



November 24, 2017

## CITY OF SASKATOON

# Asbestos-Containing Building Materials Assessment Report - Waste Water Sodium Hypochlorite Building



REPORT

**Submitted to:**

The City of Saskatoon  
1101 Avenue P North  
Saskatoon, SK S7L 7K6

**Report Number: 1667963**

**Distribution:**

One Copy: City of Saskatoon  
One Copy: Golder Associates Ltd.





## Table of Contents

|  |          |
|--|----------|
| <b>1.0 INTRODUCTION.....</b>                                 | <b>1</b> |
| <b>2.0 SCOPE OF WORK .....</b>                               | <b>1</b> |
| 2.1 Asbestos-Containing Materials .....                      | 1        |
| <b>3.0 RESULTS AND DISCUSSION .....</b>                      | <b>2</b> |
| 3.1 Asbestos-Containing Materials .....                      | 2        |
| 3.1.1 List of Identified Asbestos-Containing Materials ..... | 2        |
| 3.1.2 Non Asbestos-Containing Materials .....                | 3        |
| <b>4.0 EXCLUDED AREAS AND MATERIALS .....</b>                | <b>3</b> |
| <b>5.0 CONCLUSIONS AND RECOMMENDATIONS.....</b>              | <b>3</b> |
| 5.1 Asbestos-Containing Materials .....                      | 3        |
| <b>6.0 SURVEY LIMITATIONS.....</b>                           | <b>4</b> |
| <b>7.0 CLOSURE.....</b>                                      | <b>5</b> |

### APPENDICES

#### APPENDIX A

Laboratory Certificate of Analysis Report

#### APPENDIX B

Site Photographs

#### APPENDIX C

Waste Water Sodium Hypochlorite Building Room by Room Spreadsheet

#### APPENDIX D

Floor Plan



### 1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by the City of Saskatoon (the Client) to conduct an asbestos-containing building materials assessment of the Waste Water Sodium Hypochlorite Building (the Site) located in Saskatoon, Saskatchewan. This assessment report details our findings, conclusions and recommendations for the Site. A walkthrough of the Site was conducted on June 22, 2017, by Kody Henderson, OHS Project Manager, and the assessment was conducted on October 13, 2017 by Scott Bishop, Junior Occupational Hygienist. Asbestos-containing building materials were identified within the Waste Water Sodium Hypochlorite Building during the assessment. Further information is provided in Section 3.0.

### 2.0 SCOPE OF WORK

In accordance with Tender 16-0844, Golder's scope of work included conducting an asbestos-containing building materials assessment of the Site to evaluate the quantities, locations, and conditions of asbestos-containing building materials.

Following the field work, Golder prepared this assessment report that includes laboratory analysis results, findings of the assessment, conclusions, and recommendations.

#### 2.1 Asbestos-Containing Materials

The assessment involved a non-destructive inspection of the Site to assess the type and extent of suspect ACMs in the facility. The systems that were reviewed as part of the inspections included, but were not limited to:

- *Structural* - systems including: insulation between solid webbed joists, fireproofing, building envelope, and interior/exterior caulking around windows and doors;
- *Mechanical* - systems insulation including: hot water and steam system, condensate system, chilled water system, glycol system, domestic hot and cold water, emergency generator exhaust, boiler units, heat exchangers, and asbestos cement piping; and
- *Architectural* - systems including: texture coats, sheet flooring, vinyl floor tile, acoustical spray-applied materials, condensation control applications, ceiling tile, wall board, drywall joint compound, and asbestos sheet products.

Systematic sampling of suspect ACMs was conducted as part of the assessment. Samples were submitted under chain of custody to International Asbestos Testing Laboratory Inc. (IATL) and analyzed for asbestos type and percentage content using Polarized Light Microscopy (PLM) in accordance with EPA methodologies (EPA 600/R-93/116).

Further information related to the assessment and sample collection methods can be found in the Golder document *Golder Asbestos Assessment General Survey Plan and Protocol* provided to the Client.



### 3.0 RESULTS AND DISCUSSION

The Waste Water Sodium Hypochlorite Building consists of open equipment/storage rooms and a control room, and was constructed in 1971. During the assessment, the entire building was treated as one functional space.

- The Laboratory Certificate of Analysis report for the bulk asbestos samples is included in Appendix A.
- Photographs collected during the assessment are provided in Appendix B.
- A room by room spreadsheet outlining the locations, quantities, friability, and condition of identified asbestos-containing materials as well as additional information is provided in Appendix C.
- Floor plans outlining the sample locations and locations of identified asbestos-containing materials are provided in Appendix D.
- Please refer to Sections 4.0 and 6.0 of this report for a summary of the limitations encountered.

### 3.1 Asbestos-Containing Materials

A total of fifteen (15) samples of building materials were collected and tested for asbestos content during the assessment of the Waste Water Sodium Hypochlorite Building. Two (2) of the samples were found to contain asbestos.

Potential asbestos-containing materials and components may be located within the electrical panels on Site.

#### 3.1.1 List of Identified Asbestos-Containing Materials

A list of the identified asbestos-containing materials is provided below.

- Black window glazing; and,
- Exterior grey expansion joint caulking.

Further information on the identified asbestos-containing materials listed is provided below.

##### ***Black Window Glazing***

One (1) sample of black window glazing was collected during the assessment. The sample collected was found to contain 10% Chrysotile asbestos. Asbestos-containing black window glazing (see Photograph 1 in Appendix B) was observed in the following locations:

- Room 100 (approximately 10 ft);
- Room 102 (approximately 20 ft);
- Room 103 (approximately 20 ft); and
- Room 104 (approximately 40 ft).

