012

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Telephone: 856-231-9449 Fax: 856-231-9818

CERTIFICATE OF ANALYSIS

Client: O H Solutions
233 Mitchell Ave
Dorchester ON N0L 1G3

Report Date: 10/8/2012
Report No.: 286852
Project: Engineering
Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804920 **Description / Location:** White/Grey Floor Tile; 12"
Client No.: 18-01 Recycle

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804920 **Description / Location:** Yellow Mastic **Layer No.:** 2
Client No.: 18-01 Recycle

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804921 **Description / Location:** White/Grey Floor Tile; 12"
Client No.: 18-02 Recycle

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804921 **Description / Location:** Yellow Mastic **Layer No.:** 2
Client No.: 18-02 Recycle

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

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Dorchester ON N0L 1G3

Report Date: 10/8/2012
Report No.: 286852
Project: Engineering
Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804922 **Description / Location:** White/Grey Floor Tile; 12"
Client No.: 18-03 Recycle

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804922 **Description / Location:** Yellow Mastic **Layer No.:** 2
Client No.: 18-03 Recycle

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804923 **Description / Location:** Off-White Floor Tile
Client No.: 19-01 Admin Office

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804924 **Description / Location:** Off-White Floor Tile
Client No.: 19-02 Admin Office

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

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Report Date: 10/8/2012
Report No.: 286852
Project: Engineering
Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804925 **Description / Location:** Off-White Floor Tile
Client No.: 19-03 Admin Office

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804926 **Description / Location:** White Floor Tile
Client No.: 20-01 CAD Area

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804927 **Description / Location:** White Floor Tile
Client No.: 20-02 CAD Area

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804928 **Description / Location:** White Floor Tile
Client No.: 20-03 CAD Area

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

Comments: Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

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Project: Engineering
Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804929 **Description / Location:** Off-White Floor Tile
Client No.: 21-01 Upper Level (Corridor)

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804930 **Description / Location:** Off-White Floor Tile
Client No.: 21-02 Upper Level (Corridor)

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804931 **Description / Location:** Off-White Floor Tile
Client No.: 21-03 Upper Level (Corridor)

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804932 **Description / Location:** Grey Floor Tile
Client No.: 22-01 Main Building Lower Level

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

Comments: Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

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Report No.: 286852
Project: Engineering
Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804933 **Description / Location:** Grey Floor Tile
Client No.: 22-02 Main Building Lower Level

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804934 **Description / Location:** Grey Floor Tile
Client No.: 22-03 Main Building Lower Level

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804935 **Description / Location:** Tan Floor Tile
Client No.: 23-01 Main Building Lower Level Lunchroom

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804936 **Description / Location:** Tan Floor Tile
Client No.: 23-02 Main Building Lower Level Lunchroom

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

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Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804937 **Description / Location:** Tan Floor Tile
Client No.: 23-03 Main Building Lower Level Lunchroom

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804938 **Description / Location:** Off-White Floor Tile
Client No.: 24-01 Main Building Engineering W/R

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804939 **Description / Location:** Off-White Floor Tile
Client No.: 24-02 Main Building Engineering W/R

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804940 **Description / Location:** Off-White Floor Tile
Client No.: 24-03 Main Building Engineering W/R

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

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Dorchester ON N0L 1G3

Report Date: 10/8/2012
Report No.: 286852
Project: Engineering
Project No.: 12-008

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4804941 **Description / Location:** White Floor Tile
Client No.: 25-01 Main Building Front Entrance

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804942 **Description / Location:** White Floor Tile
Client No.: 25-02 Main Building Front Entrance

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4804943 **Description / Location:** White Floor Tile
Client No.: 25-03 Main Building Front Entrance

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Accreditations: **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

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Analysis Performed By: M. Mirza

Date: 10/8/2012

APPENDIX II

ASBESTOS REGULATION 278/05, LEAD ON CONSTRUCTION PROJECTS GUIDELINES, SILICA ON CONSTRUCTION PROJECTS GUIDELINES

Ontario

GUIDELINE

SILICA ON CONSTRUCTION PROJECTS

Health and Safety Guidelines

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GUIDELINE

SILICA ON CONSTRUCTION PROJECTS

Occupational Health and Safety Branch
Ministry of Labour **September 2004**

TABLE OF CONTENTS

Foreword

This Guideline has been prepared to assist persons, such as employers, construction project owners, constructors, contractors and subcontractors, who have duties under the Occupational Health and Safety Act (OHSA) and its regulations to protect workers from exposure to silica. It should not be taken to be a statement of the law or what is necessary to comply with the law. A person with legal duties may or may not agree with the Guideline and there is no legal requirement to follow the Guideline. It is for each such person to decide what is necessary to comply with the OHSA and its regulations.

A person who needs assistance in determining what constitutes compliance should consult with his or her legal advisor. Ministry inspectors will assess workplace situations against the relevant provisions of the OHSA and its regulations but they do not enforce the Guideline, although they may refer to it in determining whether the relevant laws have been complied with.

1.0 INTRODUCTION

Scope

Employers have a duty to protect their workers from silica exposure on construction projects. This Guideline has been prepared to raise the awareness of employers and workers in the construction industry of the hazards posed by silica in construction and the measures and procedures that should be taken to control those hazards

For the purposes of this guideline, silica refers to crystalline silica in a respirable[1] form.

Silica in Construction

Silica (SiO_2) is a compound resulting from the combination of one atom of silicon with two atoms of oxygen. It is the second most common mineral in the earth's crust and is a major component of sand, rock and mineral ores. Silica exists in several forms, of which crystalline silica is of most concern. The best-known and most abundant type of crystalline silica is quartz. Other forms of crystalline silica include cristobalite, tridymite, and tripoli.

In construction, worker exposure to silica is of particular concern because silica is the primary component of many construction materials. Some commonly used construction materials containing silica include:

- abrasives used for blasting
- brick, refractory brick
- concrete, concrete block, cement, mortar
- granite, sandstone, quartzite, slate
- gunite
- mineral deposits
- rock and stone
- sand, fill dirt, top soil
- asphalt containing rock or stone.

Many construction activities can generate airborne silica-containing dust. In construction, abrasive blasting generates the most dust. Exposure to silica from abrasive blasting can result if the abrasive contains silica and/or if the material being blasted contains silica. Other activities that generate airborne dust include:

[1] "Respirable" means that size fraction of the airborne particulate deposited in the gas-exchange region of the respiratory tract and collected during air sampling with a particle size-selective device that,

(a) meets the American Conference of Governmental Industrial Hygienists (ACGIH) particle size-selective criteria, and

(b) has the cut point of 4 microns at 50 per cent collective efficiency.

- chipping, hammering, and drilling of rock
- crushing, loading, hauling, and dumping of rock
- sawing, hammering, drilling, grinding, and chipping of concrete or masonry structures
- demolition of concrete and masonry structures
- dry sweeping or pressurized air blowing of concrete, rock, or sand dust
- road construction
- sweeping, cleaning, and dismantling equipment
- tunnelling, excavation, and earth moving of soils with high silica content.

2.0 LEGAL REQUIREMENTS

Occupational Health and Safety Act (OHSA)

The OHSA sets out, in very general terms, the duties of employers and others to protect workers from health and safety hazards on the job. These duties include, but are not limited to:

- taking all reasonable precautions to protect the health and safety of workers [clause 25(2)(h)],
- ensuring that equipment, materials and protective equipment are maintained in good condition [clause 25(1)(b)],
- providing information, instruction and supervision to protect worker health and safety [clause 25(2)(a)], and
- acquainting a worker or a person in authority over a worker with any hazard in the work and in the handling, storage, use, disposal and transport of any article, device, equipment or a biological, chemical or physical agent [clause 25(2)(d)].

In addition, section 30 of the OHSA deals with the presence of designated substances on construction projects. Since silica is a designated substance (R.R.O. 1990, Reg. 845), compliance with the OHSA and regulations will require some action to be taken where there is a silica hazard on a construction project.

Section 30 of the OHSA requires the owner of a project to determine if silica is present on a project and, if it is, to so inform all potential contractors as part of the bidding process. In a similar way, contractors who receive this information are to pass it onto other contractors and subcontractors who are bidding for work on the project. If the owner or any contractor fails to comply with this requirement, they will be liable for any loss or damages that result from a contractor subsequently discovering that silica is present.

Workplace Hazardous Materials Information System (WHMIS) Regulation, R.R.O. 1990, Reg. 860

The WHMIS Regulation applies to all workplaces covered by the OHSA. Any employer or constructor who uses WHMIS controlled products is required to comply with the WHMIS Regulation regarding the requirements for labels, material safety data sheets, and worker education and training.

The Ministry of Labour is responsible for the administration and enforcement of both federal and provincial WHMIS legislation.

Regulation for Construction Projects, O. Reg. 213/91

The Regulation for Construction Projects, O. Reg. 213/91, applies to all construction projects. Although silica is not mentioned specifically, the following sections of the regulation would apply to situations where there is the potential for workers to be exposed to silica:

Section 14 (5) A competent person shall perform tests and observations necessary for the detection of hazardous conditions on a project.

Section 21 (1) A worker shall wear such protective clothing and use such personal protective equipment or devices as are necessary to protect the worker against the hazards to which the worker may be exposed.

(2) A worker's employer shall require the worker to comply with subsection (1).

(3) A worker required to wear personal protective clothing or use personal protective equipment or devices shall be adequately instructed and trained in the care and use of the clothing, equipment or device before wearing or using it.

Section 30 Workers who handle or use…substances likely to endanger their health shall be provided with washing facilities with clean water, soap and individual towels.

Section 46 (1) A project shall be adequately ventilated by natural or mechanical means,

(a) if a worker may be injured by inhaling a noxious…dust or fume;

(2) If it is not practicable to provide natural or mechanical ventilation in the circumstances described in clause (1)(a), respiratory protective equipment suitable for the hazard shall be provided and be used by the workers.

Section 59 If the dissemination of dust is a hazard to a worker, the dust shall be adequately controlled or each worker who may be exposed to the hazard shall be provided with adequate personal protective equipment.

Regulation Respecting Silica, R.R.O. 1990, Reg. 845

The Ministry's designated substance regulation (DSR) for silica, Regulation 845, specifies occupational exposure limits (OELs) for silica and requires assessment and a control program to ensure compliance with these OELs. The OEL for respirable crystalline silica is 0.05 milligrams per cubic metre (mg/m3) of air by volume as an 8-hour daily or 40-hour weekly time-weighted average for cristobalite and tridymite. In the case of quartz and tripoli, the OEL is 0.10 milligrams per cubic meter of air by volume.

Despite the fact that Regulation 845 and the OEL for silica do not generally apply to a constructor or to an employer on a construction project in respect of those workers who work at or on the project, construction employers still have a responsibility to protect the health of their workers. However, if the construction project is located at a workplace where silica is present and likely to be inhaled by a worker then the employer of the workplace must protect the workers on the project by obeying the instructions set out in sections 4 and 5 of Regulation 845, even if the work is performed under a contract with another person. (Section 4 and 5 state how much airborne silica the worker may be exposed to with safety and describes when, and what circumstances, respirators must be used in order to meet these requirements.).

Measures and procedures that ensure construction workers receive the same standard of protection as workers covered by Regulation 845 should therefore be implemented on construction projects where exposure to silica is a hazard. Such measures and procedures are deemed to be in compliance with section 25(2)(h) of the OHSA, as taking “every precaution reasonable in the circumstances for the protection of a worker”.

3.0 HEALTH EFFECTS

The prolonged inhalation of respirable dust containing crystalline silica may result in silicosis, a disease characterized by progressive fibrosis of the lungs. A pneumoconiosis (lung disease caused by the inhalation of dust), silicosis is marked by shortness of breath and impaired lung function which may give rise to complications that can result in death. The development and the severity of silicosis depends on the airborne concentration of silica dust to which a worker is exposed and the duration of exposure.

The International Agency for Research on Cancer (IARC) has concluded that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans and has classified these forms of silica as Group 1 carcinogens. In addition, the American Conference of Governmental Industrial Hygienists (ACGIH) has classified quartz as a suspected human carcinogen with an A2 classification

Crystalline silica may be harmful following high exposure levels received over a period, ranging from a few weeks to years or after long-term exposures to lower levels. There are three major types of silicosis: chronic, accelerated, and acute.

Chronic Silicosis

Chronic silicosis is most common. Symptoms may not appear for a long time, usually more than 10 years, and may progress and worsen over a period of many years. Chronic silicosis may be either a simple or a complicated type.

The effects of silicosis can continue to develop even after the exposure ceases and they are irreversible. In addition, the progression of lung fibrosis can also lead to the development of lung cancer

Simple Chronic Silicosis

Simple silicosis is almost entirely without symptoms. In the early stages of the disease the lung nodules are small (usually 1 to 3 mm) and discrete in the upper lung fields. As the disease progresses the nodules increase in number and size and also occupy the lower field. Although simple silicosis may never grow more serious, long-term exposure to silica dust may lead to complicated silicosis.

Complicated Chronic Silicosis

Complicated chronic silicosis is also called progressive massive fibrosis (PMF). The first symptoms may be shortness of breath with exercise, wheezing or sputum that causes coughing. However, some people with the disease have no symptoms. Complicated silicosis can become worse when in combination with other lung diseases. Severe complicated silicosis can result in heart disease in addition to lung disease.

Accelerated Silicosis

Accelerated silicosis is almost the same as chronic silicosis. However, it develops more quickly and the lung scars show up sooner. Accelerated silicosis can develop when exposure to large amounts of silica dust occurs over a short time period. Nodules may appear on a chest x-ray five years after the first exposure to silica dust and the disease can quickly worsen.

Acute Silicosis

Acute silicosis is a lung disease that develops rapidly. As few as 8 to 18 months may elapse from the time of first exposure to the onset of symptoms, which include progressive shortness of breath, fever, cough and weight loss. There is a rapid progression of respiratory failure usually resulting in death within one or two years.

How does silica enter the body?

Occupational exposure to silica occurs through inhalation of small airborne particles of silica dust, mainly in the range of 5.0 μm to 0.5 μm, which are not expelled from the lung when inhaled. Instead, they remain in the lung and are deposited in lymph nodes, where over time, calcium can deposit in those nodes and settle along the rim of the lymph node. This condition is known as “egg-shell” calcification. In some cases, silica particles are carried into the lungs where a scar may form around the particles. Over time, the hardened scars gradually start to show up on the chest x-ray as fibrosis of the lung.

4.0 CONTROLLING THE SILICA HAZARD

In order for silica to be a hazard, silica-containing dust particles that are small enough to be inhaled (i.e., respirable) must get into the air. The strategy for controlling the silica hazard can therefore be broken down into three basic approaches:

- prevent silica dust from getting into the workplace air
- remove silica dust present in the air
- if present, prevent workers from inhaling the dust.

To avoid the inhalation of silica, it is essential to have the following control methods in place:

- engineering controls
- work practices and hygiene practices
- respirators and personal protective equipment
- training.

However, even with appropriate measures to control silica, some workers may still be affected. For this reason, periodic medical examinations are important for determining if the control measures in place are effective and if workers are suffering from any of the effects of silica exposure. This is known as medical surveillance (see Appendix 1), and can be considered to be a method of early detection and prevention of silicosis.

4.1 Engineering Controls

Engineering controls are methods of designing or modifying equipment, ventilation systems, and processes to minimize the amount of a substance that gets into the workplace air. They include:

- substitution
- process control
- enclosure and/or isolation of the emission source
- ventilation.

Substitution can eliminate silica from certain processes by replacing it with a less toxic material. Some examples are:

- silica sand used in abrasive blasting may be replaced by metal shot and grit, alumina, garnet, cereal husks, sawdust, high pressure water, steel sand, silicon carbide or corundum (Note: When choosing non-silica containing abrasives, avoid choosing abrasives that may introduce new health hazards to the workplace. For example, abrasives containing walnut shells may cause allergic reactions in some workers.);
- the replacement of sandstone grinding wheels with ones using an abrasive like aluminum oxide; and
- the use of magnesite or aluminum oxide bricks in place of silica bricks in furnaces.

When it is not possible to use a silica substitute, changing how a process is performed can lower silica exposures. For instance, wet methods reduce dust and should be used whenever practical, particularly in cutting, grinding, and drilling operations. Another example is the modification of an abrasive operation to produce a coarser dust that is less hazardous because it settles more readily and is less likely to be trapped in the lungs if inhaled.

If a process cannot be modified to reduce exposure, it may have to be isolated or enclosed. Dusty operations can be isolated by carrying them out in areas that are physically separated from non-dusty areas and keeping workers not involved in the operation out of the area. Where isolation is not effective, the process can be completely sealed off from the rest of the workplace with an enclosure.

Ventilation refers to engineering controls that rely on the removal of contaminated air from the workplace and the replacement of exhausted air with filtered air. The most effective use of ventilation to control a silica hazard is the removal of dust at its source (local exhaust ventilation). Often dust-generating tools are equipped with dust collection systems to prevent dust from spreading or becoming airborne. An essential component of these systems are the cleaning devices, such as filters, which will effectively remove the dust.

4.2 Work Practices and Hygiene Practices

Work practices and hygiene practices are on-the-job activities that reduce the exposure potential from contaminated surfaces and work areas. Silica can also accumulate on the hands, clothing and hair. From there it can be disturbed, re-suspended in air and inhaled. Workers should therefore be able to wash and shower at the end of each shift. There should be no smoking, eating, drinking or chewing in contaminated areas and lunches should be stored in an uncontaminated area. It is therefore important to follow good work and hygiene practices whenever silica is present.

