WASTE MANAGEMENT PLAN

FOR THE ASTON BAY PROPERTY
(ALSO KNOWN AS STORM PROPERTY)
NUNAVUT, CANADA

Prepared For:

ASTON BAY

Prepared By:

APEX Geoscience Ltd.

Effective June 2020

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1. Introduction

This Waste Management Plan ("WMP") applies to mineral exploration activities conducted by, or on behalf of, Aston Bay Holdings Ltd. ("Aston Bay") at the Aston Bay Property (the "Property" or the "Project, "also known as the "Storm Property" or the "Storm Project"), Somerset Island, Nunavut. This WMP will come into effect June 2020, pending approval. Copies and updates to this plan may be obtained via Aston Bay.

1.1 Contact Details

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1.2 Purpose and Scope

The primary objective of the Aston Bay Property WMP is to provide employees and contractors with operational guidelines to minimize the generation of wastes and facilitate the collection, storage, transportation, and disposal of wastes while minimizing adverse effects on the environment. The WMP includes the following:

- A summary of regulatory requirements;
- Potential waste minimization, recycling, and reuse options;
- Methods for collection, storage, and disposal of hazardous and non-hazardous wastes;
- Ways to minimize environmental impacts;
- Training, inspection, and monitoring efforts.

1.3 Other Plans

The WMP should be considered as a part of the Property wide management system. Other management plans in place at the Aston Bay Property include:

- Abandonment and Restoration Plan ("ARP")
- Emergency Response Plan ("ERP")
- Environmental Management Plan ("EMP")
- Fuel Management Plan ("FMP")
- Spill Prevention and Response Plan ("SPRP")

1.4 Project Description

Aston Bay Property is located on northern Somerset Island, in the Qikiqtani Region of Nunavut (Appendix A, Figure 1) within the 1:50,000 scale National Topographic System ("NTS") map sheets 058B14 and 15, 058C02, 03, 06, 07, 10, 11, 13 and 14 and 058F02, 03 and 04. The nearest community to the Property is Resolute Bay, located 112 km to the north, across Parry Sound on the southern edge of Cornwallis Island. The Property includes the Seal Zinc prospect and multiple copper-silver showings, collectively known as the Storm Copper prospect.

Aston Bay Property comprises one hundred eighteen contiguous mineral claims and twelve prospecting permits. The Property covers a combined area of approximately 391, 483 ha and is bound by latitudes 72°45' N and 73°56' N, and longitudes 93°20' W and 95°20' W (Appendix A, Figure 2 and Figure 3).

From 1964 until 2001, Cominco Ltd. was actively conducting exploration within the Property area. Commander Resources Ltd. ("Commander") explored on the Property from 2008 to 2011. In November 2011, Aston Bay entered into an option agreement with Commander and by February 2016, acquired 100% of Commander's interest in the Property. From 2012 to 2015, Aston Bay completed small exploration programs, but no drilling was undertaken. The 10-20 person Aston Camp was established in 2014 located at approximately 73°42' N latitude and 94°43' W longitude. In 2016, the Aston Camp was removed, with the exception of one 14'x16' wooden shack containing survival equipment, and the 40-person Storm Camp and airstrip was established along the Aston River at approximately 73°39'23" N latitude and 94°27'07" W longitude (Appendix A, Figure 4 and Figure 5). Between 2016 and 2018, Aston Bay completed surface sampling, an airborne geophysical survey, and diamond drilling. In 2019, no exploration work was completed.

Aston Bay's annual exploration program may include 5,000 to 10,000 m of diamond drilling, soil and rock geochemical sampling, geological mapping and ground geophysical surveys. Similar programs are anticipated for 3 to 4 subsequent years. All exploration activities will be helicopter supported and based out of Storm Camp.