##### ***Exterior Grey Expansion Joint Caulking***

One (1) sample of exterior grey expansion joint caulking was collected during the assessment. The sample collected was found to contain 2.1% Chrysotile asbestos. Asbestos-containing grey expansion joint caulking (see Photograph 2 in Appendix B) was observed in the following locations:

- Exterior (approximately 100 ft).



### 3.1.2 Non Asbestos-Containing Materials

The following materials were sampled during this assessment and were found to not contain asbestos or were observed to be non-suspect materials:

- Grey firestop putty;
- White door and window frame caulking;
- Pipe fitting insulation;
- Grey duct mastic;
- White firestop;
- Black window frame caulking;
- Brick mortar; and,
- Exterior grey window caulking.

## 4.0 EXCLUDED AREAS AND MATERIALS

The following is a list of the areas and/or materials excluded during the assessment.

- Building materials accessible by a ten-foot ladder were assessed by Golder during the assessment. Materials located at heights that were inaccessible from a ten-foot ladder were not assessed. If materials at heights are to be removed or impacted by future renovation or demolition activities, additional investigation and sampling of suspect materials may be required.
- The roof and associated components were not assessed by Golder during the assessment as per Tender 16-0844. If the roof and associated components are to be removed or impacted by future renovation or demolition activities, additional investigation and sampling of suspect materials may be required.
- The electrical panels and associated components were not inspected by Golder during the assessment. If the panels are to be removed or impacted by future renovation or demolition activities, additional investigation and sampling of suspect materials may be required.

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the visual assessment and the laboratory analytical results, the following project specific conclusions and recommendations are provided.

### 5.1 Asbestos-Containing Materials

Asbestos was positively identified within the black window glazing and exterior grey expansion joint caulking on Site. Asbestos was not identified in the remaining samples collected and analyzed.

If the building is scheduled for renovations that will impact the identified asbestos-containing materials, it must be removed. If additional suspect asbestos-containing building materials are encountered during renovation activities, additional sampling should be undertaken to evaluate asbestos content.



## ASBESTOS-CONTAINING BUILDING MATERIALS ASSESSMENT REPORT - WASTE WATER SODIUM HYPOCHLORITE BUILDING

Removal work should be completed by workers that are adequately trained in the hazards and proper methods of working with asbestos. Throughout the abatement activities, appropriate air monitoring and inspections should be conducted by a competent person to document that contamination is contained and that ACM are disposed of appropriately. Ensure asbestos waste is disposed of in accordance with the requirements of the Government of Saskatchewan.

All quantities listed in the report are approximate and are based on the conditions at the time of the assessment. Prior to abatement work it is recommended that a competent person conduct a review of the site to quantify and obtain all measurements of all building materials detailed in this report for cost estimating purposes.

In anticipation of potential abatement, Golder's recommendations for the asbestos-containing materials identified during the assessment are outlined below.

### **Black Window Glazing**

If scheduled for impact, asbestos-containing black window glazing should be abated following low-risk abatement work procedures as outlined in the *Saskatchewan Asbestos Abatement Manual* (2017). Alternatively, as the glazing was observed in good condition, and with a priority rating of 5 (please see the room by room spreadsheet provided in Appendix C for a description of the priority ratings), the glazing can be managed in place if not scheduled for impact.

### **Exterior Grey Expansion Joint Caulking**

If scheduled for impact, asbestos-containing grey expansion joint caulking should be abated following low-risk abatement work procedures as outlined in the *Saskatchewan Asbestos Abatement Manual* (2017). Alternatively, as the caulking was observed in good condition, and with a priority rating of 5 (please see the room by room spreadsheet provided in Appendix C for a description of the priority ratings), the caulking can be managed in place if not scheduled for impact.

## **6.0 SURVEY LIMITATIONS**

This report is based on data and information collected by Golder during the assessment conducted on October 13, 2017 and is based solely on site conditions encountered at the time of the assessment. Any use of this document or the findings, conclusions or recommendations provided in this report by any person other than the City of Saskatoon is at the sole risk of such user.

The conclusions and recommendations contained in this survey report are based upon professional opinions with regard to the subject matter. These opinions are in accordance with currently accepted environmental assessment standards and practices applicable to these locations and are subject to the following inherent limitations:

The data and findings presented in this report are valid as of the dates of the investigations. The passage of time, manifestation of latent conditions or occurrence of future events may warrant further exploration at the properties, analysis of the data, and re-evaluation of the findings, observations, and conclusions expressed in this report. No assurance is made regarding changes in conditions or practices subsequent to the time of the investigation. It was beyond the scope of this assessment to conduct a risk assessment and the potential health risks that may be associated with asbestos exposure for building occupants.

The data reported and the findings, observations and conclusions expressed in this report are limited by the Scope of Work. The Scope of Work was defined by Tender 16-0844 and the initial site walkthrough with the Client, the time and budgetary constraints imposed by the Client, and availability of access to the property.



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

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

Golder's assessment reports present professional opinions and findings of a scientific and technical nature. While attempts were made to relate the data and findings to applicable environmental laws and regulations, the report shall not be construed to offer legal opinion or representations as to the requirements of, nor compliance with, environmental laws, rules, regulations or policies of federal, provincial, or local governmental agencies. Any use of the survey report constitutes acceptance of the limits of Golder's liability.

Golder's liability extends only to its client and not to other parties who may obtain this survey report. Issues raised by the report must be reviewed by appropriate legal counsel.

## 7.0 CLOSURE

We trust the information presented in this report meets your requirements. If you have any questions, please contact Kody Henderson at (780) 483-3499 or email at [kody\\_henderson@golder.com](mailto:kody_henderson@golder.com). Thank you for the opportunity to be of service. We look forward to working with you again in the future.