Good housekeeping is important wherever silica dust is generated. Containers of silica-containing waste should be kept tightly covered to prevent dust from becoming airborne. Surfaces should be kept clean by washing down with water or vacuuming with a vacuum equipped with a high-efficiency particulate air (HEPA) filter. Cleaning with compressed air or dry sweeping should be avoided.

4.3 Personal Protective Equipment

Personal protective equipment includes protective clothing and respirators. The purpose of protective clothing is to prevent the contamination of regular clothing and the transportation of silica-containing materials from the workplace. Clothing that is contaminated with silica dust should not therefore be worn home without cleaning.

Sometimes engineering controls and work practices cannot lower the concentration of silica to non-hazardous levels and workers must wear respirators for protection. If respirators must be used, a respirator program should be implemented. It should include written procedures for the selection, use, care and maintenance of personal respiratory protection equipment. Workers should be instructed and trained on the care and use of personal protective equipment before using it. Some workers may have a medical condition that causes them to have difficulty breathing when wearing a respirator. Such workers should not be assigned to do work that requires a respirator if they have written medical proof of their condition.

Respirator Selection

Where respirators are provided, they should be appropriate in the circumstances for the type and the concentration of airborne silica. Respirators should be selected in accordance with the U.S. National Institute for Occupational Safety and Health (NIOSH) assigned protection factors (APF).

Use, Care, and Maintenance of Respirators

The following general use, care, and maintenance procedures should be followed whenever respirators are required:

- respirators should be used and maintained in accordance with the manufacturer's specifications
- proper seal of respirators should be checked prior to each use
- storage of respirators should be in a convenient, clean and sanitary location and stored in a manner that does not subject them to damage or distortion
- respirators assigned for the exclusive use of one worker, should be cleaned, disinfected and inspected after each shift
- respirators used by more than one worker, should be cleaned, disinfected and inspected after each use
- any respirator parts that are damaged or that have deteriorated should be replaced before the respirator is used.

For additional information on the use, care, and maintenance of respirators, please refer to CSA standard Z94.4-02.

Ideally respirators should be assigned for the exclusive use of one worker. But before a decision is made for a respirator to be shared by more than one worker, the following factors should be considered:

- the fit of the equipment
- the health and safety risk to the worker that would be caused by non-exclusive use of the equipment
- any undue economic hardship to the employer that would be caused by exclusive use of the equipment.

Respirators with a tight-fitting facepiece must be fitted to the worker in such a way that there is an effective seal between the equipment and the worker's face. Each worker must be fit-tested for each type of respirator to be worn.

4.4 Training

Training is an important component in preventing worker exposure to silica. Control methods, measures and procedures can only be as effective as the workers carrying them out. It is therefore essential for training to cover the following:

- WHMIS training
- the hazards of silica, including health effects and symptom recognition;
- the recognition of typical operations containing silica;
- personal hygiene, respirator requirements, and work measures and procedures;
- the use, care, maintenance, cleaning and disposal of personal respiratory protective equipment.

Instruction and training should be provided by a competent person. This could be the employer or someone hired by the employer. A competent person is defined under the OHSA as a person who:

- is qualified because of his/her knowledge, training and experience to organize the work and its performance;
- is familiar with the provisions of this Act and the regulations that apply to the work; and
- has knowledge of any potential health and safety hazards in the workplace.

The health and safety representative or the representative of a joint health and safety committee should be advised about when and where the training and instruction is to be carried out.

4.5 Medical Surveillance

Medical surveillance can be used as a preventive and remedial measure. By providing regular medical examinations and clinical tests on workers exposed to silica, subsequent adverse health effects can be detected. The examining physician can then alert the worker, the employer and the joint health and safety committee to exposure problems in the workplace that might otherwise go unrecognized. This should ensure that remedial steps will be taken.

Workers working with silica on a regular basis should have pre-placement medical examinations that include chest X-rays and pulmonary function tests, followed by periodic medical examinations. The frequency of the periodic examination will depend on the intensity and length of exposure to silica and shall be decided by the examining physician. It need not be the same for all workers but shall be done at least once every two years. Additional information on the medical surveillance program for silica exposed workers can be found in Appendix 1.

5.0 CLASSIFICATION OF WORK

A key feature of this guideline is the classification of work. It is the classification of the work that determines the appropriate respirators, measures and procedures that should be followed to protect the worker from silica exposure. In this guideline, silica-containing construction operations are classified into three groups, Type 1, Type 2, and Type 3 operations, and can be thought of as being of low, medium and high risk. From Type 1 to Type 3 operations, the corresponding respirator, and measures and procedures become increasingly stringent.

The classification of typical silica-containing construction tasks is based on available and published exposure data. Type 1, Type 2, and Type 3 operations, are based on the following airborne concentrations of respirable crystalline silica in the form of cristobalite, tridymite, quartz, and tripoli:

	TYPE 1 OPERATIONS	TYPE 2 OPERATIONS	TYPE 3 OPERATIONS
Cristobalite and Tridymite	> 0.05 to 0.50 mg/m^3	> 0.50 to 2.50 mg/m^3	> 2.5 mg/m^3
Quartz and Tripoli	> 0.10 to 1.0 mg/m^3	> 1.0 to 5.0 mg/m^3	> 5.0 mg/m^3

The following section lists the typical construction operations that generate silica-containing dust:

TYPE 1 OPERATIONS

- The drilling of holes in concrete or rock that is not part of a tunnelling operation or road construction.
- Milling of asphalt from concrete highway pavement.
- Charging mixers and hoppers with silica sand (sand consisting of at least 95 per cent silica) or silica flour (finely ground sand consisting of at least 95 per cent silica).
- Any other operation at a project that requires the handling of silica-containing material in a way that may result in a worker being exposed to airborne silica.
- Entry into a dry mortar removal or abrasive blasting area while airborne dust is visible for less than 15 minutes for inspection and/or sampling.
- Working within 25 metres of an area where compressed air is being used to remove silica-containing dust outdoors.

TYPE 2 OPERATIONS

- Removal of silica containing refractory materials with a jackhammer.
- The drilling of holes in concrete or rock that is part of a tunnelling or road construction.
- The use of a power tool to cut, grind, or polish concrete, masonry, terrazzo or refractory materials.
- The use of a power tool to remove silica containing materials.
- Tunnelling (operation of the tunnel boring machine, tunnel drilling, tunnel mesh installation)
- Tuckpoint and surface grinding.
- Dry mortar removal with an electric or pneumatic cutting device.
- Dry method dust cleanup from abrasive blasting operations.
- The use of compress air outdoors for removing silica dust.
- Entry into area where abrasive blasting is being carried out for more than 15 minutes.

TYPE 3 OPERATIONS

- Abrasive blasting with an abrasive that contains ≥ 1 per cent silica.
- Abrasive blasting of a material that contains ≥ 1 per cent silica.

Employers, supervisors, and workers should be able to recognize and correctly classify the types of operations carried out in the workplace, in order to select appropriate respirators, and implement appropriate measures and procedures. Respirator requirements are listed in Table 1 (below) for Type 1, Type 2, and Type 3 operations.

Table 1: Respirator Requirements

Operations	Required Respirator
Type 1 **(> 0.05 to 0.50 mg/m^3 of silica in the form of cristobalite and tridymite)** **(> 0.10 to 1.0 mg/m^3 of silica in the form of quartz and tripoli)**	**NIOSH APF = 10**
• The drilling of holes in concrete or rock that is not part of a tunnelling operation or road construction. • Milling of asphalt from concrete highway pavement. • Charging mixers and hoppers with silica sand (sand consisting of at least 95 per cent silica) or silica flour (finely ground sand consisting of at least 95 per cent silica). • Any other operation at a project that requires the handling of silica-containing material in a way that may result in a worker being exposed to airborne silica. • Entry into a dry mortar removal or abrasive blasting area while airborne dust is visible for less than 15 minutes for inspection and/or sampling. • Working within 25 metres of an area where compressed air is being used to remove silica-containing dust outdoors.	Half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100 per cent efficiency.
Type 2 **(> 0.50 to 2.5 mg/m^3 of silica in the form of cristobalite and tridymite)** **(> 1.0 to 5.0 mg/m^3 of silica in the form of quartz and tripoli)**	**NIOSH APF = 50**
• Removal of silica containing refractory materials with a jackhammer. • The drilling of holes in concrete or rock that is part of a tunnelling operation or road construction. • The use of a power tool to cut, grind, or polish concrete, masonry, terrazzo or refractory materials. • The use of a power tool to remove silica-containing materials. • The use of a power tool indoors to chip or break and remove concrete, masonry, stone, terrazzo or refractory materials. • Tunnelling (operation of the tunnel boring machine, tunnel drilling, tunnel mesh installation). • Tuckpointing and surface grinding. • Dry method dust clean-up from abrasive blasting operations. • Dry mortar removal with an electric or pneumatic cutting device. • The use of compressed air outdoors for removing silica dust. • Entry into area where abrasive blasting is being carried out for more than 15 minutes.	Full-facepiece air-purifying respirator with any 100-series particulate filter. Tight-fitting powered air-purifying respirator with any 100-series particulate filter. Full-facepiece supplied-air respirator operated in demand mode. Half-mask or full-facepiece supplied air respirator operated in continuous-flow mode.
Type 3 **(> 2.5 mg/m^3 of silica in the form of cristobalite and tridymite)** **(> 5.0 mg/m^3 of silica in the form of quartz and tripoli)**	**NIOSH APF ≥ 1000**
• Abrasive blasting with an abrasive that contains ≥ 1 per cent silica • Abrasive blasting of a material that contains ≥ 1 per cent silica	Type CE abrasive-blast supplied air respirator operated in a positive-pressure mode with a tight-fitting half-mask facepiece. Type CE abrasive-blast supplied air respirator operated in a pressure-demand or positive pressure mode with a tight-fitting full-facepiece.

* NIOSH APF = National Institute of Occupational Safety and Health Assigned Protection Factor
Note: It is recommended that compressed air that is used to supply supplied air respirators meet the breathing air purity requirements of CSA Standard Z180.1-00. Where an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor/alarm should be provided.

6.0 MEASURES AND PROCEDURES FOR WORKING WITH SILICA

Protective measures and procedures should be implemented when working with silica. Specific measures and procedures will depend on how the work is classified. This section of the guideline outlines the general measures and procedures for all work with lead, followed by specific recommendations for Type 1, Type 2 and Type 3 operations.

6.1 General Measures and Procedures for Type 1, Type 2, and Type 3 Operations

The following is a list of general measures and procedures that should be followed for all work with silica:

- Clean-up after each operation is encouraged to prevent dust containing silica from spreading;
- Compressed air or dry sweeping should be avoided when cleaning a work area;
- Compressed air should not be used for removing dust from clothing;
- Workers exposed to silica should be provided with or have access to washing facilities equipped with clean water, soap, and individual towels.
- Silica dust on personal protective clothing and equipment should be removed by damp wiping or HEPA vacuuming;
- Contaminated personal protective clothing and equipment should be handled with care to prevent disturbing the silica dust and the generation of airborne silica dust
- Washing facilities and laundering procedures must be suitable for handling silica contaminated laundry.

Preparation of the Work Area

Warning signs should be posted in sufficient number to warn of the hazard. If it is an indoor operation, signs should be posted at each entrance to the work area. The signs should display the following information in large, clearly visible letters:

1. There is a silica dust hazard.
2. Access to the work area is restricted to authorized persons.
3. Respirators must be worn in the work area.

Dust Control Measures

The generation of airborne silica-containing dust should be controlled with a mechanical ventilation system, wetting, or the use of a dust collection system. If silica-containing airborne dust is generated, mechanical ventilation with an air flow sufficient to remove airborne contaminants from workers' breathing zone should be provided. The air flow of the mechanical ventilation system should be at least 50 cubic feet per minute per square foot of face area (0.25 m^3/s per square meter of face area). However, if it is determined that none of these methods are practical, workers may be provided with respirators (see Table 1: Respirator

Requirements) to protect them from exposure. The following should be considered before assigning respirators:

- Risk to workers using wetting or a dust collection system.
- Likelihood of damage to equipment if wetting or a dust collection system is used.
- Frequency and duration of the operation.

If compressed air is being used to remove silica-containing dust outdoors, the operator and workers within 25 metres of the work area who may be exposed to the dust must either be removed from the path of the dust cloud or provided with respirators (see Table 1: Respirator Requirements).

Where effective dust control measures are in place and where an employer can demonstrate on a continual basis that the silica exposure levels are below the OEL, respirators may not be required.

6.2 Measures and Procedures for Type 1 Operations

A half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100 per cent efficiency should be provided for workers performing Type 1 operations. Respirators should also be provided when:

- entering a dry mortar removal area with visible airborne dust for less than 15 minutes for the purposes of inspection and/or sampling purposes.
- work is being performed within 25 metres of an outdoor area where silica-containing dust is being removed with compressed air.

6.3 Measures and Procedures for Type 2 Operations

Respirators with a NIOSH APF of 50 (see Table 1: Respirator Requirements) should be provided for workers performing Type 2 operations. In addition, the generation of silica-containing airborne dust should be controlled by thoroughly wetting the area prior to and/or during drilling or cutting operations and during the loading, scraping or moving of rock.

Other workers entering a work area where Type 2 operations are being performed should remain at least 10 metres away. Ropes or barriers should be set up to prevent unauthorized personnel from entering the work area. If this is not possible and there are workers within the 10-metre limit, the Type 2 operation should be enclosed to prevent the escape of airborne silica-containing dust (see Section 6.4.1: Barriers, Partial Enclosures and Full Enclosures).

6.4 Measures and Procedures for Type 3 Operations

The operator of the abrasive blasting nozzle should wear a Type CE abrasive blast supplied air respirator operated in a pressure demand or positive pressure mode with a tight-fitting half-mask or full facepiece.

It is recommended that compressed air that is used to supply supplied air respirators meet the breathing air purity requirements of CSA Standard Z180.1-00. Where an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor/alarm should be provided

While abrasive blasting is in progress or the airborne dust from abrasive blasting is visible,

- any worker entering the work area where abrasive blasting is being carried out for less than 15 minutes for inspection and/or sampling purposes should wear a half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100 per cent efficiency.
- any worker entering a work area where abrasive blasting is being carried out for more than 15 minutes should wear a respirator with a NIOSH APF of 50 (see Table 1: Respirator Requirements).
- workers engaged in cleaning dust from abrasive blasting operations, should wear a respirator with a NIOSH APF of 50 (see Table 1: Respirator Requirements).

Where abrasive blasting is conducted, barriers, partial enclosures and full enclosures should be in place to prevent other workers from being exposed to silica-containing dust and to prevent the spread of dust to other work areas.

6.4.1 Barriers, Partial Enclosures and Full Enclosures

Barriers, partial enclosures, and full enclosures are used to separate the work area from the rest of the project, and in some cases, to prevent silica exposure to other workers not directly involved in the operation. Partial and full enclosures can also prevent or reduce the dispersion of silica into the surrounding work area and environment. Barriers should only be used where full and partial enclosures are not practicable.

Barriers

Ropes or barriers do not prevent the release of contaminated dust or other contaminants into the environment. However, they can be used to restrict access of workers who are not adequately protected with proper PPE, and also prevent the entry of workers not directly involved in the operation. Ropes or barriers should be placed at a distance far enough from the operation that allows the silica-containing dust to settle. If this is not achievable, warning signs should be posted at the distance where the silica-containing dust settles to warn that access is restricted to persons wearing PPE. For example, the removal of mortar and cutting operations, ropes or barriers should be located at least 10 metres away. All workers within the barrier or warning sign zone must be adequately protected.

Partial Enclosures

Partial enclosures allow some level of emission to the atmosphere outside of the enclosure. Partial enclosures may consist of vertical tarps and floor tarps so long as the tarps are overlapped and securely fixed together at the seams. A partial enclosure is not a recommended containment system if significant dust is being generated.

Full Enclosures

Full enclosures are tight enclosures (with tarps that are generally impermeable and fully sealed joints and entryways). Full enclosures allow minimal or no fugitive emissions to reach the outside environment.

For full enclosures, the following requirements should be met:

If, as outlined above, a Type 3 operation should be enclosed, the enclosure should meet the following requirements:

- entry ways in the enclosure should be equipped with air locks, overlapping door tarps or doors
- the enclosure should be supported by a secure structure
- all joints in the enclosure should be fully sealed
- the escape of abrasive and debris from the enclosure should be controlled, at air supply points, by the use of baffles, louvers, flap seals and filters
- general mechanical ventilation should be provided to remove contaminated air from the enclosure and replacement air should be provided to replace the exhausted air
- the air pressure within the enclosure should be negative relative to the outside
- equipment venting such air shall be equipped with filters adequate to control vented air to provincial environmental standards
- the air velocity within the enclosure should provide an average minimum cross-draft or down-draft past each worker during abrasive blasting operations as follows:
    - cross-draft velocity of 0.5 m/sec (100 ft/min)
    - down-draft velocity of 0.25 m/sec (50 ft/min)

If the enclosure is located outdoors these additional requirements should be met:

- the enclosure should be made of windproof materials that are impermeable to dust
- the enclosure should be supported by a structure that prevents more than minor movement of the enclosure.

