March 17, 2015

REPORT

PRE-DEMOLITION DESIGNATED SUBSTANCES SURVEY

SNOW LEOPARD & OLD GIRAFFE BUILDINGS - TORONTO ZOO - 361A OLD FINCH AVENUE, SCARBOROUGH, ONTARIO

Submitted to:
Mr. Ben Knoop, Supervisor, Projects & Exhibitry
Toronto Zoo
361 Old Finch Avenue,
Scarborough, Ontario
M1B 5K7

Report Number: 1524848 (1000)

Distribution:

2 Copies - Toronto Zoo
2 Copies - Golder Associates Ltd.

Golder Associates

Executive Summary

The Toronto Zoo retained Golder Associates Ltd. (Golder) to complete an intrusive, pre-demolition designated substances & hazardous building materials survey (DSS) for the Snow Leopard and Old Giraffe buildings located at the Toronto Zoo, 361A Old Finch Avenue, Scarborough, Ontario (the Site). Based on the information provided via email and during telephone conversations between Golder and the Toronto Zoo, Golder understands that the buildings are scheduled for demolition. The intrusive investigation was completed on March 5, 2015 by Mr. Chris Milosh of Golder's EHS Management and Compliance Group.

The survey was performed with the objective of identifying designated substances, as required under the Ontario *Occupational Health and Safety Act* (the *Act*), R.S.O. 1990 (as amended), and to provide recommendations to remove or manage these materials in accordance with provincial regulations and guidelines, and prior to planned demolition operations.

The hazardous building materials surveyed include asbestos-containing materials (ACM), lead, mercury, and silica. The remaining designated substances (acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates and vinyl chloride) were not anticipated to be present at the Site; however their presence was noted, if observed. In addition, polychlorinated biphenyls (PCBs), and ozone depleting substances (ODS) were also included in our assessment.

Based on the laboratory analytical results as well as Golder's Site observations, the following hazardous building materials were determined or assumed to be present:

Hazardous Building Materials identified, include:

Location	Material & Description	Estimated Quantity	Condition	Sample # / Content	Recommended Actions
Lead					
Snow Leopard Building – Wooden Walls, Poles, and Trim	Green Paint	Approximately 1,000 Square Feet	Good	P-01 / 0.013% Lead by Dry Weight	Measures should be taken to ensure the TWA for lead is not exceeded. Refer to conclusions and recommendations for further details.
Mercury					
Snow Leopard & Old Giraffe Buildings	Fluorescent Lighting System	Approximately 8 Light Tubes	Good	N/A	Manage in place or recycle and reuse by qualified personnel or dispose of in accordance with procedures specified by federal and provincial regulations.

Location	Material & Description	Estimated Quantity	Condition	Sample # / Content	Recommended Actions
Silica					
Throughout the Sites Concrete Foundation.	Silica	Approximately 1,500 Square Feet	Good	N/A	Any work involving disturbances to silica should be completed in accordance with the Guideline - Silica on Construction Projects.
Polychlorinated Biphenyls					
Snow Leopard & Old Giraffe Building	Fluorescent Lighting System	Approximately 4 Ballasts	Good	N/A	If the material is to be disturbed during demolitions, handle, store and dispose of in accordance with SOR 2008/273, O. Reg. 347/90 and O. Reg. 362/90.

Details regarding each of the identified hazardous building materials including approximate quantities, locations and present condition, where appropriate, are contained within the corresponding section of the report. Recommendations for management and/or removal of these materials are provided in the Conclusions and Recommendations section herein.

Although ACM was not identified at the Site, inaccessible, buried, or concealed ACM may be discovered in additional locations (i.e. Transite™ asbestos cement products, caulking, gaskets, the packing material within cast-steel “bell and spigot” water drainage pipe joint connectors, etc.) during the demolition operations. Based on this, contractors retained to conduct demolition/construction activities should be notified of this limitation and written procedures should be established in the event that concealed ACM are identified. The overall objective is to minimize exposure during construction activities. If suspected ACM not identified in this report are encountered during any future construction or demolition activities, the work should stop immediately and the material tested to confirm asbestos content. Alternatively, suspect ACM may be presumed to be asbestos-containing and removed as prescribed under O.Reg.278/05.

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1.0 INTRODUCTION

The Toronto Zoo retained Golder Associates Ltd. (Golder) to complete an intrusive, pre-demolition designated substances & hazardous building materials survey (DSS) for the Snow Leopard and Old Giraffe buildings located at the Toronto Zoo, 361A Old Finch Avenue, Scarborough, Ontario (the Site). Based on the information provided via email and during telephone conversations between Golder and the Toronto Zoo, Golder understands that the buildings are scheduled for demolition. The intrusive investigation was completed on March 5, 2015 by Mr. Chris Milosh of Golder's EHS Management and Compliance Group.

The survey was performed with the objective of identifying designated substances, as required under the Ontario *Occupational Health and Safety Act* (the *Act*), R.S.O. 1990 (as amended), and to provide recommendations to remove or manage these materials in accordance with provincial regulations and guidelines, and prior to planned demolition operations.