## Report Signature Page

### **GOLDER ASSOCIATES LTD.**

Prepared by:

Scott Bishop, B.A.  
Junior Occupational Hygienist

Reviewed by:

Kody Henderson, Dipl. Env. Sci., CRSP  
OHS Project Manager

Reviewed by:

Andrew Grant, B.Sc., P.Eng., EP, CRSP  
Associate, OHS Project Director

SWB/KH/AG/ba

Golder, Golder Associates and the GA globe design are trademarks of Golder Associates Corporation.

\\golder\gal\edmonton\active\2016\3 proj\1667963 cityofsaskatoon\_asbsurveys\_saskatoon\07 reports\61 - wastewater sodium hypochlorite\city of saskatoon - ww sodium hypochlorite - asbestos building material assessment report.docx





# **APPENDIX A**

## **Laboratory Certificate of Analysis Report**

CERTIFICATE OF ANALYSIS

Client: Golder Associates Ltd  
16820 107 Ave  
Edmonton AB T5P 4C3


Report Date: 10/28/2017  
Report No.: 550065 - PLM Rev #2, 10/30/2017  
Project: Sodium Hypochlorite Bldg  
Project No.: 1667963

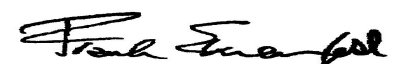
Client: GOL572

PLM BULK SAMPLE ANALYSIS SUMMARY

|   |   |   |
|---|---|---|
| <b>Lab No.:</b> 6369251<br><b>Client No.:</b> A-001 | <b>Analyst Observation:</b> Black Glazing<br><b>Client Description:</b> Black Window Glazing        | <b>Location:</b> 104<br><b>Facility:</b>    |
| <u>Percent Asbestos:</u><br><i>10 Chrysotile</i>    | <u>Percent Non-Asbestos Fibrous Material:</u><br>None Detected                                      | <u>Percent Non-Fibrous Material:</u><br>90  |
| <b>Lab No.:</b> 6369252<br><b>Client No.:</b> A-002 | <b>Analyst Observation:</b> Grey Putty<br><b>Client Description:</b> Grey Firestop Putty            | <b>Location:</b> 104<br><b>Facility:</b>    |
| <u>Percent Asbestos:</u><br><i>None Detected</i>    | <u>Percent Non-Asbestos Fibrous Material:</u><br>5 Cellulose  | <u>Percent Non-Fibrous Material:</u><br>95  |
| <b>Lab No.:</b> 6369253<br><b>Client No.:</b> A-003 | <b>Analyst Observation:</b> White/Off-White Caulk<br><b>Client Description:</b> White Door Caulking | <b>Location:</b> 103<br><b>Facility:</b>    |
| <u>Percent Asbestos:</u><br><i>None Detected</i>    | <u>Percent Non-Asbestos Fibrous Material:</u><br>None Detected                                      | <u>Percent Non-Fibrous Material:</u><br>100 |
| <b>Lab No.:</b> 6369254<br><b>Client No.:</b> A-004 | <b>Analyst Observation:</b> Grey Insulation<br><b>Client Description:</b> Pipe Fitting Insulation   | <b>Location:</b> 103<br><b>Facility:</b>    |
| <u>Percent Asbestos:</u><br><i>None Detected</i>    | <u>Percent Non-Asbestos Fibrous Material:</u><br>50 Mineral Wool                                    | <u>Percent Non-Fibrous Material:</u><br>50  |
| <b>Lab No.:</b> 6369255<br><b>Client No.:</b> A-005 | <b>Analyst Observation:</b> Grey Mastic<br><b>Client Description:</b> Grey Duct Mastic              | <b>Location:</b> 103<br><b>Facility:</b>    |
| <u>Percent Asbestos:</u><br><i>None Detected</i>    | <u>Percent Non-Asbestos Fibrous Material:</u><br>None Detected                                      | <u>Percent Non-Fibrous Material:</u><br>100 |
| <b>Lab No.:</b> 6369256<br><b>Client No.:</b> A-006 | <b>Analyst Observation:</b> White Insulation<br><b>Client Description:</b> White Firestop           | <b>Location:</b> 103<br><b>Facility:</b>    |
| <u>Percent Asbestos:</u><br><i>None Detected</i>    | <u>Percent Non-Asbestos Fibrous Material:</u><br>None Detected                                      | <u>Percent Non-Fibrous Material:</u><br>100 |

Analytical Method -US EPA 600, R93-116. Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 10/18/2017  
Date Analyzed: 10/28/2017  
Signature:   
Analyst: Linda Price

Approved By:   
Frank E. Ehrenfeld, III  
Laboratory Director

CERTIFICATE OF ANALYSIS

Client: Golder Associates Ltd  
16820 107 Ave  
Edmonton AB T5P 4C3

Report Date: 10/28/2017  
Report No.: 550065 - PLM Rev #2, 10/30/2017  
Project: Sodium Hypochlorite Bldg  
Project No.: 1667963