Indoor Operations

If abrasive blasting is being conducted indoors and persons other than those doing the abrasive blasting may be exposed to silica-containing dust, the abrasive blasting area should be separated from the rest of the project by an enclosure that will confine the dust within the abrasive blasting area. When an indoor abrasive blasting operation is completed, dust and waste should be cleaned up and removed by vacuuming with a HEPA-filter-equipped vacuum, wet sweeping or wet shovelling.

Outdoor Operations

If abrasive blasting is being conducted outdoors and persons other than those doing the abrasive blasting may be exposed to silica-containing dust, the work area should be identified by ropes or barriers located at least 25 metres from the abrasive blasting area, to prevent entry by workers not directly involved in the operation.

If it is not possible to locate the ropes or barriers at least 25 metres from the abrasive blasting operation, the employer should ensure that the abrasive blasting area is separated from the rest of the project by an enclosure that will confine the dust within the abrasive blasting area.

APPENDIX 1 – MEDICAL SURVEILLANCE OF SILICA-EXPOSED WORKERS

Where construction workers are exposed to airborne silica, measures and procedures to control their exposure should be implemented. This Guideline has outlined (in Section 4) the types of controls that should be in place for various work activities. However, even with the appropriate measures to control the silica hazard, some workers may be affected. Workers should therefore be periodically examined to determine if they are experiencing any adverse effects.

The essential features of a silica medical surveillance program are presented below.

Medical Surveillance Program

Purpose

The objective of a medical surveillance program is to protect the health of workers by:

- ensuring their fitness for exposure to silica
- evaluating their absorption of silica
- enabling remedial action to be taken when necessary
- providing health education.

Program

The medical surveillance program should include the following:

- pre-employment and pre-placement medical examinations
- periodic medical examinations
- clinical tests
- health education
- record keeping.

Medical Examinations

The medical examination should include the following:

History

The initial medical and occupational history should include enquiries about the worker's previous exposure to silica, personal habits (smoking) and history of present or past respiratory disorders (particularly tuberculosis). At the periodic examination, the history shall be updated to include:

(a) information on the frequency and duration of exposure to silica since the previous examination; and

(b) the occurrence of signs and symptoms of respiratory disease, e.g., dyspnea, cough, sputum, haemoptysis, wheezing and chest pain.

Physical Examination

Medical surveillance should include a general physical examination, with attention particularly directed to the respiratory system. The frequency of periodic examinations will depend on the intensity and length of exposure to silica and should be decided by the examining physician. It need not be the same for all workers but should not be less than once every two years.

Clinical Tests

X-rays and pulmonary function tests should be taken to assess a worker's fitness for continued exposure to silica. Refer to the Code for Medical Surveillance of Silica Exposed Workers in R.R.O. 1990, Reg. 845 for specific requirements.

To avoid unnecessary x-rays at a pre-placement medical examination, the examining physician should, where practicable, obtain the medical status from another facility if the worker has been previously examined in the past year. Radiographs should be closely examined for early signs of silicosis or other chest disease.

When exposure is discontinued, the frequency of X-rays and the period of surveillance will depend on the intensity and duration of exposure and the findings in previous X-rays. The examining physician shall determine the duration and frequency of follow-up

Pulmonary Function Tests

Pulmonary function tests should be taken in conjunction with the chest X-rays. Calibration of the instruments should meet current standards. Tests should include FEV_1, FVC, FEV_1/FVC per cent and a mid-flow rate such as FEF 25-75 per cent. All relevant data should be corrected to body temperature and pressure (BTPS).

Action Levels

An assessment of a worker's fitness for work should be based on both the clinical examination and clinical test results. For this reason, no specific action levels are stated for the latter. If silicosis is confirmed, the physician should then determine whether the worker is fit, fit with limitations or unfit for further exposure. A worker should not be removed from silica exposure before consultation with the Workplace Safety Insurance Board (WSIB). To qualify for compensation or rehabilitation further assessment by the WSIB will be necessary.

APPENDIX 2: RESPIRATOR REQUIREMENTS & OTHER MEASURES AND PROCEDURES FOR TYPE 1, 2, AND 3 SILICA-CONTAINING OPERATIONS

OPERATIONS	REQUIRED RESPIRATOR	OTHER MEASURES & PROCEDURES
TYPE 1		
• The drilling of holes in concrete or rock that is not part of a tunnelling operation or road construction. • Milling of asphalt from concrete highway pavement. • Charging mixers and hoppers with silica sand (sand consisting of at least 95 per cent silica) or silica flour (finely ground sand consisting of at least 95 per cent silica). • Any other operation at a project that requires the handling of silica-containing material in a way that may result in a worker being exposed to airborne silica. • Entry into a dry mortar removal or abrasive blasting area while airborne dust is visible for less than 15 minutes for inspection and/or sampling. • Working within 25 metres of an area where compressed air is being used to remove silica-containing dust outdoors.	Half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100% efficiency.	• Clean-up after each operation should be done to prevent dust containing silica from spreading • Compressed air or dry sweeping should be avoided when cleaning a work area • Compressed air should not be used for removing dust from clothing • Workers exposed to silica should be provided with or have access to washing facilities equipped with clean water, soap, and individual towels • Silica dust on personal protective clothing and equipment should be removed by damp wiping or HEPA vacuuming • Contaminated personal protective clothing and equipment should be handled with care to prevent disturbing the silica dust and the generation of airborne silica dust • Washing facilities and laundering procedures must be suitable for handling lead contaminated laundry • Warning signs should be posted in sufficient numbers to warn of the silica hazard. There should be a sign, at least, at each entrance to the work area. The signs should display the following information in large, clearly visible letters: – There is a silica dust hazard. – Access to the work area is restricted to authorized persons. – Respirators must be worn in the work area.

OPERATIONS	REQUIRED RESPIRATOR	OTHER MEASURES & PROCEDURES
TYPE 2		
• Removal of silica containing refractory materials with a jackhammer. • The drilling of holes in concrete or rock that is part of a tunnelling operation or road construction. • The use of a power tool to cut, grind, or polish concrete, masonry, terrazzo or refractory materials. • The use of a power tool to remove silica-containing materials. • The use of a power tool indoors to chip or break and remove concrete, masonry, stone, terrazzo or refractory materials. • Tunnelling (operation of the tunnel boring machine, tunnel drilling, tunnel mesh installation). • Tuckpointing and surface grinding. • Dry mortar removal with an electric or pneumatic cutting device. • Dry method dust clean-up from abrasive blasting operations. • The use of compressed air outdoors for removing silica dust. • Entry into area where abrasive blasting is being carried out for more than 15 minutes.	Full-facepiece air-purifying respirator with N-, R-, or P-series filter and 100% efficiency. Tight-fitting powered air-purifying respirator with a high-efficiency filter. Full-facepiece supplied-air respirator operated in demand mode. Half-mask or full-facepiece supplied air respirator operated in continuous-flow mode.	**(In addition to Type 1 measures and procedures.)** • Other workers entering a work area where Type 2 operations are being performed should remain at least 10 metres away. Ropes or barriers should be set up to prevent unauthorized personnel from entering the work area. If this is not possible and there are workers within the 10-metre limit, the Type 2 operation should be enclosed to prevent the escape of airborne silica-containing dust (partial or full enclosures).
TYPE 3		
• Abrasive blasting with an abrasive that contains ≥ 1 per cent silica • Abrasive blasting of a material that contains ≥ 1 per cent silica	Type CE abrasive-blast supplied air respirator operated in a positive-pressure mode with a tight-fitting half-mask facepiece. Type CE abrasive-blast supplied air respirator operated in a pressure-demand or positive pressure mode with a tight-fitting full-facepiece.	**(In addition to Type 1 and Type 2 measures and procedures.)** • While abrasive blasting is in progress or the airborne dust from abrasive blasting is visible, – any worker entering the work area where abrasive blasting is being carried out for less than 15 minutes for inspection and/or sampling purposes should wear a half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100% efficiency. – any worker entering a work area where abrasive blasting is being carried out for more than 15 minutes should wear a respirator with a NIOSH APF of 50 – workers engaged in cleaning dust from abrasive blasting operations, should wear a respirator with a NIOSH APF of 50 • Where abrasive blasting is conducted, barriers, partial enclosures and full enclosures should be in place to prevent other workers from being exposed to silica-containing dust and to prevent the spread of dust to other work areas.

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GUIDELINE

LEAD ON CONSTRUCTION PROJECTS

Occupational Health and Safety Branch
Ministry of Labour

September 2004

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Foreword

This Guideline has been prepared to assist persons, such as employers, construction project owners, constructors, contractors and subcontractors, who have duties under the Occupational Health and Safety (OHSA) and its regulations to protect workers from exposure to lead. It should not be taken to be a statement of the law or what is necessary to comply with the law. A person with legal duties may or may not agree with the Guideline and there is no legal requirement to follow the Guideline. It is for each such person to decide what is necessary to comply with the OHSA and its regulations.

A person who needs assistance in determining what constitutes compliance should consult with his or her legal advisor. Ministry inspectors will assess workplace situations against the relevant provisions of the OHSA and its regulations but they do not enforce the Guideline, although they may refer to it in determining whether the relevant laws have been complied with.

1.0 INTRODUCTION

Scope

Employers have a duty to protect their workers from lead exposure on construction projects. This guideline has been prepared to raise the awareness of employers and workers in the construction industry of the hazards posed by lead in construction and the measures and procedures that should be taken to control those hazards.

For the purpose of this guideline, lead refers to inorganic lead.

Lead in Construction

Lead is a heavy metal that has been in industrial use for thousands of years. It is pale silvery grey when freshly cut but it darkens on exposure to air. It is heavy, malleable, and a poor conductor of electricity. Lead may be used in its pure elemental form or combined chemically with other elements to form lead compounds. Inorganic lead compounds are used in pigments, paints, glasses, plastics and rubber compounds.

Lead can be present on construction projects in two distinct ways:

- It can be found in construction materials, such as paints, coatings, mortar, concrete, solder, and sheet metal.
- It can be present at a construction site in existing structures, building components, and where lead was previously used in a manufacturing process.

Construction activities of particular concern include:

- abrasive blasting of structures coated with lead-based paints
- application or removal of lead-containing paints
- welding, burning, or high temperature cutting of lead-containing coatings or materials
- removal of lead-containing dust using an air mist extraction system
- removal of lead-containing mortars using an electric or pneumatic cutting device.

2.0 LEGAL REQUIREMENTS

Occupational Health and Safety Act (the OHSA)

The OHSA sets out, in very general terms, the duties of employers and others to protect workers from health and safety hazards on the job. These duties include:

- taking all reasonable precautions to protect the health and safety of workers [clause 25(2)(h)]
- ensuring that equipment, materials and protective equipment are maintained in good condition [clause 25(1)(b)]
- providing information, instruction and supervision to protect worker health and safety [clause 25(2)(a)]
- acquainting a worker or a person in authority over a worker with any hazard in the work and in the handling, storage, use, disposal and transport of any article, device, equipment or a biological, chemical or physical agent [clause 25(2)(d)].

In addition, section 30 of the OHSA deals with the presence of designated substances on construction projects. Since lead is a designated substance (R.R.O. 1990, Reg. 843), compliance with the OHSA and Regulations will require some action to be taken where there is a lead hazard on a construction project.

Section 30 requires the owner of a project to determine if lead is present on a project and, if it is, to so inform all potential contractors as part of the bidding process. In a similar way, contractors who receive this information are to pass it onto other contractors and subcontractors who are bidding for work on the project. If the owner or any contractor fails to comply with this requirement, they will be liable for any loss or damages that result from a contractor subsequently discovering that lead is present.

Workplace Hazardous Materials Information System (WHMIS) Regulation, R.R.O. 1990, Reg.860

The WHMIS Regulation applies to all workplaces covered by the OHSA. Any employer or constructor who uses WHMIS controlled products is required to comply with the WHMIS Regulation (Reg. 860) regarding the requirements for labels, material safety data sheets, and worker education and training.

The Ministry of Labour is responsible for the administration and enforcement of both federal and provincial WHMIS legislation.

Regulation for Construction Projects. O. Reg. 213/91

The Regulation for Construction Projects, O. Reg. 213/91, applies to all construction projects. Although lead is not mentioned specifically, the following sections of the O. Reg. 213/91 would apply to situations where there is the potential for workers to be exposed to lead:

Clause 14 (5) A competent person shall perform tests and observations necessary for the detection of hazardous conditions on a project.

Section 21 (1) A worker shall wear such protective clothing and use such personal protective equipment or devices as are necessary to protect the worker against the hazards to which the worker may be exposed.

(2) A worker's employer shall require the worker to comply with subsection (1).

(3) A worker required to wear personal protective clothing or use personal protective equipment or devices shall be adequately instructed and trained in the care and use of the clothing, equipment or device before wearing or using it.

Section 30 Workers who handle or use…substances likely to endanger their health shall be provided with washing facilities with clean water, soap and individual towels.

Section 46 (1) A project shall be adequately ventilated by natural or mechanical means,

(a) if a worker may be injured by inhaling a noxious…dust or fume;

(2) If it is not practicable to provide natural or mechanical ventilation in the circumstances described in clause (1)(a), respiratory protective equipment suitable for the hazard shall be provided and be used by the workers.

Section 59 If the dissemination of dust is a hazard to a worker, the dust shall be adequately controlled or each worker who may be exposed to the hazard shall be provided with adequate personal protective equipment.

Regulation respecting Lead, R.R.O. 1990, Regulation 843

The Ministry's designated substance regulation (DSR) for lead, Regulation 843, specifies occupational exposure limits (OELs) for lead, and requires assessment and a control program to ensure compliance with these OELs. The OEL for inorganic lead is 0.05 milligrams per cubic metre (mg/m^3) of air as an 8-hour daily or 40-hour weekly time-weighted average.

Despite the fact that Regulation 843 and the OEL for lead do not generally apply to a constructor or to a construction employer on a construction project in respect of those workers who work at or on the project, construction employers still have a responsibility to protect the health of their workers. However, if the construction project is located at a workplace where lead is present and likely to be inhaled, ingested or absorbed by a worker then the employer of the workplace must protect the workers on the project by obeying the instructions set out in sections 4 and 5 of Regulation 843, even if the work is performed under a contract with another person. (Section 4 and 5 state how much airborne lead the worker may be exposed to with safety and describes when, and what circumstances, respirators must be used in order to meet these requirements.)

Measures and procedures that ensure construction workers receive the same standard of protection as workers covered by Regulation 843 should therefore be implemented on construction projects where exposure to lead is a hazard. Such measures and procedures are deemed to be in compliance with section 25(2)(h) of the OHSA, as taking "every precaution reasonable in the circumstances for the protection of a worker".

3.0 HEALTH EFFECTS

How lead enters the body – what are the routes of entry?

Two routes of entry are of major concern: inhalation and ingestion. Airborne lead particles in the form of fumes, dusts and mists can be inhaled deeply into the lungs if they are small enough, less than five micrometres (μm), i.e., five one-millionths of a meter. Larger particles are trapped in the upper respiratory tract, cleared from the lungs, and subsequently swallowed. You can also swallow lead dust if it gets in your food or drinks, or if you eat or smoke without washing your hands first.

What happens when lead enters the body – what are the health effects?

Shortly after lead is inhaled or ingested, it can enter the bloodstream and travel to soft tissues (such as the liver, kidneys, lungs, brain, spleen, muscles, and heart). After several weeks, most of the lead moves into your bones and teeth and can be stored there for a long time. Therefore, exposure to small amounts of lead can build up over time, and the more lead you have in your body, the more likely it is that you will experience health problems.

Early signs of lead poisoning include:

- tiredness
- irritability
- muscle and joint pain
- headaches
- stomach aches and cramps.

Harmful effects can follow a high exposure over a short period of time **(acute poisoning)**, or long-term exposure to lower doses **(chronic poisoning)**. Symptoms of acute lead poisoning include a metallic taste in the mouth and gastrointestinal symptoms such as vomiting, abdominal cramps, constipation, and diarrhea. Symptoms of chronic lead poisoning are more difficult to recognize because they are similar to many common complaints. However, severe chronic poisoning can lead to more characteristic symptoms, such as a blue line on the gums, wrist drop (the inability to hold the hand extended), severe abdominal pain and pallor.

Lead can also cause serious damage to a number of systems in the body. Overexposure to lead can affect:

> **Blood:** Lead can interfere with the body's ability to manufacture hemoglobin, the molecule in red blood cells responsible for carrying oxygen to the tissues. This may lead to anemia.

Kidneys: Kidneys purify blood before it is distributed for use by the rest of the body. However, kidneys are not effective in filtering lead from the bloodstream. In addition, lead can damage the kidneys and reduce its ability to filter waste from the bloodstream.

Gastrointestinal System: Lead poisoning may result in abdominal pain, loss of appetite, vomiting, nausea, constipation or diarrhea.

Nervous System: Lead poisoning can cause peripheral nerve damage that results in muscle weakness. It may also lead to behavioural changes and to impairment of vision and hearing. At very high levels, lead can affect the brain, causing convulsions, coma, and even death.

Reproductive System: Lead may harm the developing fetus because of the shared blood supply between a mother and her fetus. Exposure of pregnant women to excessive lead may result in miscarriages and stillbirths. Overexposure to lead in men can impair sperm production.

Bones and Teeth: Absorbed lead can be deposited and stored in mineralizing tissues (bones and teeth) for a long period of time. Under certain circumstances, the release of stored lead increases and can re-enter the blood and target other systems in the body. The release of stored lead increases during periods of pregnancy, lactation, menopause, physiologic stress, chronic disease, hyperthyroidism, kidney disease, broken bones, and advanced age, and is exacerbated by calcium deficiency.