The hazardous building materials surveyed include asbestos-containing materials (ACM), lead, mercury, and silica. The remaining designated substances (acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates and vinyl chloride) were not anticipated to be present at the Site; however their presence was noted, if observed. In addition, polychlorinated biphenyls (PCBs), and ozone depleting substances (ODS) were also included in our assessment.

1.1 Site Description

The Site consists of two structures which were reportedly constructed circa mid 1970's.

The following is a brief description of the building systems observed:

Structural: The Site buildings were observed to be constructed with a poured concrete slab, wooden walls, and steel and wooden roof-tops;

Walls: Interior walls consisted primarily of wood and poured concrete;

Flooring: Flooring surfaces consisted of poured concrete for both buildings;

Ceilings: Consisted of wooden panelling; and,

Mechanical Systems: the Snow Leopard building was not heated or cooled, however the Old Giraffe building was heated by electric-powered, deck-mounted, fan-motor heating units. The giraffe bay doors are hydraulically operated by a motorized hydraulic unit, which appeared to be in good condition at the time of the investigation.

Where observed, the mechanical ductwork and piping were noted to be either uninsulated. Illumination for the Site is provided by both incandescent and fluorescent light fixtures.

2.0 METHODOLOGY

The surveyor visually investigated the Site for select suspected ACM, lead-containing paint (LCP), mercury in thermostats and pressure sensing devices, PCBs in light ballasts and other electrical equipment, and ODS as refrigerants in various mechanical systems. The remaining designated substances were not expected to be present at this Site and were not noted as part of the survey.

2.1 Asbestos-Containing Materials

Readily available information was gathered regarding the building including age, type of structure, historical documents including previous reports, presence of renovated areas or additions, and any details regarding the building mechanical systems.

Bulk samples of select suspect ACM were collected for confirmation purposes. Homogeneous material sampling was utilized during the course of the investigation on materials that are uniform in colour, texture, and installation or construction date. As per Table 1 of Ontario Regulation 278/05 - Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations as amended (O. Reg. 278/05), three samples per homogeneous material were collected and submitted for analysis. During analysis, if a positive sample is identified, no additional analyses were conducted for other samples and the entire area of homogeneous material from which the sample was taken is deemed to be an ACM. This is referred to as a "stop positive" analytical result.

Representative samples of suspected ACM were submitted to the International Asbestos Testing Laboratory (IATL) for analysis to determine asbestos type and percentage content by polarized light microscopy, in accordance with the US Environmental Protection Agency (USEPA) Method EPA/600/R-93/116, as prescribed under O. Reg. 278/05.

2.2 Friability

Each ACM and presumed ACM identified as part of this assessment was evaluated based on its friability. The friability of a material plays a role in how easily the material can be damaged and release airborne fibres. The criteria used to assess the friability of a material are summarized in Table A.

Table A – Friability of Materials

Friable	A material is considered friable if when dry, it can be crumbled, pulverized, or powdered by hand pressure. A material that is normally non-friable may also be considered friable if it exists in a crumbled, pulverized, or powdered state.
Non-Friable	A material is considered non-friable if when dry, it cannot be crumbled, pulverized or powdered by hand pressure.

2.3 Condition of Material

Each ACM and presumed ACM identified as part of this assessment was also evaluated based on its condition. The criteria used to assess the condition of a material are summarized in Table B.

Table B – Condition of Materials

Good	**Mechanical Insulation**: Insulation is covered in intact jacketing with minor or no damage or deterioration. No ACM is exposed. Includes materials where the covering has minor deterioration but no holes. **Spray or Trowel-Applied Material**: Surface of material shows no evidence of damage or deterioration and no delaminating. Includes textured finishes or fireproofing that are not encapsulated or painted and where no delaminating or damage is observed. Also includes encapsulated fireproofing or sealed textured finishes. **Non-Friable Material**: Material intact or with minor cracks or breaks but with no loose, friable material and no friable debris is present.
Fair	**Mechanical Insulation**: Minor damage to jacketed insulation including tears, cuts or deterioration, or undamaged insulation that is not covered. Insulation is exposed with no surface deterioration. May be minor pieces of insulation missing but may be repaired. **Spray or Trowel-Applied Material**: Includes materials that are not thoroughly sealed but with no evidence of deterioration of delaminating. Generally, fireproofing materials should be classified as either good or poor. **Non-Friable Materials**: Materials that show signs of physical deterioration or significant breakage but remain non-friable. No loose, friable debris is present.
Damaged	**Mechanical Insulation**: Material in a condition such those asbestos fibres may be readily released and may become airborne with disturbance. ACM is exposed and significant damage has occurred. **Spray or Trowel-applied Material**: Materials show signs of physical damage, delaminating or deterioration. **Non-friable Material**: Material is severely damaged or deteriorated to a state where material is considered to be friable. Loose debris may or may not be present.