Client: GOL572

PLM BULK SAMPLE ANALYSIS SUMMARY

|                          |  |                                      |
|--------------------------|--|--------------------------------------|
| <b>Lab No.:</b> 6369257  | <b>Analyst Observation:</b> Off-White Insulation   | <b>Location:</b> 101                 |
| <b>Client No.:</b> A-007 | <b>Client Description:</b> Pipe Fitting Insulation | <b>Facility:</b>                     |
| <u>Percent Asbestos:</u> | <u>Percent Non-Asbestos Fibrous Material:</u>      | <u>Percent Non-Fibrous Material:</u> |
| <i>None Detected</i>     | 50 Mineral Wool                                    | 50                                   |

|                          |  |                                      |
|--------------------------|--|--------------------------------------|
| <b>Lab No.:</b> 6369258  | <b>Analyst Observation:</b> Black Caulk                | <b>Location:</b> 100                 |
| <b>Client No.:</b> A-008 | <b>Client Description:</b> Black Window Frame Caulking | <b>Facility:</b>                     |
| <u>Percent Asbestos:</u> | <u>Percent Non-Asbestos Fibrous Material:</u>          | <u>Percent Non-Fibrous Material:</u> |
| <i>None Detected</i>     | None Detected  | 100                                  |


|                          |   |                                      |
|--------------------------|---|--------------------------------------|
| <b>Lab No.:</b> 6369259  | <b>Analyst Observation:</b> Tan Mortar        | <b>Location:</b> Exterior            |
| <b>Client No.:</b> A-009 | <b>Client Description:</b> Brick Mortar       | <b>Facility:</b>                     |
| <u>Percent Asbestos:</u> | <u>Percent Non-Asbestos Fibrous Material:</u> | <u>Percent Non-Fibrous Material:</u> |
| <i>None Detected</i>     | None Detected                                 | 100                                  |

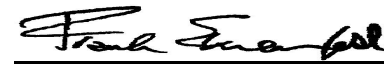
|                          |   |                                      |
|--------------------------|---|--------------------------------------|
| <b>Lab No.:</b> 6369260  | <b>Analyst Observation:</b> Tan Mortar        | <b>Location:</b> Exterior            |
| <b>Client No.:</b> A-010 | <b>Client Description:</b> Brick Mortar       | <b>Facility:</b>                     |
| <u>Percent Asbestos:</u> | <u>Percent Non-Asbestos Fibrous Material:</u> | <u>Percent Non-Fibrous Material:</u> |
| <i>None Detected</i>     | None Detected                                 | 100                                  |

|                          |   |                                      |
|--------------------------|---|--------------------------------------|
| <b>Lab No.:</b> 6369261  | <b>Analyst Observation:</b> Tan Mortar        | <b>Location:</b> Exterior            |
| <b>Client No.:</b> A-011 | <b>Client Description:</b> Brick Mortar       | <b>Facility:</b>                     |
| <u>Percent Asbestos:</u> | <u>Percent Non-Asbestos Fibrous Material:</u> | <u>Percent Non-Fibrous Material:</u> |
| <i>None Detected</i>     | None Detected                                 | 100                                  |

|                          |   |                                      |
|--------------------------|---|--------------------------------------|
| <b>Lab No.:</b> 6369262  | <b>Analyst Observation:</b> Tan Mortar        | <b>Location:</b> Exterior            |
| <b>Client No.:</b> A-012 | <b>Client Description:</b> Brick Mortar       | <b>Facility:</b>                     |
| <u>Percent Asbestos:</u> | <u>Percent Non-Asbestos Fibrous Material:</u> | <u>Percent Non-Fibrous Material:</u> |
| <i>None Detected</i>     | None Detected                                 | 100                                  |

Analytical Method -US EPA 600, R93-116. Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 10/18/2017  
Date Analyzed: 10/28/2017  
Signature:   
Analyst: Linda Price

Approved By:   
Frank E. Ehrenfeld, III  
Laboratory Director

### CERTIFICATE OF ANALYSIS

Client: Golder Associates Ltd  
16820 107 Ave  
Edmonton AB T5P 4C3

Client: GOL572

Report Date: 10/28/2017  
Report No.: 550065 - PLM Rev #2, 10/30/2017  
Project: Sodium Hypochlorite Bldg  
Project No.: 1667963

### PLM BULK SAMPLE ANALYSIS SUMMARY

**Lab No.:** 6369263  
**Client No.:** A-013

Percent Asbestos:  
*None Detected*

**Analyst Observation:** Tan Mortar  
**Client Description:** Brick Mortar  
Percent Non-Asbestos Fibrous Material:  
None Detected

**Location:** Exterior  
**Facility:**  
Percent Non-Fibrous Material:  
100

**Lab No.:** 6369264  
**Client No.:** A-014

Percent Asbestos:  
*None Detected*

**Analyst Observation:** Grey/Brown Caulk  
**Client Description:** Grey Window Caulking  
Percent Non-Asbestos Fibrous Material:  
None Detected

**Location:** Exterior  
**Facility:**  
Percent Non-Fibrous Material:  
100

**Lab No.:** 6369265  
**Client No.:** A-015

Percent Asbestos:  
**PC 1.2 Chrysotile**

**Analyst Observation:** Grey Caulk  
**Client Description:** Grey Expansion Joint Caulking  
Percent Non-Asbestos Fibrous Material:  
None Detected

**Location:** Exterior  
**Facility:**  
Percent Non-Fibrous Material:  
98.8

Analytical Method -US EPA 600, R93-116. Please refer to the Appendix of this report for further information regarding your analysis.

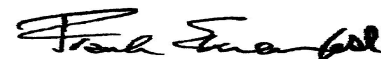
Date Received: 10/18/2017

Date Analyzed: 10/28/2017

Signature:

Analyst: Linda Price

Approved By:



Frank E. Ehrenfeld, III  
Laboratory Director

---

CERTIFICATE OF ANALYSIS

---

Client: Golder Associates Ltd  
16820 107 Ave  
Edmonton AB T5P 4C3

Client: GOL572

Report Date: 10/28/2017  
Report No.: 550065 - PLM  
Project: Sodium Hypochlorite Bldg  
Project No.: 1667963

## Appendix to Analytical Report

**Customer Contact:**

**Analysis:** US EPA 600, R93-116

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

**iATL Customer Service:** customerservice@iatl.com

**iATL Office Manager:** cdavis@iatl.com

**iATL Account Representative:** Pete Lesniak

**Sample Login Notes:** See Batch Sheet Attached

**Sample Matrix:** Bulk Building Materials

**Exceptions Noted:** See Following Pages

### General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at [www.iATL.com](http://www.iATL.com) and in our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA LAP LLC, or any agency of local, state or province governments nor of any agency of the U.S. government.