Although there are many possible symptoms, they should not be relied upon to warn of a lead-exposure problem because some changes take a long time to develop and workers may not notice a change in their health. If workers carry lead-containing dust home on their clothes, footwear, skin or hair, their family can be exposed to lead too. Children in particular are more susceptible to the harmful effects of lead. Even low-level exposures may harm the intellectual development, behaviour, size and hearing of infants. The best approach in preventing lead poisoning is to ensure that proper lead-exposure controls are in place before any health problems are noted.

4.0 CONTROLLING THE LEAD HAZARD

Lead may affect the health of workers if it is in a form that may be inhaled (i.e. airborne particles) or ingested. In order for lead to be a hazard by inhalation, lead particles that are small enough to be inhaled must get into the air. There are three types of particles: dust, fume and mist. Lead dust consists of solid particles created through processes such as blasting, sanding, grinding, and electric or pneumatic cutting. Lead fumes are produced when lead or lead-contaminated materials are heated to temperatures above 500 °C, such as welding, high temperature cutting, and burning operations. The heating causes a vapour to be given off and the vapour condenses into solid fume particles. Mists are made up of liquid droplets suspended in air. The spray application of lead-based paint can generate a high concentration of lead-containing mist.

The strategy for controlling airborne lead hazard can therefore be broken down into three basic approaches:

- prevent lead from getting into the air
- remove lead present in the air
- if present in the air, prevent workers from inhaling it.

To prevent the ingestion of lead, workers should exercise good work and hygiene practices.

To avoid the ingestion, inhalation and unintentional transfer of lead from contaminated areas, it is essential to have the following control methods in place:

- engineering controls
- work practices and hygiene practices
- protective clothing and equipment
- training.

Even with appropriate measures to control lead, some workers may still be affected. For this reason, periodic medical examinations are important for determining if the control measures in place are effective and if workers are suffering from the effects of lead exposure. This is known as medical surveillance (see Appendix 1) and can be considered to be a method for early detection and prevention of lead poisoning.

4.1 Engineering Controls

Workplace parties, which include owners, constructors, contractors, supervisors and workers, involved in construction projects that may expose workers to lead should:

- Substitute lead-containing coatings and materials with lead-free coatings and materials (e.g. substitute lead-containing paints with non-lead based paints). This may also apply to those who develop specifications.
- Select methods and equipment for the removal or installation of lead-containing coatings and materials that will reduce dust generation (e.g. wet methods, such as wet sweeping and shovelling, reduce dust generation and should be used whenever practicable). This may also apply to those who develop the specifications.
- General mechanical ventilation should be provided to remove contaminated air from the workplace, and filtered air should be provided to replace the exhausted air.
- Local mechanical ventilation should be provided to remove contaminants at the source. This is the most effective method. Power tools that can generate lead-containing dust should be equipped with effective dust collection systems.

4.2 Work Practices and Hygiene Practices

Work practices and hygiene practices are on-the-job activities that reduce the exposure potential. Lead-containing material can accumulate on the hands, clothing and hair. From there it can be disturbed, re-suspended in air and inhaled or ingested. Workers should therefore be able to wash and shower at the end of each shift. The specific washing and decontamination facilities that should be provided for the most hazardous work are described in Section 6 of this guideline. For all work involving lead exposure, there should be no smoking, eating, drinking or chewing in contaminated areas. Food and beverages should be stored in an uncontaminated area.

An effective housekeeping program requires the regular cleanup removal of lead-containing dust and debris. Surfaces should be kept clean by washing down with water or vacuuming with a vacuum equipped with a high efficiency particulate air (HEPA) filter. Containers of lead-containing waste should be kept tightly covered to prevent dust from becoming airborne. Cleaning with compressed air or dry sweeping should be avoided.

4.3 Protective Clothing and Equipment

Personal protective clothing and equipment should be provided where workers may be exposed to lead. Appropriate personal protective clothing and equipment to prevent skin contamination, include but are not limited to coveralls or full-body work clothing; gloves, hats, and footwear or disposable coverlets; and safety glasses, face shields or goggles. Respirators should be provided to prevent the inhalation of lead where engineering controls and work practices do not control the concentration of lead to below the OEL.

Protective Clothing

The purpose of protective clothing is to prevent skin exposure and the contamination of regular clothing. All clothing and equipment that has been worn in a lead-contaminated area must be

removed at the end of each shift and be decontaminated. Under no circumstances should these be taken home. When handling lead-contaminated clothing avoid shaking, as this can be a significant source of exposure to lead dust. Lead-contaminated clothing and equipment should be placed in sealed impermeable plastic bags with proper labels indicating lead contamination. Washing facilities and procedures must be suitable for handling lead contaminated laundry.

Respirators

Where engineering controls and work practices do not control the concentration of lead to below the OEL, workers should wear respirators. If respirators are used, a respirator program should be implemented. The program should be developed in consultation with the joint health and safety committee or health and safety representative, if there is one, and should include written procedures for the selection, use, care and maintenance of personal respiratory protective equipment. Workers should be instructed and trained on the care and use of personal protective equipment before using it. Some workers may have a medical condition that causes them to have difficulty breathing when wearing a respirator. If such workers have written medical proof of their condition, they should not be required to do work that requires a respirator.

Respirator selection

Where respirators are provided, they should be appropriate in the circumstances for the anticipated concentrations of airborne lead. Respirators should be selected in accordance with the U.S. National Institute for Occupational Safety and Health (NIOSH) assigned protection factors (APF).

Use, Care, and Maintenance of Respirators

The following general use, care, and maintenance procedures should be followed whenever respirators are required:

- respirators should be used and maintained in accordance with the manufacturer's specifications
- storage of respirators should be in a convenient, clean and sanitary location and in a manner that does not subject them to damage or distortion
- respirators assigned for the exclusive use of one worker, should be cleaned, disinfected and inspected after each shift on which they are used
- respirators used by more than one worker, should be cleaned, disinfected and inspected after each use
- any respirator parts that are damaged or that have deteriorated should be replaced before the respirator is used
- please refer to CSA standard Z94.4-02 for additional information of the use and care of respirators.

Ideally respirators should be assigned for the exclusive use of one worker. But before a decision is made for a respirator to be shared by more than one worker, the following factors should be considered:

- the fit of the equipment
- the health and safety risk to the worker that supplying non-exclusive use equipment would cause
- any undue economic hardship to the employer that supplying exclusive use equipment would cause.

Respirators with a tight-fitting face-piece, must be fitted to the worker in such a way that there is an effective seal between the equipment and the worker's face. Each worker must be fitted for each type of respirator to be worn.

4.4 Training

Training is an important component in preventing worker exposure to lead. Control methods, measures and procedures can only be as effective as the workers carrying them out. It is therefore essential for training to cover the following:

- WHMIS training,
- the hazards of lead, including health effects and symptom recognition,
- personal hygiene, respirator requirements, and work measures and procedures, and
- the use, cleaning and disposal of respirators and protective equipment;

Instruction and training should be provided by a competent person. This could be the employer or someone hired by the employer. A competent person is defined under the OHSA as a person who:

- is qualified because of his/her knowledge, training and experience to organize and carry out the work safely;
- is familiar with the provisions of the act and the regulations that apply to the work; and
- has knowledge of any potential health and safety hazards in the workplace.

The health and safety representative or the representative of a joint health and safety committee should be advised about when and where the training and instruction is to be carried out.

4.5 Medical Surveillance

Medical surveillance can be used as a preventive measure. By providing regular medical examinations and biological monitoring (i.e. blood-lead tests) on workers exposed to lead, subsequent adverse health effects can be detected. The examining physician can then alert the

worker, the employer and the joint health and safety committee to exposure problems in the workplace that might otherwise go unrecognized

Workers working with lead on a regular basis should have pre-placement medical examinations that include blood-lead tests, followed by periodic medical examinations. Blood-lead tests should be taken every six months, or more frequently at the discretion of a physician. Additional information of the medical surveillance program for lead exposed workers can be found in Appendix 1.

5.0 CLASSIFICATION OF WORK

A key feature of this guideline is the classification of work. It is the classification of the work that determines the appropriate respirators, measures and procedures that should be followed to protect the worker from lead exposure. In this guideline, lead-containing construction operations are classified into three groups, Type 1, Type 2, and Type 3 operations, and can be thought of as being of low, medium and high risk. Some groups, Type 2 and Type 3, are further subdivided. From Type 1 to Type 3 operations, the corresponding respirator requirements, and measures and procedures become increasingly stringent.

The classification of typical lead-containing construction tasks is based on presumed airborne concentrations obtained from the U.S. Occupational Safety and Health Administration (OSHA), the Ontario Ministry of Labour, and published research studies. The classification of Type 1, Type 2, or Type 3 operations are grouped based on the following concentrations of airborne lead:

TYPE 1 OPERATIONS	TYPE 2 OPERATIONS		TYPE 3 OPERATIONS	
	Type 2a	Type 2b	Type 3a	Type 3b
< 0.05 mg/m^3	> 0.05 to 0.50 mg/m^3	> 0.50 to 1.25 mg/m^3	> 1.25 to 2.50 mg/m^3	> 2.50 mg/m^3

TYPE 1 OPERATIONS

- Application of lead-containing coatings with a brush or roller.
- Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap.
- Removal of lead-containing coatings or materials using a power tool that has an effective* dust collection system equipped with a HEPA filter.
- Installation or removal of lead-containing sheet metal.
- Installation or removal of lead-containing packing, babbit or similar material.
- Removal of lead-containing coatings or materials using non-powered hand tools, other than manual scraping or sanding.
- Soldering.

* Effective implies that the dust collection system should be capable of controlling airborne lead concentration levels to below 0.05 mg/m^3. Employers should follow manufacturer's recommendations and maintenance specifications for optimal function.

TYPE 2 OPERATIONS

TYPE 2a OPERATIONS

- Welding or high temperature cutting of lead-containing coatings or materials outdoors. This operation is considered a Type 2a operation only if it is short-term, not repeated, and if the material has been stripped prior to welding or high temperature cutting. Otherwise, it will be considered a Type 3a operation.
- Removal of lead-containing coatings or materials by scraping or sanding using non-powered hand tools.
- Manual demolition of lead-painted plaster walls or building components by striking a wall with a sledgehammer or similar tool.

TYPE 2b OPERATIONS

- Spray application of lead-containing coatings.

TYPE 3 OPERATIONS

TYPE 3a OPERATIONS

- Welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space.
- Burning of a surface containing lead.
- Dry removal of lead-containing mortar using an electric or pneumatic cutting device.
- Removal of lead-containing coatings or materials using power tools without an effective dust collection system equipped with a HEPA filter.
- Removal or repair of a ventilation system used for controlling lead exposure.
- Demolition or cleanup of a facility where lead-containing products were manufactured.
- An operation that may expose a worker to lead dust, fume or mist that is not a Type 1, Type 2, or Type 3b operation.

TYPE 3b OPERATIONS

- Abrasive blasting of lead-containing coatings or materials.
- Removal of lead-containing dust using an air mist extraction system.

Employers, supervisors, and workers should be able to recognize and classify lead-containing operations in order to provide appropriate respirators, measures and procedures. Respirator requirements are listed in Table 1 for Type 1, Type 2, and Type 3 operations.

TABLE 1: RESPIRATOR REQUIREMENTS

Operations	Required Respirator
Type 1 (< 0.05 mg/m^3)	
• Application of lead-containing coatings with a brush or roller. • Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap. • Removal of lead-containing coatings or materials using a power tool that has an effective dust collection system equipped with a HEPA filter. • Installation or removal of lead-containing sheet metal. • Installation or removal of lead-containing packing, babbit or similar material. • Removal of lead-containing coatings or materials with a non-powered hand tool, other than manual scraping and sanding. • Soldering.	Respirators should not be necessary if the general procedures listed in Section 6.1 are followed and if the level of lead in the air is less than 0.05 mg/m^3. However, if the worker wishes to use a respirator, a half-mask particulate respirator with N-, R- or P-series filter, and 95, 99 or 100% efficiency should be provided.
Type 2a (> 0.05 to 0.50 mg/m^3)	**NIOSH APF = 10**
• Welding or high temperature cutting of lead-containing coatings or materials outdoors. This operation is considered a Type 2a operation only if it is short-term, not repeated, and if the material has been stripped prior to welding or high temperature cutting. Otherwise, it will be considered a Type 3a operation. • Removal of lead-containing coatings or materials by scraping or sanding using non-powered hand tools. • Manual demolition of lead-painted plaster walls or building components by striking a wall with a sledge hammer or similar tool.	Half-mask particulate respirator with N-, R-or P-series filter, and 95, 99 or 100% efficiency.
Type 2b (> 0.50 mg/m^3 to 1.25 mg/m^3)	**NIOSH APF = 25**
• Spray application of lead-containing coatings.	Powered air purifying respirator equipped with a hood or helmet, and any type of high efficiency filter. Supplied air respirator equipped with a hood or helmet and operated in a continuous flow mode.

Operations	Required Respirator
Type 3a (> 1.25 to 2.50 mg/m^3)	**NIOSH APF = 50**
• Welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space. • Burning of a surface containing lead. • Dry removal of lead-containing mortar using an electric or pneumatic cutting device • Removal of lead-containing coatings or materials using power tools without an effective dust collection system equipped with a HEPA filter. • Removal or repair of a ventilation system used for controlling lead exposure. • Demolition or cleanup of a facility where lead-containing products were manufactured. • An operation that may expose a worker to lead dust, fume or mist that is not a Type 1,Type 2 or Type 3b operation.	Full-facepiece air-purifying respirator with N-, R-or P-series filter, and 100% efficiency. Tight-fitting powered air-purifying respirator with a high efficiency filter. Full-facepiece supplied-air respirator operated in demand mode. Half-mask or full-facepiece supplied air respirator operated in continuous-flow mode.
Type 3b (> 2.50 mg/m^4)	**NIOSH APF ≥ 1000**
• Abrasive blasting of lead-containing coatings or materials.	Type CE abrasive-blast supplied respirator operated in a positive pressure mode with a tight-fitting half-mask facepiece.
• Removal of lead-containing dust using an air mist extraction system.	Full-facepiece supplied-air respirator operated in pressure-demand or other positive-pressure mode.

* NIOSH APF = National Institute of Occupational Safety and Health Assigned Protection Factor
Note: It is recommended that compressed air used to supply air respirators should meet the breathing air purity requirement of CSA Standard Z180.1-00. Where an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor/alarm must be provided.

6.0 MEASURES AND PROCEDURES FOR WORKING WITH LEAD

Protective measures and procedures should be implemented when working with lead. Specific measures and procedures will depend on how the work is classified. This section of the guideline outlines general measures and procedures for all work with lead, followed by specific recommendations for Type 1, Type 2, and Type 3 operations.

6.1 General Measures and Procedures for Type 1, Type 2, and Type 3 Operations

The following is a list of general measures and procedures that should be followed for **all** work with lead:

- washing facilities consisting of a wash basin, water, soap and towels should be provided and workers should use these washing facilities before eating, drinking, smoking or leaving the project;
- workers should not eat, drink, chew gum or smoke in the work area;
- drop sheets should be used below all lead operations which produce or may produce dust, chips, or debris containing lead;
- dust and waste should be cleaned up and removed by vacuuming with a HEPA filter equipped vacuum;
- clean-up after each operation should be done to prevent lead contamination and exposure to lead;
- dust and waste should be cleaned up at regular intervals and placed in a container that is:
    - dust tight
    - identified as containing lead waste
    - cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before being removed from the work area
    - removed from the workplace frequently and at regular intervals;
- the work area should be inspected daily at least once to ensure that the work area is clean; and
- compressed air or dry sweeping should not be used to clean up any lead-containing dust or waste from a work area or from clothing.

6.2 Measures and Procedures for Type 1 Operations

Respirators should not be necessary if the general procedures (above) are followed. However, any worker who requests a respirator should be provided with a half-mask particulate respirator with N-, R- or P-series filter, and 95, 99 or 100% efficiency.

6.3 Measures and Procedures for Type 2 Operations

Preparation of the Work Area

For all Type 2 operations, signs should be posted in sufficient numbers to warn of the lead hazard. There should be a sign, at least, at each entrance to the work area. The signs should display the following information in large, clearly visible letters:

1. There is a lead dust, fume or mist hazard.
2. Access to the work area is restricted to authorized persons.
3. Respirators must be worn in the work area.

Personal Protective Clothing and Equipment

Suitable protective clothing and equipment, as recommended in Section 4.3, should be worn by every worker who enters the work area.

Where lead-containing paints or coatings are being applied by spraying, all workers in the work area should wear a powered air purifying respirator equipped with a hood or helmet and a high efficiency filter, or a supplied air respirator equipped with a hood or helmet and operated in a continuous flow mode should be adequate.

For all other Type 2 operations, a half-mask particulate respirator with N-, R- or P-series filter, and 95, 99 or 100% efficiency should be adequate.

6.4 Measures and Procedures for Type 3 Operations

6.4.1 Preparation of the Work Area

Warning signs should be provided for all Type 3 operations. Signs should be posted in sufficient numbers to warn of the lead hazard, and at least at each entrance of the work area. The signs should display the following information in large, clearly visible letters:

1. There is lead dust, fume or mist hazard.
2. Access to the work area is restricted to authorized persons.
3. Respirators must be worn in the work area.