2.4 Lead

Systematic sampling and visual identification of suspected lead-containing painted surfaces were completed as part of the survey. Samples of suspect lead-containing paints were collected and also submitted to IATL for lead content analysis, in accordance with the American Society for Testing and Materials (ASTM) Method D3335-85A. This method is derived from the USEPA SW 846 Method 3050B where each sample is digested, diluted and analyzed by atomic absorption spectroscopy (AAS).

An inventory was made of the other known or suspected lead-containing materials (i.e. batteries for emergency lights, solder on pipes, lead pipes, etc.) based on visual observations.

2.5 Mercury

A review of potential mercury-containing equipment installed at the Site was completed as part of the survey, such that any mercury-containing switches, thermostats (switch bulbs) and pressure-sensing devices were noted, if observed.

Elemental mercury may be present in thermostats and trace amounts of mercury vapour may be present in metal halide light bulbs and fluorescent light tubes. If elemental mercury from a thermostat is spilled, the beads

and droplets can accumulate and emit colourless and odourless vapours. These vapours may present a health risk to building occupants. Light bulbs and tubes, if broken, may pose an occupational hazard to unprotected workers.

2.6 Silica

Crystalline silica is presumed to be present in building materials constructed from raw aggregates such as concrete mortar, brick, plaster and ceiling tiles. Silica is likely present in the concrete and aggregate used to construct the Site. As such, no sampling was conducted to confirm the presence of silica in such building materials.

2.7 Polychlorinated Biphenyls

The Site was visually assessed for the presence of PCBs in stored/waste fluorescent light ballasts, and on-Site transformers, if observed. Due to health and safety concerns associated with energized fluorescent lighting systems, connected and energized fluorescent lights were not breached or accessed during the investigation. Where necessary, label information from the ballasts such as the manufacturer, model numbers, serial numbers, and date codes can collected and compared to the criteria found in the Environment Canada Report EPS 2/CC/2 (revised) August 1991 - Identification of Lamp Ballasts Containing PCBs. No PCB sampling was conducted during the Site visit.

2.8 Ozone-depleting Substances

A review of thermostats, refrigeration and air conditioning units was completed to verify the presence of ozone depleting substances such as refrigerants R-11, R-12 and R-22, where observed. The presence of chlorofluorocarbons (CFCs) is determined by gathering label information such as the manufacturer, model numbers, serial numbers, and date codes.

3.0 SCOPE OF WORK

The Scope of Work involved conducting an intrusive building materials survey within selected areas of the Site, to:

- Identify designated substances and other selected hazardous materials present at the Site prior to demolition operations;
- Conduct representative bulk sampling of materials suspected of containing asbestos and paint suspected of containing lead, to supplement visual observations;
- Complete analysis of bulk samples for asbestos type/percentage or lead content; and,
- Provide a report detailing the findings and any recommendations with respect to removal of any identified designated substances on Site, prior to the re-construction operations.

The Scope of Work was limited to readily accessible building materials that are part of the building envelope only, and are present above the floor slab.

3.1 Regulations, Guidelines, Standards

The Regulations, Guidelines, and Standards referenced throughout this report are listed and defined in Appendix A.

4.0 FINDINGS

4.1 Asbestos

A total of 12 samples representing three distinct homogeneous building materials were collected from the Site and submitted for asbestos content analysis. Materials sampled included; window caulking, black tar and felt material, black rubber and tar material, and roofing shingles and tar paper. Based on the Laboratory Certificate of Analysis and Golder's Site observations, ACM was not identified in the materials sampled.

The laboratory Certificate of Analysis is presented in *Appendix B1 - Laboratory Certificate of Analysis - Asbestos*. A detailed summary of the asbestos bulk samples collected including location, area, quantity, condition, asbestos content, photograph, and recommendation is presented *in Appendix C – Hazardous Materials Sample Results & Inventory Report Form.*

4.2 Lead

A total of two samples of suspect lead-containing painted surfaces were collected from the Site and submitted for lead content analysis. Based on the Laboratory Certificate of Analysis, the green paint on the wooden walls, columns and trim on the Snow Leopard Building (Sample P-01) was found to contain 0.013% lead by dry weight. The paint from the Old Giraffe Building (Sample P-02 was found to be below the analytical detection limit for lead content, and thus is considered lead-free.

The laboratory Certificate of Analysis is presented in *Appendix B2 - Laboratory Certificate of Analysis - Lead*. A detailed summary of the painted surface samples collected including location, area, quantity, condition, lead content, photograph, and recommendations is presented *in Appendix C – Hazardous Materials Sample Results & Inventory Report Form.*

4.3 Mercury

Fluorescent light bulbs/tubes throughout the Site are suspected to contain small amounts of mercury vapour. A detailed summary of the mercury-containing equipment at the Site including location, estimated quantity, condition, photograph, and recommendation is presented *in Appendix C – Hazardous Materials Sample Results & Inventory Report Form.*

4.4 Silica

Silica is a naturally occurring mineral and may be found as common aggregates in concrete products, mortar, brick and ceiling tiles and is likely present in the concrete foundations of both Site buildings. Silica is suspected to be present in concrete and concrete products (mortar, concrete, etc.).