This report shall not be reproduced except in full, without written approval of the laboratory.

### Information Pertinent to this Report:

Analysis by US EPA 600 93-116: Determination of Asbestos in Bulk Building Materials by Polarized Light Microscopy (PLM).

#### Certifications:

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

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.

Analytical Methodology Alternatives: Your initial request for analysis may not have accounted for recent advances in regulatory requirements or advances in technology that are routinely used in similar situations for other qualified projects. You may have the option to explore additional analysis for further information. Below are a few options, listed as the matrix followed by the appropriate methodology. Also included are links to more information on our website.

Bulk Building Materials that are Non-Friable Organically Bound (NOB) by Gravimetric Reduction techniques employing PLM and TEM: ELAP 198.6 (PLM-NOB), ELAP 198.4 (TEM-NOB)

Loose Fill Vermiculite Insulation, Attic Insulation, Zonolite (copyright), etc.: US EPA 600 R-4/004 (multi-tiered analytical process)  
Sprayed On Insulation/Fireproofing with Vermiculite (SOF-V): ELAP 198.8 (PLM-SOF-V)>

## CERTIFICATE OF ANALYSIS

Client: Golder Associates Ltd  
16820 107 Ave  
Edmonton AB T5P 4C3

Client: GOL572

Report Date: 10/28/2017  
Report No.: 550065 - PLM  
Project: Sodium Hypochlorite Bldg  
Project No.: 1667963

Soil, sludge, sediment, aggregate, and like materials analyzed for asbestos or other elongated mineral particles (ex. erionite, etc.): ASTM D7521, CARB 435, and other options available

Asbestos in Surface Dust according to one of ASTM's Methods (very dependent on sampling collection technique – by TEM): ASTM D 5755, D5756, or D6480

Various other asbestos matrices (air, water, etc.) and analytical methods are available.

### Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a list with highlighted disclaimers that may be pertinent to this project. For a full explanation of these and other disclaimers, please inquire at [customerservice@iatl.com](mailto:customerservice@iatl.com).

- 1) Note: No mastic provided for analysis.
- 2) Note: Insufficient mastic provided for analysis.
- 3) Note: Insufficient material provided for analysis.
- 4) Note: Insufficient sample provided for QC reanalysis.
- 5) Note: Different material than indicated on Sample Log / Description.
- 6) Note: Sample not submitted.
- 7) Note: Attached to asbestos containing material.
- 8) Note: Received wet.
- 9) Note: Possible surface contamination.
- 10) Note: Not building material. 1% threshold may not apply.
- 11) Note: Recommend TEM-NOB analysis as per EPA recommendations.
- 12) Note: Asbestos detected but not quantifiable.
- 13) Note: Multiple identical samples submitted, only one analyzed.
- 14) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.080%.
- 15) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.125%.

### Recommendations for Vermiculite Analysis:

Several analytical protocols exist for the analysis of asbestos in vermiculite. These analytical approaches vary depending upon the nature of the vermiculite mineral being tested (e.g. un-processed gange, homogeneous exfoliated books of mica, or mixed mineral composites). Please contact your client representative for pricing and turnaround time options available.

iATL recommends initial testing using the EPA 600/R-93/116 method. This method is specifically designed for the analysis of asbestos in bulk building materials. It provides an acceptable starting point for primary screening of vermiculite for possible asbestos.

Results from this testing may be inconclusive. EPA suggests proceeding to a multi-tiered analysis involving wet separation techniques in conjunction with PLM and TEM gravimetric analysis (EPA 600/R-04/004).

Further information on this method and other vermiculite and asbestos issues can be found at the following: Agency for Toxic Substances and Disease Registry (ATSDR) [www.atsdr.cdc.gov](http://www.atsdr.cdc.gov), United States Geological Survey (USGS) [www.minerals.usgs.gov/minerals/](http://www.minerals.usgs.gov/minerals/), US EPA [www.epa.gov/asbestos](http://www.epa.gov/asbestos). The USEPA also has an informative brochure "Current Best Practices for Vermiculite Attic Insulation" EPA 747F03001 May 2003, that may assist the health and remediation professional.

The following is a summary of the analytical process outlines in the EPA 600/R-04/004 Method:

- 1) **Analytical Step/Method:** Initial Screening by PLM, EPA 600R-93/116  
**Requirements/Comments:** Minimum of 0.1 g of sample. ~0.25% LOQ for most samples.
- 2) **Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004  
**Requirements/Comments:** Minimum 50g\*\* of dry sample. Analysis of "Sinks" only.
- 3) **Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004  
**Requirements/Comments:** Minimum 50g\*\* of dry sample. Analysis of "Floats" only.
- 4) **Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004  
**Requirements/Comments:** Minimum 50g\*\* of dry sample. Analysis of "Sinks" only.
- 5) **Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004

---

CERTIFICATE OF ANALYSIS

---

Client: Golder Associates Ltd  
16820 107 Ave  
Edmonton AB T5P 4C3

Client: GOL572

Report Date: 10/28/2017  
Report No.: 550065 - PLM  
Project: Sodium Hypochlorite Bldg  
Project No.: 1667963

**Requirements/Comments:** Minimum 50g\*\* of dry sample. Analysis of "Suspension" only.

LOQ, Limit of Quantitation estimates for mass and volume analyses.