6.4.2 Barriers, Partial Enclosures and Full Enclosures

Barriers, partial enclosures, and full enclosures are used to separate the work area from the rest of the project, and in some cases, to prevent lead exposure to other workers not directly involved in the operation. Partial and full enclosures can also prevent or reduce the dispersion of lead into the surrounding work area and environment. Barriers should only be used where full and partial enclosures are not practicable.

Barriers

Ropes or barriers do not prevent the release of contaminated dust or other contaminants into the environment. However, they can be used to restrict access of workers who are not adequately protected with proper PPE, and also prevent the entry of workers not directly involved in the operation. Ropes or barriers should be placed at a distance far enough from the operation that allows the lead-containing dust to settle. If this is not achievable, warning signs should be posted at the distance where the lead-containing dust settles to warn that access is restricted to persons wearing PPE. For example, the removal of mortar and cutting operations, ropes or barriers should be located at least 10 metres away. All workers within the barrier or warning sign zone must be adequately protected.

Partial Enclosures

Partial enclosures allow some emissions to the atmosphere outside of the enclosure. Partial enclosures may consist of vertical tarps and floor tarps so long as the tarps are overlapped and securely fixed together at the seams. A partial enclosure is not a recommended containment system if significant dust is being generated.

Full Enclosures

Full enclosures are tight enclosures (with tarps that are generally impermeable and fully sealed joints and entryways). Full enclosures allow minimal or no fugitive emissions to reach the outside environment. For full enclosures, the following requirements should be met:

- the enclosure should be made of windproof materials that are impermeable to dust
- the enclosure should be supported by a secure structure
- all joints in the enclosure should be fully sealed
- entrances to the enclosure should be equipped with overlapping tarps or air locks
- the escape of abrasive and debris from the enclosure should be controlled, at air supply points, by the use of baffles, louvers, flap seals and filters
- general mechanical ventilation should be provided to remove contaminated air from the enclosure and filtered air should be provided to replace the exhausted air
- equipment venting such air should be equipped with filters adequate to control vented air to provincial environmental standards
- the air velocity within the enclosure should provide an average minimum cross-draft or down-draft past each worker during abrasive blasting operations as follows:
    - cross-draft velocity of 0.5 m/sec (100 ft/min)
    - down-draft velocity of 0.25 m/sec (50 ft/min)

Indoor Operations

- For Type 3a operations conducted indoors, barriers, partial enclosures, or full enclosures should be provided.
- For Type 3b operations (abrasive blasting, removal of lead-containing dust using an air mist extraction system) conducted indoors, full enclosures should be provided.

Outdoor Operations

- For Type 3a and 3b operations conducted outdoors, barriers, partial enclosures, or full enclosures should be provided.
- For dry abrasive blasting conducted outdoors, full enclosures should be provided.

6.4.3 Decontamination Facility

A decontamination facility should be made available for workers carrying out for the following Type 3 operations:

Type 3a Operations

- removal of lead-containing coatings and materials using power tools without an effective dust collection system equipped with a HEPA filter
- demolition or clean-up of a facility where lead-containing products were manufactured

Type 3b Operations

- abrasive blasting of lead-containing coatings or materials
- removal of lead-containing dust using an air mist extraction system

The decontamination facility should be located as close as practicable to the work area and should consist of:

- a room suitable for changing into protective clothing and for storing contaminated protective clothing and equipment
- a shower room as described below
- a room suitable for changing into street clothes and for storing clean clothing and equipment

The rooms in the decontamination facility should be arranged in sequence and constructed so as to prevent the spread of lead dust.

The shower room in the decontamination facility should be provided with the following:

- hot and cold water or water of a constant temperature that is not less than 40° Celsius or more than 50° Celsius

- individual controls inside the room to regulate water flow and, if there is hot and cold water, temperature
- clean towels.

Prior to each shift in which a decontamination facility is being used, a competent person should inspect the facility to ensure that there are no defects that would allow lead-containing dust to escape. Defects should be repaired before the facility is used. The decontamination facility should be maintained in a clean and sanitary condition.

Workers using the decontamination facility should do the following in the order shown:

- decontaminate protective clothing that will be reused on site by vacuuming with a HEPA-filter-vacuum or by damp wiping
- remove the decontaminated protective clothing
- place protective clothing that will not be reused on site in a container suitable for lead-containing dust and waste
- shower without removing the respirator
- remove and clean the respirator

6.4.4 Dust Control Measures

General and Local Mechanical Ventilation

Where the work area is enclosed, general mechanical ventilation should be provided. The air exhausted from an enclosed work area should pass through a dust collector effective for capturing the size of particulate matter being generated and for the volume and velocity of air moving through the enclosure.

Where a dust generating operation is carried out, local mechanical ventilation should be provided to remove dust at the source. Local mechanical ventilation is highly recommended for welding, burning, and high temperature cutting of lead-containing coatings and materials, and for the removal of lead-containing coatings and materials using power tools. Where local mechanical ventilation is used, the following should be met:

- Air velocity at any point in front of or at the opening of the ventilation hood should be sufficient to overcome opposing air currents and capture the contaminated air by causing it to flow into the hood.
- Air velocity at the source should be at least 0.5 m/sec (100 ft/min)
- Air discharged from the local mechanical ventilation system should pass through a HEPA filter and be routed out of the workplace in a way that will prevent the return of contaminants to the workplace.

If local ventilation is not practicable, an appropriate respirator (as listed in Table 1) should be provided. However, the decision that local ventilation is not practicable should not be made without first consulting the joint health and safety committee or health and safety representative, if any, and without considering the following:

- any undue economic hardship to the employer that providing a local ventilation system would cause
- the frequency and duration of the operation
- any potential risks to the workers by not providing a local ventilation system.

Wet Methods

Wet methods should be incorporated in the operation to reduce dust generation. Examples of wet methods include wetting surfaces, wet scraping, and wet shovelling.

Wetting should not be used if it would create a hazard or could cause damage to equipment or to the project. Power tools should be equipped with a shroud, and the shroud should be kept flush with the surface.

6.4.5 Personal Protective Equipment

Protective Clothing

Every worker who enters a Type 3 operation work area should wear protective clothing (see Protective Clothing in Section 4.3).

Respirators

For most Type 3 operations, workers should wear a respirator with a NIOSH approved assigned protection factor of 50 (see Respirator Requirements in Table 1). Where the operation is abrasive blasting, the operator should wear a Type CE abrasive blast supplied air respirator operated in a pressure demand or positive pressure mode with a tight-fitting half-mask or tight-fitting full-facepiece.

It is recommended that compressed air used to supply supplied air respirators meet the breathing air purity requirements of CSA Standard Z180.1-00. Where an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor/alarm should be provided.

6.4.6 Clean-Up

Dust and waste should be cleaned up and removed by vacuuming with a HEPA filter equipped vacuum, wet sweeping and/or wet shovelling. Clean-up after each operation should be encouraged to prevent lead contamination and exposure to lead.

When abrasive blasting is finished, cleanup and removal of lead-containing dust and waste should take place.

APPENDIX 1 – Medical Surveillance Of Lead-Exposed Workers

Where construction workers are exposed to airborne lead, measures and procedures to control their exposure should be implemented. This guide has outlined (in Section 4) the types of controls that should be in place for various work activities. But to ensure that these controls are effective they should be periodically evaluated. One way of doing this is by establishing a medical surveillance program. A medical surveillance program refers to the systematic collection, analysis, and evaluation of health data in the workplace to identify cases, patterns, or trends suggesting an adverse effect on workers' health. It is highly recommended that employers establish and maintain a medical surveillance program in their workplace.

The essential features of a lead medical surveillance program are outlined below.

Medical Surveillance Program

Purpose

The objective of a medical surveillance program is to protect the health of workers by:

- ensuring their fitness for exposure to lead
- evaluating their absorption of lead
- enabling remedial action to be taken when necessary
- providing health education.

Program

The medical surveillance program should include the following:

- pre-employment and pre-placement medical examinations
- periodic medical examinations
- clinical tests
- health education
- record keeping.

Medical Examinations

The medical examination should include the following:

History

The initial medical and occupational history should include enquiries about the worker's previous exposure to lead (both occupational and non-occupational), personal habits

(smoking and hygiene), and history of present or past gastrointestinal, hemopoietic, renal, reproductive, endocrine, or nervous disorders.

At subsequent examinations, the history should be updated to include:

- information on the frequency and duration of exposure to lead since the previous examination;
- the occurrence of signs and symptoms that may be an early indication of lead intoxication, e.g., abdominal pain, constipation, vomiting, asthenia, paraesthesia and psychological change.

Physical Examination

Medical surveillance should include a general physical examination. Particular attention should be directed to those systems that may be affected by lead. Personal hygiene should also be noted.

Biological Monitoring

Biological monitoring refers to the collection and assessment of bodily fluids or tissue, to evaluate occupational exposure to chemical hazards. The concentration of lead in a worker's blood is a good indicator of lead absorption by that individual. It does not indicate the total body burden of lead, but it is useful in the assessment of a worker's fitness for continued exposure to lead. As such, determining the blood lead levels in lead-exposed workers is highly recommended.

The concentration of lead in the blood can be used to determine:

- When a worker should be removed from lead exposure;
- When an enquiry regarding work practices and personal hygiene should be made;
- When further test(s) should be made; and,
- When a worker may be permitted to return to work.

The determination of whether a worker is fit, fit with limitations or unfit for exposure to lead should only be made by a physician. In addition, a physician should determine the required frequency for biological monitoring on an individual basis.

If symptoms or signs of lead intoxication are present the worker should be removed from lead exposure regardless of blood lead level.

In addition, it is recommended that a pre-placement blood-lead test be taken to establish a baseline for each worker that is exposed to lead.

APPENDIX 2: Respirator Requirements & Other Measures and Procedures for Type 1, 2, and 3 Lead-Containing Operations

OPERATIONS	REQUIRED RESPIRATOR	OTHER MEASURES & PROCEDURES
TYPE 1		
• Application of lead-containing coatings with a brush or roller. • Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap. • Removal of lead-containing coatings or materials using a power tool that has an effective dust collection system equipped with a HEPA filter. • Installation or removal of lead-containing sheet metal. • Installation or removal of lead-containing packing, babbit or similar material • Removal of lead-containing coatings or materials using non-powered hand-held tools, other than manual scraping or sanding. • Soldering.	Respirators should not be necessary if general procedures listed in Section 6.1 of the Guideline are followed and if the levels of lead in air are less than 0.05 mg/m^3. However, if the worker wishes to use a respirator, a half-mask particulate respirator with N-, R- or P-series filter, and 95, 99 or 100% efficiency should be provided.	• Washing facilities consisting of wash basin, water, soap and towels should be provided and workers should use these washing facilities before eating, drinking, smoking or leaving the project; • Workers should not eat, drink, chew gum or smoke in the work area; • Dust and waste should be cleaned up at regular intervals and placed in a container that is: - dust tight - identified as containing lead waste - cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before being removed from the work area - removed from the workplace frequently and at regular intervals; • Drop sheets should be used below all lead operations which produce or may produce dust, chips, or debris containing lead; • Cleanup after each operation is encouraged to prevent lead contamination and exposure to lead; • Work area should be inspected at least daily to ensure that the work area is clean; • Compressed air or dry sweeping should not be used to clean up any lead-containing dust or waste from a work area or from clothing.

OPERATIONS	REQUIRED RESPIRATOR	OTHER MEASURES & PROCEDURES
TYPE 2		
TYPE 2a		
• Welding or high temperature cutting of lead-containing coatings or materials outdoors. This operation is considered a Type 2a operation only if it is short-term, not repeated, and if the material has been stripped prior to welding or high temperature cutting. • Removal of lead-containing coatings or materials by scraping or sanding using non-powered hand tools • Manual demolition of lead-painted plaster walls or building components by striking a wall with a sledge hammer or similar tool	Half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100 percent efficiency.	**(In addition to Type 1 measures and procedures.)** • Signs should be posted in sufficient numbers to warn of the lead hazard. There should be a sign, at least, at each entrance to the work area. The signs should display the following information in large, clearly visible letters: - There is a lead dust, fume or mist hazard. - Access to the work area is restricted to authorized persons. - Respirators must be worn in the work area. • Suitable protective clothing and equipment should be worn by every worker who enters the work area (refer to Section 4.3 of the guideline).
TYPE 2b		
• Spray application of lead-containing coatings.	Powered air purifying respirator equipped with a hood or helmet, and a high efficiency filter. OR Supplied air respirator equipped with a hood or helmet and operated in a continuous flow mode.	

<table>
<tr><th>OPERATIONS</th><th>REQUIRED RESPIRATOR</th><th>OTHER MEASURES & PROCEDURES</th></tr>
<tr><td colspan="3">TYPE 3</td></tr>
<tr><td colspan="2">TYPE 3a</td><td rowspan="5">(In addition to Type 1 and Type 2 measures and procedures.)
• For Type 3a operations conducted indoors or outdoors, enclosures should be provided in the form of barriers, partial enclosures, or full enclosures.
• For Type 3b operations conducted indoors, full enclosures should be provided.
• With the exception of dry abrasive blasting conducted outdoors, enclosures provided for all other Type 3b operations conducted outdoors should be in the form of barriers, partial enclosures, or full enclosures. For dry abrasive blasting outdoors, full enclosures should be provided.
• Where there is an enclosure, general mechanical ventilation should be provided.
• A decontamination facility (refer to 6.4.3 of the guideline) should be made available for workers carrying out the following operations:
- abrasive blasting of lead-containing coatings or materials
- the removal of lead-containing coatings or materials using power tools without an effective dust collection system equipped with a HEPA filter
- removal of lead-containing dust using an air mist extraction system
- demolition or cleanup of a facility where lead-containing products were manufactured.
• When abrasive blasting is finished, dust and waste should be cleaned up and removed by vacuuming with a HEPA filter equipped vacuum, wet sweeping and/or wet shovelling.
• Where a dust generating operation is carried out, local exhaust ventilation should be provided to remove dust at the source. Wet methods should also be incorporated in the operation to reduce dust generation.</td></tr>
<tr><td>• Welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space.
• Burning of a surface containing lead.
• Dry removal of lead-containing mortar using an electric or pneumatic cutting device.
• Removal of lead-containing coatings or materials using power tools without an effective dust collection system equipped with a HEPA filter.
• Removal or repair of a ventilation system used for controlling lead exposure.
• Demolition or cleanup of a facility where lead-containing products were manufactured.
• An operation that may expose a worker to lead dust, fume or mist that is not a Type 1, Type 2, or Type 3b operation.</td><td>Full-facepiece air-purifying respirator equipped with N-, R-, or P-series filter and 100% efficiency.
OR
Tight-fitting PAPR with a high efficiency particulate filter.
OR
Half-mask or full-facepiece supplied air respirator operated in a continuous flow mode.
OR
Half-mask supplied air respirator operated in pressure-demand or other positive-pressure mode.</td></tr>
<tr><td colspan="2">TYPE 3b</td></tr>
<tr><td>• Abrasive blasting of lead-containing coatings or materials.</td><td>Type CE abrasive-blast supplied air respirator operated in a positive-pressure mode with a tight-fitting half-mask facepiece.

Type CE abrasive-blast supplied air respirator operated in a pressure-demand or positive pressure mode with a tight-fitting full-facepiece</td></tr>
<tr><td>• Removal of lead-containing dust using an air mist extraction system</td><td>Supplied air respirator equipped with a tight-fitting half-mask or full-facepiece and operated in pressure demand or positive pressure mode.</td></tr>
</table>

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ONTARIO REGULATION 278/05

DESIGNATED SUBSTANCE — ASBESTOS ON CONSTRUCTION PROJECTS AND IN BUILDINGS AND REPAIR OPERATIONS

Consolidation Period: From January 1, 2011 to the e-Laws currency date.

Last amendment: O. Reg. 479/10.

This is the English version of a bilingual regulation.

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Definitions

1. (1) In this Regulation,

"asbestos" means any of the fibrous silicates listed in subsection (2); ("amiante")

"asbestos-containing material" means material that contains 0.5 per cent or more asbestos by dry weight; ("matériau contenant de l'amiante")

"building" means any structure, vault, chamber or tunnel including, without limitation, the electrical, plumbing, heating and air handling equipment (including rigid duct work) of the structure, vault, chamber or tunnel; ("édifice")

"competent worker", in relation to specific work, means a worker who,

(a) is qualified because of knowledge, training and experience to perform the work,

(b) is familiar with the Act and with the provisions of the regulations that apply to the work, and

(c) has knowledge of all potential or actual danger to health or safety in the work; ("travailleur compétent")

"demolition" includes dismantling and breaking up; ("démolition")

"examine", when used with reference to material, means to carry out procedures in accordance with section 3 to establish its asbestos content and to establish the type of asbestos, and "examination" has a corresponding meaning; ("examiner")

"friable material" means material that,

(a) when dry, can be crumbled, pulverized or powdered by hand pressure, or

(b) is crumbled, pulverized or powdered; ("matériau friable")

"HEPA filter" means a high efficiency particulate aerosol filter that is at least 99.97 per cent efficient in collecting a 0.3 micrometre aerosol; ("filtre HEPA")

"homogeneous material" means material that is uniform in colour and texture; ("matériau homogène")

"joint health and safety committee" means,

(a) a joint health and safety committee established under section 9 of the Act,

(b) a similar committee described in subsection 9 (4) of the Act, or

(c) the workers or their representatives who participate in an arrangement, program or system described in subsection 9 (4) of the Act; ("comité mixte sur la santé et la sécurité")

"occupier" has the same meaning as in the *Occupiers' Liability Act*; ("occupant")

"Type 1 operation" means an operation described in subsection 12 (2); ("opération de type 1")

"Type 2 operation" means an operation described in subsection 12 (3); ("opération de type 2")

"Type 3 operation" means an operation described in subsection 12 (4). ("opération de type 3") O. Reg. 278/05, s. 1 (1).