4.5 Polychlorinated Biphenyls

Potential PCB-containing light ballasts were present throughout the Site. No other suspected PCB-containing equipment was observed during the investigation.

A detailed summary of the PCB-containing equipment at the Site including location, estimated quantity, condition, photographs, and recommendations is presented in *Appendix C – Hazardous Materials Sample Results & Inventory Report Form.*

4.6 Ozone Depleting Substances

During the investigation, no equipment with suspected ODS were observed.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Asbestos

Although ACM was not identified at the Site, inaccessible, buried, or concealed ACM may be discovered in additional locations (i.e. Transite™ asbestos cement products, caulking, gaskets, the packing material within cast-steel "bell and spigot" water drainage pipe joint connectors, etc.) during the demolition operations. Based on this, contractors retained to conduct demolition/ construction activities should be notified of this limitation and written procedures should be established in the event that concealed ACM are identified. The overall objective is to minimize exposure during construction activities. If suspected ACM not identified in this report are encountered during any future construction or demolition activities, the work should stop immediately and the material tested to confirm asbestos content. Alternatively, suspect ACM may be presumed to be asbestos-containing and removed as prescribed under O. Reg. 278/05.

5.2 Lead

The MOL currently does not promulgate a minimum threshold for the classification of lead-based paint. Therefore, under these circumstances, Golder considers all painted surfaces with any detectable presence of lead to be lead-containing. Based on this, and the Laboratory Certificate of analysis, the green paint (P-01) associated with the Snow Leopard Building was found to contain 0.013% lead by dry weight. As such, any work performed on these surfaces that may lead to the generation of airborne dust or fumes should be conducted in accordance with the Ministry of Labour Guideline – Lead on Construction Projects (revised April 2011).

During the demolition operations, inaccessible lead-containing materials may be uncovered such as lead sheeting, flashing, water mains or brick ties. All bulk lead-containing materials should be extracted and sent to a licensed recycling facility. If recycling of the lead is not practicable then it must be disposed of in an approved hazardous landfill as lead waste.

O. Reg. 490/09 prescribes an OEL for elemental lead of 0.05 mg/m^3 calculated as an 8 hour/daily and a 40 hour/weekly time-weighted average (TWA) limit. Despite the fact that O. Reg. 490/09 does not apply to a construction project, employers still have a general duty and responsibility under Part III, Section 25(2)(h) of the *Act* to protect workers.

Based on this, if contracted personnel retained to conduct the work are required to perform operations where significant levels of airborne lead-containing dust may be generated, then measures must be taken by the contractor to ensure OEL for lead is not exceeded and that all reasonable regulatory and health and safety precautions are taken. The MOL Guideline – Lead on Construction Projects, (updated April 2011), provides a classification system to assist with determining the required control measures necessary, based on the proposed work activity.

The potential for worker exposure to exceed the OEL is dependent on how the materials are to be disturbed. Contractors retained to complete work should consult the cited MOL Guideline prior to completing a specific task with the objective of evaluating the need for health and safety precautions such as engineering controls, safe works and hygiene practices, personal protective equipment, and training.

5.3 Mercury

It is recommended that at the time of their disposal, mercury vapour bulbs and ampoules may be recycled and possibly reused by qualified personnel or may be disposed of in accordance with procedures specified by federal and provincial regulations.

Prior to the demolition operations, mercury-containing components should be identified and labelled. Any components suspected to contain mercury should be presumed mercury-containing until proven otherwise. Staff who may work in the immediate vicinity of mercury-containing components should be trained in the safe handling of mercury-containing components.

5.4 Silica

Sampling for crystalline silica was not conducted during this assessment. However, silica is likely to be present in the aggregate-based materials used to construct the foundations of the buildings. During future demolition activities, it is recommended that materials suspected to contain silica are routinely misted with water to control airborne dust levels, thereby preventing worker and public exposure to silica. Any work involving disturbances to silica should be completed in accordance with the Guideline - Silica on Construction Projects (revised April 2011).

5.5 Polychlorinated Biphenyls

Given the age of the Site, it is possible that PCB-containing ballasts are present at the Site. Prior to demolition, and for confirmation purposes prior to disposal, all light ballasts must be checked and compared to the Environment Canada's Report EPS 2/CC/2 (revised) August 1991, Identification of Lamp Ballasts Containing PCBs. Ballasts clearly identified as "Non-PCB" or "PCB-Free" can be recycled or disposed of as regular construction waste. All other ballasts must be identified by the markings, date code, model and serial number to confirm the presence of PCBs.

5.6 Ozone Depleting Substances

Suspected ODS-containing equipment was not observed at the Site.

5.7 Other Hazardous Materials

The following materials were not identified in the investigated areas at the Site: acrylonitrile; arsenic; benzene; coke oven emissions; ethylene oxide; isocyanates; and vinyl chloride.