\*With advance notice and confirmation by the laboratory.

\*\*Approximately 1 Liter of sample in double-bagged container (~9x6 inch bag of sample).



# **APPENDIX B**

## **Site Photographs**





## APPENDIX B

### Site Photographs



**Photograph 1: Asbestos-Containing Black Window Glazing.**



**Photograph 2: Asbestos-Containing Grey Expansion Joint Caulking.**

\\golder\galledmonton\active\2016\3 proj\1667963 cityofsaskatoon\_asbsurveys\_saskatoon\07 reports\61 - wastewater sodium hypochlorite\appendix b - site photographs.docx



# **APPENDIX C**

## **Waste Water Sodium Hypochlorite Building Room by Room Spreadsheet**

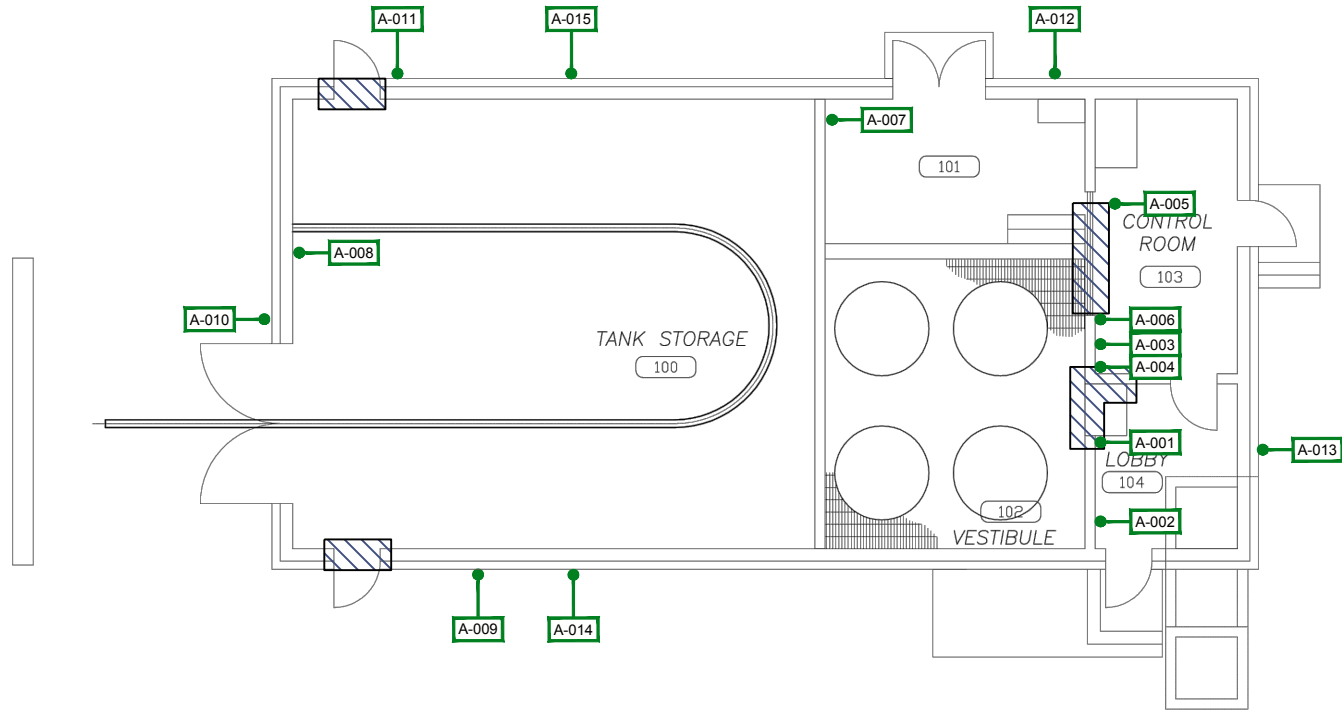
Appendix B  
Waste Water Sodium Hypochlorite Building  
ACM Inventory