(2) The fibrous silicates referred to in the definition of "asbestos" in subsection (1) are:

1. Actinolite.

2. Amosite.

3. Anthophyllite.

4. Chrysotile.

5. Crocidolite.

6. Tremolite. O. Reg. 278/05, s. 1 (2).

Application

2. (1) This Regulation applies to,

(a) every project, its owner, and every constructor, employer and worker engaged in or on the project;

(b) the repair, alteration or maintenance of a building, the owner of the building, and every employer and worker engaged in the repair, alteration or maintenance;

(c) every building in which material that may be asbestos-containing material has been used, and the owner of the building;

(d) the demolition of machinery, equipment, aircraft, ships, locomotives, railway cars and vehicles, and every employer and worker engaged in the demolition; and

(e) subject to subsection (3),

(i) work described in subsection (2) in which asbestos-containing material is likely to be handled, dealt with, disturbed or removed, and

(ii) every employer and worker engaged in the work. O. Reg. 278/05, s. 2 (1).

(2) Clause (1) (e) applies to,

(a) the repair, alteration or maintenance of machinery, equipment, aircraft, ships, locomotives, railway cars and vehicles; and

(b) work on a building that is necessarily incidental to the repair, alteration or maintenance of machinery or equipment. O. Reg. 278/05, s. 2 (2).

(3) This Regulation does not apply to an employer in respect of those workers who are employed by the employer and engaged in the activities described in clause (1) (e) if, pursuant to clause 5 (1) (c) of Ontario Regulation 490/09 (Designated Substances) made under the Act, that regulation applies to the employer and those workers with respect to asbestos. O. Reg. 493/09, s. 1.

(4) This Regulation does not apply to an owner of a private residence occupied by the owner or the owner's family or to an owner of a residential building that contains not more than four dwelling units, one of which is occupied by the registered owner or family of the registered owner. O. Reg. 278/05, s. 2 (4).

(5) This Regulation does not apply to workers and their employers when the workers are engaged in the following work under the authority of the *Fire Protection and Prevention Act, 1997*:

1. Fire suppression.

2. Rescue and emergency services.

3. The investigation of the cause, origin and circumstances of a fire or explosion or condition that might have caused a fire, explosion, loss of life or damage to property.

O. Reg. 479/10, s. 1.

(6) While the work described in subsection (5) is being performed at a workplace, this Regulation does not apply to that workplace in respect of the workers engaged in the work and their employers, and Regulation 833 of the Revised Regulations of Ontario, 1990 (Control of Exposure to Biological or Chemical Agents) made under the Act applies. O. Reg. 479/10, s. 1.

Adoption of standard

3. (1) For the purposes of this Regulation, the method and procedures for establishing whether material is asbestos-containing material and for establishing its asbestos content and the type of asbestos shall be in accordance with the following standard:

1. U.S. Environmental Protection Agency. Test Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials. June 1993. O. Reg. 278/05, s. 3 (1).

(2) The procedures required by subsection (1) shall be carried out on bulk material samples that are randomly collected by a competent worker and are representative of each area of homogeneous material. O. Reg. 278/05, s. 3 (2).

(3) The minimum number of bulk material samples to be collected from an area of homogeneous material is set out in Table 1. O. Reg. 278/05, s. 3 (3).

(4) If analysis establishes that a bulk material sample contains 0.5 per cent or more asbestos by dry weight,

(a) it is not necessary to analyze other bulk material samples taken from the same area of homogeneous material; and

(b) the entire area of homogeneous material from which the bulk material sample was taken is deemed to be asbestos-containing material. O. Reg. 278/05, s. 3 (4).

Restrictions re sprayed material, insulation, sealants

4. (1) No person shall apply or install or cause to be applied or installed, by spraying, material containing 0.1 per cent or more asbestos by dry weight that can become friable. O. Reg. 278/05, s. 4 (1).

(2) No person shall apply or install or cause to be applied or installed, as thermal insulation, material containing 0.1 per cent or more asbestos by dry weight that can become friable. O. Reg. 278/05, s. 4 (2).

(3) A liquid sealant shall not be applied to friable asbestos-containing material if,

(a) the material has visibly deteriorated; or

(b) the material's strength and its adhesion to the underlying materials and surfaces are insufficient to support its weight and the weight of the sealant. O. Reg. 278/05, s. 4 (3).

Information for workers

5. (1) This section applies whenever a worker is to do work that,

(a) involves material that,

(i) is asbestos-containing material,

(ii) is being treated as if it were asbestos-containing material,

(iii) is the subject of advice under section 9 or a notice under subsection 10 (8); or

(b) is to be carried on in close proximity to material described in clause (a) and may disturb it. O. Reg. 278/05, s. 5 (1).

(2) The constructor or employer shall advise the worker and provide him or her with the following information:

1. The location of all material described in clause (1) (a).

2. For each location, whether the material is friable or non-friable.

3. In the case of sprayed-on friable material, for each location,

i. if the material is known to be asbestos-containing material, the type of asbestos, if known, or

ii. in any other case, a statement that the material will be treated as though it contained a type of asbestos other than chrysotile. O. Reg. 278/05, s. 5 (2).

Demolition

6. (1) The demolition of all or part of machinery, equipment, a building, aircraft, locomotive, railway car, vehicle or ship shall be carried out or continued only when any asbestos-containing material that may be disturbed during the work has been removed to the extent practicable. O. Reg. 278/05, s. 6 (1).

(2) Subsection (1) does not apply so as to prevent work necessary to gain access to the asbestos-containing material that is to be removed, if the workers doing the work are protected from the hazard. O. Reg. 278/05, s. 6 (2).

7. Revoked: O. Reg. 422/10, s. 1.

Ongoing asbestos management in buildings

8. (1) This section applies on and after November 1, 2007. O. Reg. 278/05, s. 8 (1).

(2) Subsection (3) applies if,

(a) the owner of a building treats material that has been used in the building for any purpose related to it, including insulation, fireproofing and ceiling tiles, as if it were asbestos-containing material;

(b) the owner of a building has been advised under section 9 of the discovery of material that may be asbestos-containing material;

(c) the owner of a building knows or ought reasonably to know that asbestos-containing material has been used in a building for any purpose related to the building, including insulation, fireproofing and ceiling tiles;

(d) an examination under subsection (8) or section 10 establishes, or would have established if carried out as required, that asbestos-containing material has been used in a building for any purpose related to the building, including insulation, fireproofing and ceiling tiles; or

(e) a constructor or employer advises the owner of a building, in accordance with subsection 10 (8), of the discovery of material that may be asbestos-containing material and that was not referred to in a report prepared under subsection 10 (4). O. Reg. 278/05, s. 8 (2).

(3) If this subsection applies, the owner shall,

(a) prepare and keep on the premises a record containing the information set out in subsection (4);

(b) give any other person who is an occupier of the building written notice of any information in the record that relates to the area occupied by the person;

(c) give any employer with whom the owner arranges or contracts for work that is not described in clause 10 (1) (a) written notice of the information in the record, if the work,

(i) may involve material mentioned in the record, or

(ii) may be carried on in close proximity to such material and may disturb it;

(d) advise the workers employed by the owner who work in the building of the information in the record, if the workers may do work that,

(i) involves material mentioned in the record, or

(ii) is to be carried on in close proximity to such material and may disturb it;

(e) establish and maintain, for the training and instruction of every worker employed by the owner who works in the building and may do work described in clause (d), a program dealing with,

(i) the hazards of asbestos exposure,

(ii) the use, care and disposal of protective equipment and clothing to be used and worn when doing the work,

(iii) personal hygiene to be observed when doing the work, and

(iv) the measures and procedures prescribed by this Regulation; and

(f) inspect the material mentioned in the record at reasonable intervals in order to determine its condition. O. Reg. 278/05, s. 8 (3).

(4) The record shall contain the following information:

1. The location of all material described in clauses (2) (a), (b), (c), (d) and (e).

2. For each location, whether the material is friable or non-friable.

3. In the case of friable sprayed-on material, for each location,

i. if the material is known to be asbestos-containing material, the type of asbestos, if known, or

ii. in any other case, a statement that the material will be treated as though it contained a type of asbestos other than chrysotile. O. Reg. 278/05, s. 8 (4).

(5) The owner shall update the record described in clause (3) (a),

(a) at least once in each 12-month period; and

(b) whenever the owner becomes aware of new information relating to the matters the record deals with. O. Reg. 278/05, s. 8 (5).

(6) If updating under subsection (5) results in any change to the record, clauses (3) (b), (c)

and (d) apply with necessary modifications. O. Reg. 278/05, s. 8 (6).

(7) An occupier who receives a notice under clause (3) (b) is responsible for performing the duties set out in clauses (3) (d) and (e) with respect to the occupier's own workers. O. Reg. 278/05, s. 8 (7).

(8) If it is readily apparent that friable material used in a building as fireproofing or acoustical or thermal insulation has fallen and is being disturbed so that exposure to the material is likely to occur,

(a) the owner shall cause the material to be examined to establish whether it is asbestos-containing material; and

(b) until it has been established whether the material is asbestos-containing material, no further work involving the material shall be done. O. Reg. 278/05, s. 8 (8).

(9) Subsection (8) does not apply if the work is carried out in accordance with this Regulation as though the material were asbestos-containing material and, in the case of friable sprayed-on material, as though it contained a type of asbestos other than chrysotile. O. Reg. 278/05, s. 8 (9).

(10) If the examination mentioned in subsection (8) establishes that the material is asbestos-containing material, or if the material is treated as though it were asbestos-containing material as described in subsection (9),

(a) the owner shall cause the fallen material to be cleaned up and removed; and

(b) if it is readily apparent that material will continue to fall because of the deterioration of the fireproofing or insulation, the owner shall repair, seal, remove or permanently enclose the fireproofing or insulation. O. Reg. 278/05, s. 8 (10).

(11) Subsection (10) does not apply if the fallen material is confined to an area that is,

(a) above a closed false ceiling; and

(b) not part of a return air plenum. O. Reg. 278/05, s. 8 (11).

Responsibility of employer other than owner

9. An employer whose workers work in a building of which the employer is not the owner shall advise the owner if the workers discover material that may be asbestos-containing material in the building. O. Reg. 278/05, s. 9.

Owner's responsibilities before requesting tender or arranging work

10. (1) An owner shall comply with subsections (2), (3), (4), (5) and (6) before,

(a) requesting tenders for the demolition, alteration or repair of all or part of machinery, equipment, or a building, aircraft, locomotive, railway car, vehicle or ship; or

(b) arranging or contracting for any work described in clause (a), if no tenders are requested. O. Reg. 278/05, s. 10 (1).

(2) Unless clause (3) (a) or (b) applies, the owner shall have an examination carried out in accordance with section 3 to establish whether any material that is likely to be handled, dealt with, disturbed or removed, whether friable or non-friable, is asbestos-containing material. O. Reg. 278/05, s. 10 (2).

(3) An examination under subsection (2) is not required if,

(a) the owner,

(i) already knows that the material is not asbestos-containing material, or

(ii) already knows that the material is asbestos-containing material and, in the case of sprayed-on friable material, knows the type of asbestos; or

(b) the work is being arranged or contracted for in accordance with this Regulation as though the material were asbestos-containing material and, in the case of sprayed-on friable material, as though it contained a type of asbestos other than chrysotile. O. Reg. 278/05, s. 10 (3).

(4) Whether an examination is required under subsection (2) or not, the owner shall have a report prepared,

(a) stating whether,

(i) the material is or is not asbestos-containing material, or

(ii) the work is to be performed in accordance with this Regulation as though the material were asbestos-containing material and, in the case of sprayed-on friable material, as though it contained a type of asbestos other than chrysotile;

(b) describing the condition of the material and stating whether it is friable or non-friable; and

(c) containing drawings, plans and specifications, as appropriate, to show the location of the material identified under clause (a). O. Reg. 278/05, s. 10 (4).

(5) An owner shall give any prospective constructor a copy of the complete report prepared under subsection (4). O. Reg. 278/05, s. 10 (5).

(6) Subsection (5) applies, with necessary modifications, with respect to,

(a) a constructor and a prospective contractor; and

(b) a contractor and a prospective subcontractor. O. Reg. 278/05, s. 10 (6).

(7) Subsections (8), (9) and (10) apply if, during work described in clause (1) (a), material is discovered that,

(a) was not referred to in the report prepared under subsection (4); and

(b) may be asbestos-containing material. O. Reg. 278/05, s. 10 (7).

(8) The constructor or employer shall immediately notify, orally and in writing,

(a) an inspector at the office of the Ministry of Labour nearest the workplace;

(b) the owner;

(c) the contractor; and

(d) the joint health and safety committee or the health and safety representative, if any, for the workplace. O. Reg. 278/05, s. 10 (8).

(9) The written notice referred to in subsection (8) shall include the information referred to in clauses 11 (3) (a) to (f). O. Reg. 278/05, s. 10 (9).

(10) No work that is likely to involve handling, dealing with, disturbing or removing the

material referred to in subsection (7) shall be done unless,

(a) it has been determined under section 3 whether the material is asbestos-containing material; or

(b) the work is performed in accordance with this Regulation as though the material were asbestos-containing material and, in the case of sprayed-on friable material, as though it contained a type of asbestos other than chrysotile. O. Reg. 278/05, s. 10 (10).

(11) Subsection (10) does not prohibit handling, dealing with, disturbing or removing material for the sole purpose of determining whether it is asbestos-containing material. O. Reg. 278/05, s. 10 (11).

Advance notice re Type 3 operations and certain Type 2 operations

11. (1) Before commencing a Type 3 operation, the constructor, in the case of a project, and the employer, in any other case, shall notify, orally and in writing, an inspector at the office of the Ministry of Labour nearest the workplace of the operation. O. Reg. 278/05, s. 11 (1).

(2) Subsection (1) also applies with respect to a Type 2 operation described in paragraph 9 of subsection 12 (3) in which one square metre or more of insulation is to be removed. O. Reg. 278/05, s. 11 (2).

(3) The written notice required by subsection (1) shall set out,

(a) the name and address of the person giving the notice;

(b) the name and address of the owner of the place where the work will be carried out;

(c) the municipal address or other description of the place where the work will be carried out sufficient to permit the inspector to locate the place, including the location with respect to the nearest public highway;

(d) a description of the work that will be carried out;

(e) the starting date and expected duration of the work; and

(f) the name and address of the supervisor in charge of the work. O. Reg. 278/05, s. 11 (3).

Type 1, Type 2 and Type 3 operations

12. (1) For the purposes of this Regulation, operations that may expose a worker to asbestos are classified as Type 1, Type 2 and Type 3 operations. O. Reg. 278/05, s. 12 (1).

(2) The following are Type 1 operations:

1. Installing or removing ceiling tiles that are asbestos-containing material, if the tiles cover an area less than 7.5 square metres and are installed or removed without being broken, cut, drilled, abraded, ground, sanded or vibrated.

2. Installing or removing non-friable asbestos-containing material, other than ceiling tiles, if the material is installed or removed without being broken, cut, drilled, abraded, ground, sanded or vibrated.

3. Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if,

   i. the material is wetted to control the spread of dust or fibres, and

ii. the work is done only by means of non-powered hand-held tools.

4. Removing less than one square metre of drywall in which joint-filling compounds that are asbestos-containing material have been used. O. Reg. 278/05, s. 12 (2).

(3) The following are Type 2 operations:

1. Removing all or part of a false ceiling to obtain access to a work area, if asbestos-containing material is likely to be lying on the surface of the false ceiling.

2. The removal or disturbance of one square metre or less of friable asbestos-containing material during the repair, alteration, maintenance or demolition of all or part of machinery or equipment or a building, aircraft, locomotive, railway car, vehicle or ship.

3. Enclosing friable asbestos-containing material.

4. Applying tape or a sealant or other covering to pipe or boiler insulation that is asbestos-containing material.

5. Installing or removing ceiling tiles that are asbestos-containing material, if the tiles cover an area of 7.5 square metres or more and are installed or removed without being broken, cut, drilled, abraded, ground, sanded or vibrated.

6. Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if,

   i. the material is not wetted to control the spread of dust or fibres, and

   ii. the work is done only by means of non-powered hand-held tools.

7. Removing one square metre or more of drywall in which joint filling compounds that are asbestos-containing material have been used.

8. Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if the work is done by means of power tools that are attached to dust-collecting devices equipped with HEPA filters.

9. Removing insulation that is asbestos-containing material from a pipe, duct or similar structure using a glove bag.

10. Cleaning or removing filters used in air handling equipment in a building that has sprayed fireproofing that is asbestos-containing material.

11. An operation that,

   i. is not mentioned in any of paragraphs 1 to 10,

   ii. may expose a worker to asbestos, and

   iii. is not classified as a Type 1 or Type 3 operation. O. Reg. 278/05, s. 12 (3).

(4) The following are Type 3 operations:

1. The removal or disturbance of more than one square metre of friable asbestos-containing material during the repair, alteration, maintenance or demolition of all or part of a building, aircraft, ship, locomotive, railway car or vehicle or any machinery or equipment.