6.0 LIMITATIONS

This report was prepared for the exclusive use of the Toronto Zoo. This report is based on data and information collected during the Site visit conducted by Golder and is based solely on Site conditions encountered at the time of the survey, supplemented by historical information and data obtained by Golder as described in this report.

The conclusions and recommendations contained in this report are based upon professional opinions with regard to the subject matter. These opinions are in accordance with applicable and currently accepted occupational health and safety or 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 date of the investigation. 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.
- The findings, observations and conclusions expressed by Golder in this report are not, and should not be considered, an opinion concerning compliance of any past or present owner or operator of the Site with any federal, provincial or local laws or regulations.
- Additional hazardous building materials not identified in this report may become evident during future demolition activities. Should additional information become available, Golder requests that this information be brought to our attention so that we may re-assess the conclusions presented herein.
- Golder will not be responsible for any real or perceived decrease in a property value, its saleability or ability to gain financing through the reporting of information in this report.
- Golder's report presents professional opinions and findings of a scientific and technical nature. While attempts were made to relate the data and findings to applicable environmental and occupational health and safety laws and regulations, the report shall not be construed to offer legal opinion or representations as to the requirements of, nor compliance with, environmental and occupational health and safety laws, rules, regulations or policies of federal, provincial, or local governmental agencies. Any use of this assessment 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 assessment report. Issues raised by the report should be reviewed by appropriate legal counsel.
- The data reported and the findings and recommendations expressed in this report are limited by the Scope of Work. The Scope of Work is based on the request of the client, availability of access to the property and time constraints.
- In evaluating the Site conditions, Golder has relied in good faith on information provided by others. We accept no responsibility for any deficiency, mis-statements or inaccuracies contained in this report as a result of omissions, misinterpretations or fraudulent acts of the persons involved.
- The quantities of identified designated substances noted herein are estimated quantities for reporting purposes, and this report is limited in that regard. In the event that designated substances are scheduled to be removed in the future, it is solely the responsibility of the "contractor" to confirm the exact quantities of designated substances to be removed, prior to their removal.
- This report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder cannot be responsible for use of portions of the report without reference to the entire report.
- Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of

investigations, including the number of locations investigated, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how concealed conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety, and equipment capabilities.

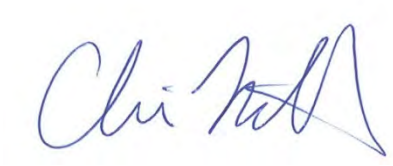
- Special risks occur whenever engineering or related disciplines are applied to identify Site conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain Site conditions. The conditions that Golder interprets to exist between and beyond investigation and sampling points may differ from those that actually exist.

7.0 CLOSURE

If you have any questions or require any further information, please feel free to contact the undersigned at (905) 723-2727. Thank you for the opportunity to be of service. We look forward to working with you again.

Report Signature Page

GOLDER ASSOCIATES LTD.



Chris G. Milosh, B.Sc.
Project Manager

Robert Stoyanoff, BTech MBA CChem CIH
Senior Industrial Hygienist

CM/RS:lb

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APPENDIX A

Regulations, Guidelines and Standards

REGULATIONS, GUIDELINES AND STANDARDS

Occupational Health and Safety Act

The Occupational Health and Safety Act (the *Act)* prescribes designated substances that may be present within buildings. The intent of the *Act* is to identify the presence of building materials and products that may contain designated substances. Section 30 of the *Act* requires that, prior to beginning a construction project (including building demolition or demolition); a document summarizing the presence of these materials must be available to contractors and subcontractors requesting tenders.

Ontario Regulation 490/09 - Designated Substances, as amended (O. Reg. 490/09), regulates all designated substances in Ontario, with the exception asbestos in building materials, which is prescribed under Ontario Regulation 278/05 - Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations, as amended (O. Reg. 278/05).

Asbestos-Containing Materials

O. Reg. 278/05 prescribes specific procedures for the identification of ACM and protocols for their removal. Under this regulation, if ACM are suspected to be present or ought reasonably to be suspected, locations of the materials must be documented. Prior to a demolition project, a document detailing the presence of all ACM must be available to contractors and subcontractors requesting tenders. All ACM must be removed or managed appropriately prior to any disturbance caused by the demolition process in accordance with provincial regulations.

Ontario Regulation 347/90 - General Waste Management, as amended (O. Reg. 347/90), made under the *Environmental Protection Act*, prescribes requirements for general waste management including ACM. The regulation defines "asbestos waste" as “solid or liquid waste that results from the removal of asbestos-containing construction or insulation materials or from the manufacture of asbestos-containing products and contains asbestos in more than a trivial amount or proportion”. This regulation requires the disposal of asbestos waste in a double sealed container, properly labelled and free of cuts, tears or punctures. The waste must be disposed of in a licensed waste facility which has been properly notified of the presence of asbestos waste.