| Included/<br>Excluded | Floor | Room #   | Area Description | Elements      | Subelements   | Material Description | Accessibility | Suspect? | Sampled? | Asbestos<br>Containing<br>Material? | Condition | Field Notes  | Sample<br>Type | Sample ID                             | Sample<br>Date | Asbestos<br>Type | ACM Product | % of asbestos | Friable | Sprayed-on | Maintenance | Inspection | Priority | Potential for<br>Disturbance | Recommended<br>Action                              | Quantity | Photograph ID | Labelling Type |
|-----------------------|-------|----------|------------------|---------------|---------------|----------------------|---------------|----------|----------|-------------------------------------|-----------|--|----------------|---------------------------------------|----------------|------------------|-------------|---------------|---------|------------|-------------|------------|----------|------------------------------|--|----------|---------------|----------------|
| Included              | M     | 100      | Open Area        | Door          | Regular Door  | Non Suspect Door     | High          | No       | No       | No                                  | Good      | Non-suspect door was<br>observed at the Site.          |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 100      | Open Area        | Walls         | Walls         | Cinderblock          | High          | No       | No       | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 100      | Open Area        | Floor         | Floor         | Concrete             | High          | No       | No       | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 100      | Open Area        | Ceiling       | Ceiling       | Metal Q-Deck         | High          | No       | No       | No                                  | Good      | Bare metal, no spray-applied<br>insulation.            |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 100      | Open Area        | Miscellaneous | Glazing       | Black Glazing        | High          | No       | Yes      | Yes                                 | Good      | On window pane.  | Bulk           | V.S. A-001                            | 13-Oct-17      | Chrysotile       | Glazing     | 10            | No      | No         | N/A         | Annually   | 5        | High                         | Manage in place                                    | 10 ft    | Photograph 1  |                |
| Included              | M     | 100      | Open Area        | Miscellaneous | Caulking      | Black Caulking       | High          | No       | Yes      | No                                  | Good      | On window frames.                                      | Bulk           | A-008                                 | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 100      | Open Area        | Miscellaneous | Caulking      | White Caulking       | High          | No       | Yes      | No                                  | Good      | On door frame.   | Bulk           | V.S.A-003                             | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
|                       |       |          |                  |               |               |                      |               |          |          |                                     |           | Bare or insulated with<br>fibreglass and PVC fittings. |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 100      | Open Area        | Mechanical    | Piping        | Metal Pipes          | High          | No       | Yes      | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
|                       |       |          |                  |               |               |                      |               |          |          |                                     |           | Located on pipe fittings.                              | Bulk           | V.S. A-004, A-007                     | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 101      | Open Area        | Door          | Regular Door  | Non Suspect Door     | High          | No       | No       | No                                  | Good      | Non-suspect door was<br>observed at the Site.          |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 101      | Open Area        | Walls         | Walls         | Cinderblock          | High          | No       | No       | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 101      | Open Area        | Floor         | Floor         | Concrete             | High          | No       | No       | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
|                       |       |          |                  |               |               |                      |               |          |          |                                     |           | Bare metal, no spray-applied<br>insulation.            |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 101      | Open Area        | Miscellaneous | Ceiling       | Metal Q-Deck         | High          | No       | No       | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 101      | Open Area        | Miscellaneous | Duct Work     | Grey Duct Mastic     | High          | No       | Yes      | No                                  | Good      |  | Bulk           | V.S. A-005                            | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 101      | Open Area        | Miscellaneous | Caulking      | White Caulking       | High          | No       | Yes      | No                                  | Good      | On door frame.   | Bulk           | V.S.A-003                             | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
|                       |       |          |                  |               |               |                      |               |          |          |                                     |           | Bare or insulated with<br>fibreglass and PVC fittings. |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 101      | Open Area        | Mechanical    | Piping        | Metal Pipes          | High          | No       | Yes      | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
|                       |       |          |                  |               |               |                      |               |          |          |                                     |           | Located on pipe fittings.                              | Bulk           | A-007, V.S. A-004                     | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 102      | Open Area        | Door          | Regular Door  | Non Suspect Door     | High          | No       | No       | No                                  | Good      | observed at the Site.                                  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 102      | Open Area        | Walls         | Walls         | Cinderblock          | High          | No       | No       | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 102      | Open Area        | Floor         | Floor         | Grated Metal         | High          | No       | No       | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
|                       |       |          |                  |               |               |                      |               |          |          |                                     |           | Bare metal, no spray-applied<br>insulation.            |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 102      | Open Area        | Ceiling       | Ceiling       | Metal Q-Deck         | High          | No       | No       | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 102      | Open Area        | Miscellaneous | Glazing       | Black Glazing        | High          | No       | Yes      | Yes                                 | Good      |  | Bulk           | V.S. A-001                            | 13-Oct-17      | Chrysotile       | Glazing     | 10            | No      | No         | N/A         | Annually   | 5        | High                         | Manage in place                                    | 20 ft    | Photograph 1  |                |
| Included              | M     | 102      | Open Area        | Miscellaneous | Duct Work     | Grey Duct Mastic     | High          | No       | Yes      | No                                  | Good      | Duct work not insulated.                               | Bulk           | V.S. A-005                            | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 102      | Open Area        | Miscellaneous | Caulking      | White Caulking       | High          | No       | Yes      | No                                  | Good      | On door and window frames.                             | Bulk           | V.S.A-003                             | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
|                       |       |          |                  |               |               |                      |               |          |          |                                     |           | Bare or insulated with<br>fibreglass and PVC fittings. |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 102      | Open Area        | Mechanical    | Piping        | Metal Pipes          | High          | No       | Yes      | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
|                       |       |          |                  |               |               |                      |               |          |          |                                     |           | Located on pipe fittings.                              | Bulk           | V.S. A-004, A-007                     | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 103      | Open Area        | Door          | Regular Door  | Non Suspect Door     | High          | No       | No       | No                                  | Good      | Non-suspect door was<br>observed at the Site.          |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 103      | Open Area        | Walls         | Walls         | Cinderblock          | High          | No       | No       | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 103      | Open Area        | Floor         | Floor         | Concrete             | High          | No       | No       | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
|                       |       |          |                  |               |               |                      |               |          |          |                                     |           | Bare metal, no spray-applied<br>insulation.            |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 103      | Open Area        | Ceiling       | Ceiling       | Metal Q-Deck         | High          | No       | No       | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 103      | Open Area        | Miscellaneous | Glazing       | Black Glazing        | High          | No       | Yes      | Yes                                 | Good      |  | Bulk           | V.S. A-001                            | 13-Oct-17      | Chrysotile       | Glazing     | 10            | No      | No         | N/A         | Annually   | 5        | High                         | Manage in place                                    | 20 ft    | Photograph 1  |                |
| Included              | M     | 103      | Open Area        | Miscellaneous | Duct Work     | Grey Duct Mastic     | High          | No       | Yes      | No                                  | Good      | Duct work not insulated.                               | Bulk           | A-005                                 | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 103      | Open Area        | Miscellaneous | Caulking      | White Caulking       | High          | No       | Yes      | No                                  | Good      | On door and window frames.                             | Bulk           | V.S.A-003                             | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 103      | Open Area        | Miscellaneous | Firestop      | White Firestop       | High          | No       | Yes      | No                                  | Good      |  | Bulk           | A-006                                 | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
|                       |       |          |                  |               |               |                      |               |          |          |                                     |           | Located on pipe fittings.                              | Bulk           | A-004, V.S. A-007                     | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 103      | Open Area        | Mechanical    | Piping        | Insulation           | High          | No       | Yes      | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
|                       |       |          |                  |               |               |                      |               |          |          |                                     |           | Non-suspect door was<br>observed at the Site.          |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 104      | Open Area        | Door          | Regular Door  | Non Suspect Door     | High          | No       | No       | No                                  | Good      | Hole in cinderblock.<br>Vermiculite not observed.      |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 104      | Open Area        | Walls         | Walls         | Cinderblock          | High          | No       | No       | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 104      | Open Area        | Floor         | Floor         | Concrete             | High          | No       | No       | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
|                       |       |          |                  |               |               |                      |               |          |          |                                     |           | Bare metal, no spray-applied<br>insulation.            |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 104      | Open Area        | Ceiling       | Ceiling       | Metal Q-Deck         | High          | No       | No       | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 104      | Open Area        | Miscellaneous | Glazing       | Black Glazing        | High          | No       | Yes      | Yes                                 | Good      |  | Bulk           | A-001                                 | 13-Oct-17      | Chrysotile       | Glazing     | 10            | No      | No         | N/A         | Annually   | 5        | High                         | Manage in place                                    | 40 ft    | Photograph 1  |                |
| Included              | M     | 104      | Open Area        | Miscellaneous | Caulking      | White Caulking       | High          | No       | Yes      | No                                  | Good      | On doors and windows.                                  | Bulk           | V.S.A-003                             | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 104      | Open Area        | Miscellaneous | Firestop      | Grey Firestop        | High          | No       | Yes      | No                                  | Good      |  | Bulk           | A-002                                 | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
|                       |       |          |                  |               |               |                      |               |          |          |                                     |           | Located on pipe fittings.                              | Bulk           | V.S. A-004, A-007                     | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
|                       |       |          |                  |               |               |                      |               |          |          |                                     |           | Bare or insulated with<br>fibreglass and PVC fittings. |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | M     | 104      | Open Area        | Mechanical    | Piping        | Metal Pipes          | High          | No       | Yes      | No                                  | Good      |  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
|                       |       |          |                  |               |               |                      |               |          |          |                                     |           | Not sampled due to safety<br>concerns.                 |                |                                       |                |                  |             |               |         |            |             |            |          |                              | Inspect and sample<br>if scheduled for<br>removal. |          |               |                |
| Included              | E     | Exterior | Exterior         | Walls         | Walls         | Brick                | High          | No       | No       | No                                  | Good      | Brick mortar sampled.                                  | Bulk           | A-009, A-010, A-<br>011, A-012, A-013 | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | E     | Exterior | Exterior         | Walls         | Caulking      | Grey Caulking        | High          | No       | Yes      | No                                  | Good      | On window frames.                                      | Bulk           | A-014                                 | 13-Oct-17      |                  |             |               |         |            |             |            |          |                              |  |          |               |                |
| Included              | E     | Exterior | Exterior         | Walls         | Caulking      | Grey Caulking        | High          | No       | Yes      | Yes                                 | Good      | On expansion joints.                                   | Bulk           | A-015                                 | 13-Oct-17      | Chrysotile       | Caulking    | 1.2           | No      | No         | N/A         | Annually   | 5        | High                         | Manage in place                                    | 100 ft   | Photograph 2  |                |
| Excluded              | E     | Exterior | Roof             | Exterior Roof | Exterior Roof |                      |               |          |          |                                     |           | Not assessed due to scope of<br>work.                  |                |                                       |                |                  |             |               |         |            |             |            |          |                              |  |          |               |                |