2. The spray application of a sealant to friable asbestos-containing material.

3. Cleaning or removing air handling equipment, including rigid ducting but not including filters, in a building that has sprayed fireproofing that is asbestos-containing material.

4. Repairing, altering or demolishing all or part of a kiln, metallurgical furnace or similar structure that is made in part of refractory materials that are asbestos-containing materials.

5. Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material, if the work is done by means of power tools that are not attached to dust-collecting devices equipped with HEPA filters.

6. Repairing, altering or demolishing all or part of any building in which asbestos is or was used in the manufacture of products, unless the asbestos was cleaned up and removed before March 16, 1986. O. Reg. 278/05, s. 12 (4).

(5) Work on ceiling tiles, drywall or friable asbestos-containing material is classified according to the total area on which work is done consecutively in a room or enclosed area, even if the work is divided into smaller jobs. O. Reg. 278/05, s. 12 (5).

(6) The following provisions apply if a dispute arises as to the classification of an operation under this section:

1. A party to the dispute may notify an inspector at the office of the Ministry of Labour nearest the workplace of the dispute.

2. The party who notifies the inspector shall promptly inform the other parties that the inspector has been notified.

3. Work on the operation shall cease until the inspector has given a decision under paragraph 4.

4. The inspector shall, as soon as possible, investigate the matter and give the parties a decision in writing. O. Reg. 278/05, s. 12 (6).

(7) Nothing in subsection (6) affects an inspector's power to issue an order for a contravention of this Regulation. O. Reg. 278/05, s. 12 (7).

Respirators

13. (1) A respirator provided by an employer and used by a worker in a Type 1, Type 2 or Type 3 operation,

(a) shall be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet;

(b) shall be assigned to a worker for his or her exclusive use, if practicable;

(c) shall be used and maintained in accordance with written procedures that are established by the employer and are consistent with the manufacturer's specifications;

(d) shall be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker;

(e) shall have damaged or deteriorated parts replaced prior to being used by a worker; and

(f) when not in use, shall be stored in a convenient, clean and sanitary location. O. Reg. 278/05, s. 13 (1).

(2) The following additional requirements apply to a respirator of the supplied air type:

1. The compressed air used for breathing shall meet the standards set out in Table 1 of CSA Standard Z180.1-00, Compressed Breathing Air and Systems (March, 2000).

2. If an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor equipped with an alarm shall be provided.

3. If an ambient breathing air system is used, the air intake shall be located in accordance with Appendix B of the standard referred to in paragraph 1. O. Reg. 278/05, s. 13 (2).

(3) If respirators are used in the workplace,

(a) the employer shall establish written procedures regarding the selection, use and care of respirators; and

(b) a copy of the procedures shall be provided to and reviewed with each worker who is required to wear a respirator. O. Reg. 278/05, s. 13 (3).

(4) A worker shall not be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator. O. Reg. 278/05, s. 13 (4).

Measures and procedures, Type 1 operations

14. The following measures and procedures apply to Type 1 operations:

1. Before beginning work, visible dust shall be removed with a damp cloth or a vacuum equipped with a HEPA filter from any surface in the work area, including the thing to be worked on, if the dust on that surface is likely to be disturbed.

2. The spread of dust from the work area shall be controlled by measures appropriate to the work to be done including the use of drop sheets of polyethylene or other suitable material that is impervious to asbestos.

3. In the case of an operation mentioned in paragraph 4 of subsection 12 (2), the material shall be wetted before and kept wet during the work to control the spread of dust or fibres, unless wetting would create a hazard or cause damage.

4. A wetting agent shall be added to water that is to be used to control the spread of dust and fibres.

5. Frequently and at regular intervals during the doing of the work and immediately on completion of the work,

   i. dust and waste shall be cleaned up and removed using a vacuum equipped with a HEPA filter, or by damp mopping or wet sweeping, and placed in a container as described in paragraph 5 of section 15, and

   ii. drop sheets shall be wetted and placed in a container as described in paragraph 5 of section 15, as soon as practicable after subparagraph i has been complied with.

6. Drop sheets shall not be reused.

7. After the work is completed, polyethylene sheeting and similar materials used for

barriers and enclosures shall not be reused, but shall be wetted and placed in a container as described in paragraph 5 of section 15 as soon as practicable after paragraph 5 of this section has been complied with.

8. After the work is completed, barriers and portable enclosures that will be reused shall be cleaned, by using a vacuum equipped with a HEPA filter or by damp wiping, as soon as practicable after paragraphs 5 and 7 have been complied with.

9. Barriers and portable enclosures shall not be reused unless they are rigid and can be cleaned thoroughly.

10. Compressed air shall not be used to clean up and remove dust from any surface.

11. Eating, drinking, chewing or smoking shall not be permitted in the work area.

12. If a worker requests that the employer provide a respirator to be used by the worker, the employer shall provide the worker with a NIOSH approved respirator in accordance with Table 2, and the worker shall wear and use the respirator.

13. If a worker requests that the employer provide protective clothing to be used by the worker, the employer shall provide the worker with protective clothing as described in paragraph 12 of section 15, and the worker shall wear the protective clothing.

14. A worker who is provided with protective clothing shall, before leaving the work area,

    i. decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing,

    ii. if the protective clothing will not be reused, place it in a container as described in paragraph 5 of section 15.

15. Facilities for the washing of hands and face shall be made available to workers and shall be used by every worker when leaving the work area. O. Reg. 278/05, s. 14.

Measures and procedures, Type 2 and Type 3 operations

15. The following measures and procedures apply to Type 2 operations and to Type 3 operations:

1. The work area shall be identified by clearly visible signs warning of an asbestos dust hazard.

2. Signs required by paragraph 1 shall be posted in sufficient numbers to warn of the hazard and shall state in large clearly visible letters that,

    i. there is an asbestos dust hazard, and

    ii. access to the work area is restricted to persons wearing protective clothing and equipment.

3. A wetting agent shall be added to water that is to be used to control the spread of dust and fibres.

4. Eating, drinking, chewing or smoking shall not be permitted in the work area.

5. Containers for dust and waste shall be,

    i. dust tight,

ii. suitable for the type of waste,

iii. impervious to asbestos,

iv. identified as asbestos waste,

v. cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before being removed from the work area, and

vi. removed from the workplace frequently and at regular intervals.

6. Frequently and at regular intervals during the doing of the work and immediately on completion of the work,

i. dust and waste shall be cleaned up and removed using a vacuum equipped with a HEPA filter, or by damp mopping or wet sweeping, and placed in a container as described in paragraph 5, and

ii. drop sheets shall be wetted and placed in a container as described in paragraph 5, as soon as practicable after subparagraph i has been complied with.

7. Drop sheets shall not be reused.

8. After the work is completed, polyethylene sheeting and similar materials used for barriers and enclosures shall not be reused, but shall be wetted and placed in a container as described in paragraph 5 as soon as practicable after paragraph 6 has been complied with.

9. After the work is completed, barriers and portable enclosures that will be reused shall be cleaned, by using a vacuum equipped with a HEPA filter or by damp wiping, as soon as practicable after paragraphs 6 and 8 have been complied with.

10. Barriers and portable enclosures shall not be reused unless they are rigid and can be cleaned thoroughly.

11. The employer shall provide every worker who will enter the work area with a NIOSH approved respirator in accordance with Table 2 and the worker shall wear and use the respirator.

12. Protective clothing shall be provided by the employer and worn by every worker who enters the work area, and the protective clothing,

i. shall be made of a material that does not readily retain nor permit penetration of asbestos fibres,

ii. shall consist of head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing,

iii. shall include suitable footwear, and

iv. shall be repaired or replaced if torn.

13. Compressed air shall not be used to clean up and remove dust from any surface.

14. Only persons wearing protective clothing and equipment shall enter a work area where there is an asbestos dust hazard. O. Reg. 278/05, s. 15.

Additional measures and procedures, Type 2 operations

16. In addition to the measures and procedures prescribed by section 15, the following measures and procedures apply to Type 2 operations:

1. If the operation is one mentioned in paragraph 1 of subsection 12 (3), the friable material that is likely to be disturbed shall be cleaned up and removed by using a vacuum equipped with a HEPA filter when access to the work area is obtained.
2. Before commencing work that is likely to disturb friable asbestos-containing material that is crumbled, pulverized or powdered and that is lying on any surface, the friable material shall be cleaned up and removed by damp wiping or by using a vacuum equipped with a HEPA filter.
3. Friable asbestos-containing material that is not crumbled, pulverized or powdered and that may be disturbed or removed during the work shall be thoroughly wetted before the work and kept wet during the work, unless wetting would create a hazard or cause damage.
4. Subject to paragraph 5, the spread of dust from a work area shall be controlled by measures appropriate to the work to be done, including the use of drop sheets of polyethylene or other suitable material that is impervious to asbestos.
5. If the operation is one mentioned in paragraph 1 or 2 of subsection 12 (3) and is carried on indoors, the spread of dust from the work area shall be prevented, if practicable, by,
   i. using an enclosure of polyethylene or other suitable material that is impervious to asbestos (including, if the enclosure is opaque, one or more transparent window areas to allow observation of the entire work area from outside the enclosure), if the work area is not enclosed by walls,
   ii. disabling the mechanical ventilation system serving the work area, and
   iii. sealing the ventilation ducts to and from the work area.
6. Before leaving the work area, a worker shall,
   i. decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, and
   ii. if the protective clothing will not be reused, place it in a container as described in paragraph 5 of section 15.
7. Facilities for the washing of hands and face shall be made available to workers and shall be used by every worker when leaving the work area. O. Reg. 278/05, s. 16.

Additional measures and procedures, glove bag operations

17. In addition to the measures and procedures prescribed by sections 15 and 16, the following measures and procedures apply to Type 2 operations referred to in paragraph 9 of subsection 12 (3):

1. The work area shall be separated from the rest of the workplace by walls, barricades, fencing or other suitable means.
2. The spread of asbestos-containing material from the work area shall be prevented by disabling the mechanical ventilation system serving the work area and sealing all openings or voids, including ventilation ducts to and from the working area.

3. Surfaces below the work area shall be covered with drop sheets of polyethylene or other suitable material that is impervious to asbestos.

4. The glove bag shall be made of material that is impervious to asbestos and sufficiently strong to support the weight of material the bag will hold.

5. The glove bag shall be equipped with,

   i. sleeves and gloves that are permanently sealed to the body of the bag to allow the worker to access and deal with the insulation and maintain a sealed enclosure throughout the work period,

   ii. valves or openings to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct or similar structure,

   iii. a tool pouch with a drain,

   iv. a seamless bottom and a means of sealing off the lower portion of the bag, and

   v. a high strength double throw zipper and removable straps, if the bag is to be moved during the removal operation.

6. A glove bag shall not be used to remove insulation from a pipe, duct or similar structure if,

   i. it may not be possible to maintain a proper seal for any reason including, without limitation,

      A. the condition of the insulation, or

      B. the temperature of the pipe, duct or similar structure, or

   ii. the bag could become damaged for any reason including, without limitation,

      A. the type of jacketing, or

      B. the temperature of the pipe, duct or similar structure.

7. Immediately before the glove bag is attached, the insulation jacketing or coating shall be inspected for damage or defects, and if any damage or defect is present, it shall be repaired.

8. The glove bag shall be inspected for damage or defects,

   i. immediately before it is attached to the pipe, duct or other similar structure, and

   ii. at regular intervals during its use.

9. If damage or defects are observed when the glove bag is inspected under subparagraph 8 i, the glove bag shall not be used and shall be disposed of.

10. If damage or defects are observed when the glove bag is inspected under subparagraph 8 ii or at any other time,

   i. the use of the glove bag shall be discontinued,

   ii. the inner surface of the glove bag and the contents, if any, shall be thoroughly wetted,

   iii. the glove bag and the contents, if any, shall be removed and placed in a container

as described in paragraph 5 of section 15, and

iv. the work area shall be cleaned by vacuuming with a vacuum equipped with a HEPA filter before removal work is resumed.

11. When the removal work is completed,

i. the inner surface of the glove bag and the waste inside shall be thoroughly wetted and the air inside the bag shall be removed through an elasticized valve, by means of a vacuum equipped with a HEPA filter,

ii. the pipe, duct or similar structure shall be wiped down and sealed with a suitable encapsulant,

iii. the glove bag, with the waste inside, shall be placed in a container as described in paragraph 5 of section 15, and

iv. the work area shall be cleaned by damp wiping or by cleaning with a vacuum equipped with a HEPA filter. O. Reg. 278/05, s. 17.

Additional measures and procedures, Type 3 operations

18. (1) In addition to the measures and procedures prescribed by section 15, the following measures and procedures apply to Type 3 operations:

1. The work area shall be separated from the rest of the workplace by walls, the placing of barricades or fencing or other suitable means.

2. Subsection (2) applies to an operation mentioned in paragraph 5 of subsection 12 (4).

3. Subsection (3) applies to an operation mentioned in paragraph 1, 2, 3 or 4 of subsection 12 (4) that is carried on outdoors.

4. Subsection (4) applies to an operation mentioned in paragraph 1, 2, 3, 4 or 6 of subsection 12 (4) that is carried on indoors. O. Reg. 278/05, s. 18 (1).

(2) In the case of an operation mentioned in paragraph 5 of subsection 12 (4), the following measures and procedures also apply:

1. The spread of dust from the work area shall be prevented by,

i. using enclosures of polyethylene or other suitable material that is impervious to asbestos (including, if the enclosure material is opaque, one or more transparent window areas to allow observation of the entire work area from outside the enclosure), if the work area is not enclosed by walls, and

ii. using curtains of polyethylene sheeting or other suitable material that is impervious to asbestos, fitted on each side of each entrance or exit from the work area.

2. Unless the operation is carried on outdoors, or inside a building that is to be demolished and will not be entered by any person except the workers involved in the operation and the workers involved in the demolition, the spread of dust from the work area shall also be prevented by,

i. creating and maintaining within the enclosed area, by installing a ventilation system equipped with a HEPA filtered exhaust unit, a negative air pressure of 0.02 inches of water, relative to the area outside the enclosed area,

ii. ensuring that replacement air is taken from outside the enclosed area and is free from contamination with any hazardous dust, vapour, smoke, fume, mist or gas, and

iii. using a device, at regular intervals, to measure the difference in air pressure between the enclosed area and the area outside it.

3. The ventilation system referred to in subparagraph 2 i shall be inspected and maintained by a competent worker before each use to ensure that there is no air leakage, and if the filter is found to be damaged or defective, it shall be replaced before the ventilation system is used.

4. Before leaving the work area, a worker shall,

i. decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, and

ii. if the protective clothing will not be reused, place it in a container as described in paragraph 5 of section 15.

5. Facilities for the washing of hands and face shall be made available to workers and shall be used by every worker when leaving the work area. O. Reg. 278/05, s. 18 (2).

(3) In the case of an operation mentioned in paragraph 1, 2, 3 or 4 of subsection 12 (4) that is carried on outdoors, the following measures and procedures also apply:

1. If practicable, any asbestos-containing material to be removed shall be thoroughly wetted before and during removal, unless wetting would create a hazard or cause damage.

2. Dust and waste shall not be permitted to fall freely from one work level to another.

3. If practicable, the work area shall be washed down with water after completion of the clean-up and removal described in paragraph 6 of section 15.

4. Temporary electrical power distribution systems for tools and equipment involved in wet removal operations shall be equipped with ground fault circuit interrupters.

5. A decontamination facility shall be located as close as practicable to the work area and shall consist of,

i. a room suitable for changing into protective clothing and for storing contaminated protective clothing and equipment,

ii. a shower room as described in paragraph 7 of subsection (4), and

iii. a room suitable for changing into street clothes and for storing clean clothing and equipment.

6. The rooms described in subparagraphs 5 i, ii and iii shall be arranged in sequence and constructed so that any person entering or leaving the work area must pass through each room.

7. When leaving the work area, a worker shall enter the decontamination facility and shall, in the following order,

i. decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing,

ii. if the protective clothing will not be reused, place it in a container as described in paragraph 5 of section 15,

iii. shower, and

iv. remove and clean the respirator. O. Reg. 278/05, s. 18 (3).

(4) In the case of an operation mentioned in paragraph 1, 2, 3, 4 or 6 of subsection 12 (4) that is carried on indoors, the following measures and procedures also apply:

1. Friable asbestos-containing material that is crumbled, pulverized or powdered and that is lying on any surface in the work area shall be cleaned up and removed using a vacuum equipped with a HEPA filter or by damp wiping and everything shall be removed from the work area or covered with polyethylene sheeting or other suitable material that is impervious to asbestos.

2. The spread of dust from the work area shall be prevented by an enclosure of polyethylene or other suitable material that is impervious to asbestos, if the work area is not enclosed by walls, and by a decontamination facility consisting of a series of interconnecting rooms including,

   i. a room suitable for changing into protective clothing and for storing contaminated protective clothing and equipment,

   ii. a shower room as described in paragraph 7,

   iii. a room suitable for changing into street clothes and for storing clean clothing and equipment, and

   iv. curtains of polyethylene sheeting or other suitable material that is impervious to asbestos, fitted to each side of the entrance or exit to each room.

3. The rooms described in subparagraphs 2 i, ii and iii shall be arranged in sequence and constructed so that any person entering or leaving the work area must pass through each room.

4. The mechanical ventilation system serving the work area shall be disabled and all openings or voids, including ventilation ducts to or from the work area, shall be sealed by tape or other appropriate means.