Lead

Lead was used as a pigment and drying agent in alkyd oil-based paint. The Surface Coating Materials Regulations (SOR/2005-109) made under the *Canada Consumer Product Safety Act* restricts the lead content of paints and other liquid coatings on new furniture, household products, children’s products, industrial surfaces and exterior and interior surfaces to 90 mg/kg by weight. The Canadian Paint and Coatings Association (CPCA), the national trade association for Canada’s paint manufacturers recommended that the Canadian paint industry voluntarily stop using any lead compounds in consumer paints by the end of 1990. Over the years, the amount of lead in paint has continued to decrease, due to the co-operative efforts of government and industry.

O. Reg. 490/09 prescribes requirements relating to protocols for lead-containing materials in the workplace, where lead is present, produced, used, handled or stored and at which the worker is likely to inhale, ingest, or absorb lead. However, O. Reg. 490/09 does not apply to construction projects. Nevertheless, the constructor and employers on construction projects have a duty to take all reasonable precautions to ensure that no worker is unacceptably exposed to airborne lead.

If operations that will likely produce airborne lead dust or fumes (e.g. during welding, torch cutting, sanding and sand blasting) are to occur during building demolition or construction, it is recommended that the disturbance of lead paint be carried out in accordance with procedures outlined in the Ontario Ministry of Labour (MOL) Guideline Lead on Construction Projects dated September 2004 (revised April 2011).

The MOL currently does not promulgate a minimum defining threshold for lead-containing paint, and allows for no minimum concentration of lead in paint to be acceptable as non-lead containing. Therefore in these circumstances, Golder considers all paints with any detectable presence of lead as lead-containing. The accepted laboratory testing methods for determination of lead in paint is either atomic absorption spectroscopy (AAS) or inductively coupled plasma spectroscopy (ICP).

Mercury

Mercury is regulated under O. Reg. 490/09., which prescribes occupational exposure limits (OELs) and other requirements for engineering controls, work practices and hygiene practices and facilities for workers who may become exposed to mercury.

Silica

Silica is a naturally occurring mineral and may be found in common aggregates in concrete mortar, brick and ceiling tiles. Silica is likely present in the concrete and mortar used to construct the Site. The health risks associated with exposure to silica is due primarily to the inhalation of respirable crystalline silica, particularly in the form of dust associated with the abrading or cutting of silica containing materials.

Silica is regulated under O. Reg. 490/09. This regulation prescribes OELs and requirements surrounding engineering controls, work practices and hygiene practices and facilities to protect workers who may be potentially exposed to crystalline silica. As prescribed under O. Reg. 490/09, an employer shall take all reasonable precautions to prevent worker exposure to silica. Procedures for workers involved in construction/demolition activities occurring on a Site where silica is disturbed are outlined in the MOL Guideline - Silica on Construction Projects dated September 2004 (revised April 2011).

Polychlorinated Biphenyls

PCBs were used as a dielectric fluid in electrical equipment such as transformers, light ballasts and capacitors. The use of PCBs in fluorescent lamp ballast capacitors was common up to 1980. The PCB Regulations (SOR/2008-273) prohibits and restricts the use of PCBs pertaining to the manufacture, export, import, sale, and or processing of PCBs and PCB-containing products.

SOR/2008-273 prescribes requirements pertaining to the handling, storage and disposal of PCBs and PCB-containing equipment. Revisions to the federal regulation have provided end-of-use deadlines for liquids containing PCBs, as well as PCBs in specified equipment. The first such deadline was December 31, 2009, by which time all equipment containing PCBs at concentrations greater than 500 mg/kg, and equipment within 100 metres of specified sensitive locations and containing PCBs at concentrations greater than 50 mg/kg, must have been phased out of use. These deadlines exclude PCB-containing light ballasts, and pole-mounted transformers.

Ozone-Depleting Substances

The Federal Halocarbon Regulations (SOR/2003-289), was enacted to ensure uniformity with respect to the release, recovery and recycling of ODS and their halocarbon alternatives in refrigeration and air conditioning systems. The regulation also requires that permits be obtained to import or export used, recovered, recycled and reclaimed ODS. Equipment containing ODS should be removed by a licensed contractor and handled in accordance with the *Code of Practice for the Reduction of CFC Emissions from Refrigeration and Air Conditioning Systems*, updated in 2008, and Ontario Regulation 463/10 - Ozone Depleting Substances and other Halocarbons (O. Reg. 463/10). ODS are often present in refrigerators and freezers, vending machines (refrigerated) and in water fountains/water coolers as well air conditioning systems.

Controlled Products and Hazardous Chemicals

In the province of Ontario, controlled products and hazardous chemicals are regulated under the Workplace Hazardous Materials Information System Regulation (O. Reg. 860/90), made under the Act. This regulation sets out the prescriptive requirements surrounding: designation of a hazardous material/controlled product, assessment of biological or chemical agents, exemptions, worker education, label requirements, and Material Safety Data Sheets (MSDS).