# **APPENDIX D**

## **Floor Plan**



LEGEND

- # ASBESTOS SAMPLE LOCATION
- ▨ ASBESTOS - CONTAINING BLACK GLAZING

- NOTE(S)
1. ASBESTOS IS A CARCINOGEN. DO NOT BREATHE ASBESTOS DUST.
  2. ASBESTOS-CONTAINING GREY EXPANSION JOINT CAULKING WAS OBSERVED ON THE EXTERIOR OF THE BUILDING.

REFERENCE(S)

PLAN OBTAINED FROM INFRASTRUCTURE SERVICES DEPARTMENT CITY OF SASKATOON. DATED: 17/11/2016

CLIENT  
CITY OF SASKATOON

CONSULTANT



YYYY-MM-DD 2017-11-22

DESIGNED KH

PREPARED VI

REVIEWED KH

APPROVED AG

SCHEMATIC ONLY, NOT TO SCALE

PROJECT  
ASBESTOS ASSESSMENT  
WASTE WATER SODIUM HYPOCHLORITE BUILDING  
470 WHITESWAN DRIVE

TITLE  
MAIN FLOOR

PROJECT NO. 1667963  
CONTROL 1000-HM-0002

REV. 0

FIGURE 1

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

For more information, visit [golder.com](http://golder.com)

|               |                   |
|---------------|-------------------|
| Africa        | + 27 11 254 4800  |
| Asia          | + 86 21 6258 5522 |
| Australasia   | + 61 3 8862 3500  |
| Europe        | + 356 21 42 30 20 |
| North America | + 1 800 275 3281  |
| South America | + 56 2 2616 2000  |

[solutions@golder.com](mailto:solutions@golder.com)  
[www.golder.com](http://www.golder.com)

**Golder Associates Ltd.**  
**16820 107 Avenue**  
**Edmonton, Alberta, T5P 4C3**  
**Canada**  
**T: +1 (780) 483 3499**