5. Unless the operation is carried on inside a building that is to be demolished and will not be entered by any person except the workers involved in the operation and the workers involved in the demolition, the spread of dust from the work area shall also be prevented by,

   i. creating and maintaining within the enclosed area, by installing a ventilation system equipped with a HEPA filtered exhaust unit, a negative air pressure of 0.02 inches of water, relative to the area outside the enclosed area,

   ii. ensuring that replacement air is taken from outside the enclosed area and is free from contamination with any hazardous dust, vapour, smoke, fume, mist or gas, and

   iii. using a device, at regular intervals, to measure the difference in air pressure between the enclosed area and the area outside it.

6. The ventilation system referred to in subparagraph 5 i shall be inspected and maintained by a competent worker before each use to ensure that there is no air leakage, and if the filter is found to be damaged or defective, it shall be replaced before the ventilation system is used.

7. The shower room in the decontamination facility shall,

   i. be provided with hot and cold water or water of a constant temperature that is not less than 40° Celsius or more than 50° Celsius,

   ii. have individual controls inside the room to regulate water flow and, if there is hot and cold water, individual controls inside the room to regulate temperature,

   iii. be capable of providing adequate supplies of hot water to maintain a water temperature of at least 40° Celsius, and

   iv. be provided with clean towels.

8. When leaving the work area, a worker shall enter the decontamination facility and shall, in the following order,

   i. decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing,

   ii. if the protective clothing will not be reused, place it in a container as described in paragraph 5 of section 15,

   iii. shower, and

   iv. remove and clean the respirator.

9. If practicable, existing electrical power distribution systems that are not water-tight shall be de-energized and locked out where wet removal operations are to be carried out.

10. Temporary electrical power distribution systems for tools and equipment involved in wet removal operations shall be equipped with ground fault circuit interrupters.

11. Friable asbestos-containing material shall be thoroughly wetted before and during removal, unless wetting would create a hazard or cause damage.

12. The work area shall be inspected by a competent worker for defects in the enclosure, barriers and decontamination facility,

   i. at the beginning of each shift,

   ii. at the end of a shift if there is no shift that begins immediately after the first-named shift, and

   iii. at least once each day on days when there are no shifts.

13. Defects observed during an inspection under paragraph 12 shall be repaired immediately and no other work shall be carried out in the work area until the repair work is completed.

14. If practicable, dust and waste shall be kept wet.

15. On completion of the work,

i. negative air pressure shall be maintained if required by subparagraph 5 i,

ii. the inner surface of the enclosure and the work area inside the enclosure shall be cleaned by a thorough washing or by vacuuming with a vacuum equipped with a HEPA filter,

iii. equipment, tools and other items used in the work shall be cleaned with a damp cloth or by vacuuming with a vacuum equipped with a HEPA filter or they shall be placed in a container as described in paragraph 5 of section 15 before being removed from the enclosure, and

iv. a visual inspection shall be conducted by a competent worker to ensure that the enclosure and the work area inside the enclosure are free from visible dust, debris or residue that may contain asbestos.

16. Once the work area inside the enclosure is dry after the steps set out in subparagraphs 15 ii, iii and iv have been completed, clearance air testing shall be conducted by a competent worker in accordance with subsection (5), unless the operation is carried on inside a building that is to be demolished and will not be entered by any person except the workers involved in the operation and the workers involved in the demolition.

17. The barriers, enclosure and decontamination facility shall not be removed or dismantled until,

i. cleaning has been done as described in paragraph 15, and

ii. if clearance air testing is required, it has been completed and the work area inside the enclosure has passed the clearance air test. O. Reg. 278/05, s. 18 (4).

(5) The following rules apply to clearance air testing:

1. Sample collection and analysis shall be done,

i. using the phase contrast microscopy method, in accordance with subsection (6), or

ii. using the transmission electron microscopy method, in accordance with subsection (7).

2. If the work area inside the enclosure fails the clearance air test, the steps set out in subparagraphs 15 ii, iii and iv of subsection (4) shall be repeated and the work area shall be allowed to dry before a further test is carried out, unless paragraph 6 of subsection (6) applies. O. Reg. 278/05, s. 18 (5).

(6) Clearance air testing using the phase contrast microscopy method shall be carried out in accordance with U.S. National Institute of Occupational Safety and Health Manual of Analytical Methods, Method 7400, Issue 2: Asbestos and other Fibres by PCM (August 15, 1994), using the asbestos fibre counting rules, and shall comply with the following requirements:

1. Testing shall be based on samples taken inside the enclosure.

2. Forced air shall be used, both before and during the sampling process, to ensure that fibres are dislodged from all surfaces inside the enclosure before sampling begins and are kept airborne throughout the sampling process.

3. At least 2,400 litres of air shall be drawn through each sample filter, even though the standard mentioned above provides for a different amount.

4. The number of air samples to be collected shall be in accordance with Table 3.

5. The work area inside the enclosure passes the clearance air test only if every air sample collected has a concentration of fibres that does not exceed 0.01 fibres per cubic centimetres of air.

6. If the work area inside the enclosure fails a first test that is done using the phase contrast microscopy method, the samples may be subjected to a second analysis using transmission electron microscopy in accordance with the standard mentioned in subsection (7).

7. When a second analysis is done as described in paragraph 6, the work area inside the enclosure passes the clearance air test only if every air sample collected has a concentration of asbestos fibres that does not exceed 0.01 fibres per cubic centimetre of air. O. Reg. 278/05, s. 18 (6).

(7) Clearance air testing using the transmission electron microscopy method shall be carried out in accordance with U.S. National Institute of Occupational Safety and Health Manual of Analytical Methods, Method 7402, Issue 2: Asbestos by TEM (August 15, 1994), and shall comply with the following requirements:

1. Testing shall be based on samples taken inside the enclosure and samples taken outside the enclosure but inside the building.

2. Forced air shall be used inside the enclosure, both before and during the sampling process, to ensure that fibres are dislodged from all surfaces before sampling begins and are kept airborne throughout the sampling process.

3. At least 2,400 litres of air shall be drawn through each sample filter, even though the standard mentioned above provides for a different amount.

4. At least five air samples shall be taken inside each enclosure and at least five air samples shall be taken outside the enclosure but inside the building.

5. Sampling inside and outside the enclosure shall be conducted concurrently.

6. The work area inside the enclosure passes the clearance air test if the average concentration of asbestos fibres in the samples collected inside the enclosure is statistically less than the average concentration of asbestos fibres in the samples collected outside the enclosure, or if there is no statistical difference between the two average concentrations. O. Reg. 278/05, s. 18 (7).

(8) Within 24 hours after the clearance air testing results are received,

(a) the owner and the employer shall post a copy of the results in a conspicuous place or places,

(i) at the workplace, and

(ii) if the building contains other workplaces, in a common area of the building; and

(b) a copy shall be provided to the joint health and safety committee or the health and safety representative, if any, for the workplace and for the building. O. Reg. 278/05,

s. 18 (8).

(9) The owner of the building shall keep a copy of the clearance air testing results for at least one year after receiving them. O. Reg. 278/05, s. 18 (9).

Instruction and training

19. (1) The employer shall ensure that instruction and training in the following subjects are provided by a competent person to every worker working in a Type 1, Type 2 or Type 3 operation:

1. The hazards of asbestos exposure.
2. Personal hygiene and work practices.
3. The use, cleaning and disposal of respirators and protective clothing. O. Reg. 278/05, s. 19 (1).

(2) The joint health and safety committee or the health and safety representative, if any, for the workplace shall be advised of the time and place where the instruction and training prescribed by subsection (1) are to be carried out. O. Reg. 278/05, s. 19 (2).

(3) Without restricting the generality of paragraph 3 of subsection (1), the instruction and training related to respirators shall include instruction and training related to,

(a) the limitations of the equipment;

(b) inspection and maintenance of the equipment;

(c) proper fitting of a respirator; and

(d) respirator cleaning and disinfection. O. Reg. 278/05, s. 19 (3).

Asbestos abatement training programs

20. (1) The employer shall ensure that,

(a) every worker involved in a Type 3 operation has successfully completed the Asbestos Abatement Worker Training Program approved by the Ministry of Training, Colleges and Universities; and

(b) every supervisor of a worker involved in a Type 3 operation has successfully completed the Asbestos Abatement Supervisor Training Program approved by the Ministry of Training, Colleges and Universities. O. Reg. 278/05, s. 20 (1).

(2) The employer shall ensure that every worker and supervisor successfully completes the appropriate program required under subsection (1) before performing or supervising the work to which the program relates. O. Reg. 278/05, s. 20 (2).

(3) A document issued by the Ministry of Training, Colleges and Universities, showing that a worker has successfully completed a program mentioned in subsection (1), is conclusive proof, for the purposes of this section, of his or her successful completion of the program. O. Reg. 278/05, s. 20 (3).

(4) In accordance with the *Agreement on Internal Trade, 1995* and the *Protocols of Amendment*, a worker shall be deemed to hold a document showing successful completion referred to in subsection (3) if he or she has successfully completed equivalent training in another province or territory of Canada, as determined by the Director. O. Reg. 278/05, s. 20 (4).

Asbestos work report

21. (1) The employer of a worker working in a Type 2 operation or a Type 3 operation shall complete an asbestos work report in a form obtained from the Ministry for each such worker,

(a) at least once in each 12-month period; and

(b) immediately on the termination of the employment of the worker. O. Reg. 278/05, s. 21 (1).

(2) As soon as the asbestos work report is completed, the employer shall,

(a) forward it to the Provincial Physician, Ministry of Labour, and

(b) give a copy to the worker. O. Reg. 278/05, s. 21 (2).

(3) For the purposes of clause (2) (a), the employer may deliver the report to the Provincial Physician in person or send it by ordinary mail, by courier or by fax. O. Reg. 278/05, s. 21 (3).

Asbestos Workers Register

22. (1) The Provincial Physician, Ministry of Labour, shall establish and maintain an Asbestos Workers Register listing the name of each worker for whom an employer submits an asbestos work report under section 21. O. Reg. 278/05, s. 22 (1).

(2) On the recommendation of the Provincial Physician, a worker who is listed in the Register may volunteer to undergo the prescribed medical examination described in paragraph 1 of subsection (4). O. Reg. 278/05, s. 22 (2).

(3) A worker who has undergone the prescribed medical examination described in paragraph 1 of subsection (4) may volunteer to undergo subsequent examinations of the same type if they are recommended by his or her physician. O. Reg. 278/05, s. 22 (3).

(4) The following medical examinations are prescribed for the purposes of subsection 26 (3) of the Act:

1. An examination consisting of a medical questionnaire, chest x-rays and pulmonary function tests.

2. A subsequent examination that consists of the components described in paragraph 1, is recommended by the worker's physician and takes place at least two years after the most recent examination. O. Reg. 278/05, s. 22 (4).

(5) A worker who is removed from exposure to asbestos because an examination discloses that he or she may have or has a condition resulting from exposure to asbestos and suffers a loss of earnings as a result of the removal from exposure to asbestos is entitled to compensation for the loss in the manner and to the extent provided by the *Workplace Safety and Insurance Act, 1997*. O. Reg. 278/05, s. 22 (5).

Use of equivalent measure or procedure

23. A constructor, in the case of a project, or the employer, in any other case, may vary a measure or procedure required by this Regulation if the following conditions are satisfied:

1. The measure or procedure, as varied, affords protection for the health and safety of workers that is at least equal to the protection that would be provided by complying with this Regulation.

2. The constructor or employer gives written notice of the varied measure or procedure, in advance, to the joint health and safety committee or the health and safety representative, if any, for the workplace. O. Reg. 278/05, s. 23.

Notice to inspector

24. (1) When this Regulation requires written notice to an inspector at an office of the Ministry of Labour, the notice shall be given,

(a) by delivering it to the office in person;

(b) by sending it by ordinary mail, by courier or by fax, or

(c) by sending the notice to the inspector by electronic means that are acceptable to the Ministry. O. Reg. 278/05, s. 24 (1).

(2) When this Regulation requires oral notice to an inspector at an office of the Ministry of Labour, the notice shall be given,

(a) in person;

(b) by telephoning the inspector; or

(c) by sending the notice to the inspector by electronic means that are acceptable to the Ministry. O. Reg. 278/05, s. 24 (2).

25. Omitted (revokes other Regulations). O. Reg. 278/05, s. 25.

26. Omitted (provides for coming into force of provisions of this Regulation). O. Reg. 278/05, s. 26.

TABLE 1
BULK MATERIAL SAMPLES

Subsection 3 (3)

Item	Type of material	Size of area of homogeneous material	Minimum number of bulk material samples to be collected
1.	Surfacing material, including without limitation material that is applied to surfaces by spraying, by troweling or otherwise, such as acoustical plaster on ceilings and fireproofing materials on structural members	Less than 90 square metres	3
		90 or more square metres, but less than 450 square metres	5
		450 or more square metres	7
2.	Thermal insulation, except as described in item 3	Any size	3
3.	Thermal insulation patch	Less than 2 linear metres or 0.5 square metres	1
4.	Other material	Any size	3

O. Reg. 278/05, Table 1.

TABLE 2
RESPIRATORS

Paragraph 12 of section 14 and paragraph 11 of section 15

Column 1		Column 2
Work Category		**Required respirator**
Type 1 Operations		
Worker requests that the employer provide a respirator to be used by the worker, as described in paragraph 12 of section 14		Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter
Type 2 Operations		
Work described in paragraph 1 of subsection 12 (3)		One of the following:
		- Air purifying full-facepiece respirator with N-100, R-100 or P-100 particulate filter
		- Powered air purifying respirator equipped with a tight-fitting facepiece (half or full-facepiece) and a high efficiency filter or N-100, P-100 or R-100 particulate filter
		- Negative pressure (demand) supplied air respirator equipped with a full-facepiece
		- Continuous flow supplied air respirator equipped with a tight fitting facepiece (half or full-facepiece)
Work described in paragraphs 2 to 7 and 9 to 11 of subsection 12 (3)		Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter
Breaking, cutting, drilling, abrading, grinding,	Material is not wetted	One of the following:
sanding or vibrating non-friable material containing asbestos by means of power tools, if the tool is		- Air purifying full-facepiece respirator with N-100, R-100 or P-100 particulate filter
attached to a dust collecting device equipped with a HEPA filter as described in paragraph 8 of subsection 12 (3)		- Powered air purifying respirator equipped with a tight-fitting facepiece (half or full-facepiece) and a high efficiency filter or N-100, P-100 or R-100 particulate filter
		- Negative pressure (demand) supplied air respirator equipped with a full-facepiece
		- Continuous flow supplied air respirator equipped with a tight fitting facepiece (half or full-facepiece)
	Material is wetted to control spread of fibre	Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter
Type 3 Operations		
Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable material containing	Material is not wetted	Pressure demand supplied air respirator equipped with a half mask
asbestos by means of power tools, if the tool is not attached to a dust collecting device equipped with a HEPA filter as described in paragraph 5 of	Material is wetted to control spread of fibre	One of the following:
subsection 12 (4)		- Air purifying full-facepiece respirator with N-100, R-100 or P-100 particulate filter
		- Powered air purifying respirator equipped with a tight-fitting facepiece (half or full-facepiece) and a high efficiency filter or N-100, P-100 or R-100 particulate filter
		- Negative pressure (demand) supplied air respirator equipped with a full-

		facepiece
		- Continuous flow supplied air respirator equipped with a tight fitting facepiece (half or full-facepiece)
Work with friable material containing asbestos, as described in paragraphs 1 to 4 and 6 of subsection 12 (4)	Material is not wetted	Pressure demand supplied air respirator equipped with a full facepiece
Work with friable material, as described in paragraphs 1 to 4 and 6 of subsection 12 (4), that contains a type of asbestos other than chrysotile	Material was applied or installed by spraying, and is	Pressure demand supplied air respirator equipped with a half mask
Work with friable material, as described in	wetted to control	One of the following:
paragraphs 1 to 4 and 6 of subsection 12 (4), that contains only chrysotile asbestos	spread of fibre	- Air purifying full-facepiece respirator with N-100, R-100 or P-100 particulate filter
		- Powered air purifying respirator equipped with a tight-fitting facepiece (half or full-facepiece) and a high efficiency filter or N-100, P-100 or R-100 particulate filter
		- Negative pressure (demand) supplied air respirator equipped with a full-facepiece
		- Continuous flow supplied air respirator equipped with a tight fitting facepiece (half or full-facepiece)
Work with friable material containing asbestos, as	Material was not	One of the following:
described in paragraphs 1 to 4 and 6 of subsection 12 (4)	applied or installed by spraying, and is	- Air purifying full-facepiece respirator with N-100, R-100 or P-100 particulate filter
	wetted to control spread of fibre	- Powered air purifying respirator equipped with a tight-fitting facepiece (half or full-facepiece) and a high efficiency filter or N-100, P-100 or R-100 particulate filter
		- Negative pressure (demand) supplied air respirator equipped with a full-facepiece
		- Continuous flow supplied air respirator equipped with a tight fitting facepiece (half or full-facepiece)

O. Reg. 278/05, Table 2.

TABLE 3
AIR SAMPLES

Paragraph 4 of subsection 18 (6)

Minimum number of air samples to be taken from each enclosure	**Area of enclosure**
2	10 square metres or less
3	More than 10 but less than 500 square metres
5	500 square metres or more

O. Reg. 278/05, Table 3.

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