Identification and Transportation of Hazardous Waste

O. Reg. 347/90 prescribes waste characterization, handling and disposal requirements for generators of hazardous waste. The transportation of hazardous wastes is governed under the *Dangerous Goods Transportation Act* (and Regulations) which prescribe requirements for storage, handling, and transportation of such waste.

APPENDIX B

Appendix B1 - Laboratory Analytical Results – Asbestos
Appendix B2 - Laboratory Analytical Results – Lead

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: Golder Associates Ltd
100 Scotia Court
Whitby, ON L1N 8Y6

Report Date: 3/11/2015
Report No.: 357847
Project: Toronto Zoo
Project No.: 1524848

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 5566664 **Description / Location:** Black/Grey Caulk; Window
Client No.: 01-A Snow Leopard Bldg - Perimeter Plexi View

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

Lab No.: 5566665 **Description / Location:** Grey Caulk; Window
Client No.: 01-B Snow Leopard Bldg - Perimeter Plexi View

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

Lab No.: 5566665 **Description / Location:** Black Mastic **Layer No.:** 2
Client No.: 01-B Snow Leopard Bldg - Perimeter Plexi View

% 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: US EPA 600/R-93/116 by Polarized Light Microscopy, (ELAP 198.1 where applicable)

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: S. Cone

Approved By: Frank E. Ehrenfeld, III
Laboratory Director

Date: 3/11/2015

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BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 5566666 **Description / Location:** Grey Caulk; Window
Client No.: 01-C Snow Leopard Bldg - Perimeter Plexi View

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

Lab No.: 5566666 **Description / Location:** Black Mastic **Layer No.:** 2
Client No.: 01-C Snow Leopard Bldg - Perimeter Plexi View

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

Lab No.: 5566667 **Description / Location:** Black Wrap
Client No.: 02-A Giraffe Bldg-Concrete Perimeter

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

Lab No.: 5566668 **Description / Location:** Black Wrap
Client No.: 02-B Giraffe Bldg-Concrete Perimeter

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

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

Analytical Method: US EPA 600/R-93/116 by Polarized Light Microscopy, (ELAP 198.1 where applicable)

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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Whitby, ON L1N 8Y6

Report Date: 3/11/2015
Report No.: 357847
Project: Toronto Zoo
Project No.: 1524848

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 5566669 **Description / Location:** Black Wrap
Client No.: 02-C Giraffe Bldg-Concrete Perimeter

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

Lab No.: 5566670 **Description / Location:** Black Rubber
Client No.: 03-A Giraffe Bldg-Perimeter Roof

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

Lab No.: 5566671 **Description / Location:** Black Rubber
Client No.: 03-B Giraffe Bldg-Perimeter Roof

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

Lab No.: 5566672 **Description / Location:** Black Rubber
Client No.: 03-C Giraffe Bldg-Perimeter Roof

% 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: US EPA 600/R-93/116 by Polarized Light Microscopy, (ELAP 198.1 where applicable)

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: 3/11/2015
Report No.: 357847
Project: Toronto Zoo
Project No.: 1524848

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 5566673 **Description / Location:** Black/Grey Shingle
Client No.: 04-A Giraffe Bldg-2 Out Bldg Sheds Roof

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	10	Fibrous Glass	90

Lab No.: 5566674 **Description / Location:** Black Shingle
Client No.: 04-B Giraffe Bldg-2 Out Bldg Sheds Roof

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	15	Fibrous Glass	85

Lab No.: 5566674 **Description / Location:** Black/Brown Tar Paper **Layer No.:** 2
Client No.: 04-B Giraffe Bldg-2 Out Bldg Sheds Roof

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

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

Analytical Method: US EPA 600/R-93/116 by Polarized Light Microscopy, (ELAP 198.1 where applicable)

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: S. Cone

Date: 3/11/2015

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100 Scotia Court
Whitby, ON L1N 8Y6

Report Date: 3/11/2015
Report No.: 357847
Project: Toronto Zoo
Project No.: 1524848

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 5566675 **Description / Location:** Brown/Red Shingle
Client No.: 04-C Giraffe Bldg-2 Out Bldg Sheds Roof

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	15	Fibrous Glass	85

Lab No.: 5566675 **Description / Location:** Black/Brown Tar Paper **Layer No.:** 2
Client No.: 04-C Giraffe Bldg-2 Out Bldg Sheds Roof

% 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: US EPA 600/R-93/116 by Polarized Light Microscopy, (ELAP 198.1 where applicable)

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: S. Cone

Date: 3/11/2015

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CERTIFICATE OF ANALYSIS

Client: Golder Associates Ltd
100 Scotia Court
Whitby, ON L1N 8Y6

Report Date: 3/11/2015
Report Number: 357907
Project: Toronto Zoo
Project No.: 11524848

LEAD PAINT SAMPLE ANALYSIS SUMMARY

Lab No.	Client No.	Location / Description	Concentration Lead By Weight (%)
5566389	P-01	Green Paint Snow Leopard Bldg; Ext. Walls	0.013
5566390	P-02	Green Paint Old Giraffe Bldg; Ext. Walls	<0.0087

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: 3/6/2015
Date Analyzed: 3/11/2015
Analyst: C. Shaffer

Approved By:

Frank E. Ehrenfeld, III
Laboratory Director

APPENDIX C

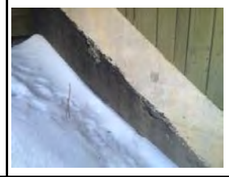
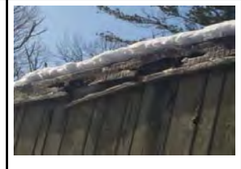
Hazardous Materials Sample Results & Inventory Report Form

1524848

Hazardous Materials Sample Results & Inventory Report Form

Site Name/ Address: Snow Leopard Building & Old Giraffe Building - Toronto Zoo, 361A Old Finch Avenue, Scarborough, ON

Form Completed By: Chris Milosh, B.Sc.

	Building	Area/Location	Hazardous Material (Asbestos, Lead, (PCB, Silica, Mercury, etc.)	Material Description	Sample #	Estimated Quantity (sq. ft, sq. m, linear ft., linear m, # of X, etc.)	Condition of Hazardous Material (Poor, Fair, Good)	Laboratory Analytical Result	Photo (s) Attached? (Y/N)	Recommended Actions
1	Snow Leopard Building	Perimiter Plexiglass Viewing Panes	Non-Asbestos	Grey/Black Window Caulking	01-A to 01-C	15 Linear Feet	Good	None Detected		No specific precautions or disposal instructions required other than general construction dust suppresion techniques.
2	Old Giraffe Building	Exterior - Base of Concrete Foundation Walls	Non-Asbestos	Black Tar and Felt Material	02-A to 02-B	500 Square Feet	Good	None Detected		No specific precautions or disposal instructions required other than general construction dust suppresion techniques.
3	Old Giraffe Building	Exterior - Roof - Perimeter Roof Flashing	Non-Asbestos	Black Rubber/Tar Material	03-A to 03-C	1,000 Square Feet	Good	None Detected		No specific precautions or disposal instructions required other than general construction dust suppresion techniques.
4	Old Giraffe Building	Exterior - Shed Buildings - Roof-Tops	Non-Asbestos	Roofing Shingles & Tar Paper	04-A to 04-C	250 Square Feet	Good	None Detected	No Photograph Available.	No specific precautions or disposal instructions required other than general construction dust suppresion techniques.
5	**Snow Leopard Building**	**Wooden Walls, Poles & Building Trim**	**Lead**	**Green Paint**	**P-01**	**1,000 Square Feet**	**Good**	**0.013% Lead by Dry Weight**		**Measures should be taken to ensure the TWA for lead is not exceeded. Refer to conclusions and recommendations for further details.**

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Form Completed By: Chris Milosh, B.Sc.

	Building	Area/Location	Hazardous Material (Asbestos, Lead, (PCB, Silica, Mercury, etc.)	Material Description	Sample #	Estimated Quantity (sq. ft, sq. m, linear ft., linear m, # of X, etc.)	Condition of Hazardous Material (Poor, Fair, Good)	Laboratory Analytical Result	Photo (s) Attached? (Y/N)	Recommended Actions
6	Old Giraffe Building	Wooden Walls and Exterior Trim	Non-Lead	Green Paint	P-02	2,500 Square Feet	Good	<0.0087% Lead by Dry Weight		No specific precautions or disposal instructions required other than general construction dust suppresion techniques.
7	Snow Leopard Building & Old Giraffe Building	Flourescent Lighting System	Mercury	Mercury Vapour in Fluorescent Light Tubes	N/A	8 Light Tubes	Good	N/A		Upon disposal, keep separate from all other waste to prevent damage to the glass bulb/fixture containing the mercury. Must be disposed of in accordance with procedures prescribed under federal and provincial regulations.
8	Snow Leopard Building & Old Giraffe Building	Floor Slab & Foundation Walls	Silica	Grout & Materials Containing Concrete	N/A	1,500 Square Feet	Good	N/A		Any work involving disturbances to silica should be completed in accordance with the Guideline - Silica on Construction Projects.
9	Snow Leopard Building & Old Giraffe Building	Flourescent Lighting System	PCB	Fluorescent Light Ballasts	N/A	4 Ballasts	Good	N/A		Handle, store or dispose of in accordance with SOR 2008/273, O. Reg. 347/90 and O. Reg. 362/90

N/A - Not Applicable

This spreadsheet should be read in conjunction with the report. The quantities reported above are estimates only and may not accurately reflect the exact quantities at the Site. Contractors retained to complete or quote on the abatement activities should independently confirm the reported quantities.

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

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 44 1628 851851
North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

solutions@golder.com
www.golder.com

Golder Associates Ltd.
100, Scotia Court
Whitby, Ontario, L1N 8Y6
Canada
T: +1 (905) 723 2727

Golder Associates