A fuel cache of approximately 80,000 L (400 drums) will be established at the current fuel cache, adjacent to camp. The cache will be primarily diesel and jet fuel, with small quantities of gasoline and propane. All fuel and any other hazardous materials will be stored within secondary containment. Off-season fuel storage may include up to 60 drums of jet fuel and diesel, and up to 20 cylinders of propane. Small, temporary fuel caches of less than 4,000L may also be required to support the drilling and exploration programs. Within 30 days of establishing any temporary

fuel cache, Crown-Indigenous Relations and Northern Affairs Canada ("CIRNAC") will be notified of the details of the cache including: location, fuel type, container sizes, method of storage and date of removal.

Aston Bay is currently applying for a Nunavut Water Board ("NWB") Type B Water Licence Renewal and Amendment as the current water licence 2BE-STO1520 will expire on June 1, 2020. Additionally, as the CIRNAC Land Use Permit ("LUP") N2015C0014 will expire April 21, 2021, Aston Bay is also applying for a new Class A LUP. The NWB amendment is requesting an increase in the water allowance, from 82 m^3/day (2 m^3/day for camp and 80 m^3/day for drilling) to 299 m^3/day (10 m^3/day for camp and 289 m^3/day for drilling). In addition, Aston Bay is applying to increase the drilling area to include the entire currently permitted Project Extent, but will ensure that all ground disturbance activities, water use and waste disposal will only occur over lands that have an active mineral tenure held by Aston Bay. No exploration activities, drilling, water use, or waste disposal will be undertaken on Inuit Owned Lands ("IOL"), without a licence granted by the Qikiqtani Inuit Association ("QIA").

1.5 Applicable Legislation and Guidelines

Applicable acts, regulations, and legislation that relate to waste management in Nunavut are listed below:

1.5.1 Federal

- Canadian Centre for Occupational Health and Safety Act
- Hazardous Products Act
- Canadian Environmental Protection Act
- Fisheries Act
- Nunavut Waters and Nunavut Surface Rights Tribunal Act
- Transportation of Dangerous Goods Act
- National Fire Code of Canada
- Northern Land Use Guidelines
- Workplace Hazardous Materials Information System ("WHMIS")
- CCME Environmental Codes of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products
- Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations
- Guidelines for Spill Contingency Planning (CIRNAC)

1.5.2 Territorial

- Fire Prevention Act
- Environmental Protection Act
- Mine Health and Safety Act and Regulations
- Public Health Act
- Safety Act
- Nunavut Occupational Health and Safety Regulations
- Environmental Guideline for the General Management of Hazardous Waste
- Environmental Guideline for Used Oil and Waste Fuel
- Environmental Guideline for Waste Batteries
- Environmental Guideline for the Burning and Incineration of Solid Waste

2. Waste Management

2.1 Definition of Wastes

Waste at the Aston Bay Property is considered to be any material or substance that can no longer be used for its intended purpose, and is destined for recycling, disposal, or storage. Hazardous wastes are broadly defined in the *Environmental Guideline for the General Management of Hazardous Waste* by the Government of Nunavut Department of Environment (Appendix D) as being "any unwanted material or products that can cause illness or death to people, plants and animals". Hazardous wastes may include waste petroleum products, solvents, paints, waste chemicals, batteries, and any combination of hazardous and non-hazardous materials (i.e. mixed waste).

The responsibility for proper waste management rests with the waste generator and should be budgeted for accordingly, as a cost of doing business.

2.2 Waste Sources

Tables 1 and 2 provide a summary of the potential types of hazardous and non-hazardous (inert) wastes generated at the Aston Bay Property.

Table 1. Non-hazardous (inert) wastes.

Waste Type	Examples
Organic	Food wastes
Scrap metal	Discarded tent frames, empty drums, rebar, wire, metal furniture, vehicle parts, nails/screws
Wood	Plywood and lumber from camp structures, broken core boxes, timbers used for drill pad construction
Glass	Bottles, jars, windows, mirrors
Rubber products	ATV tires, floor mats
Plastics	Bottles, plastic packaging, plastic bags
Equipment	Non-hydrocarbon contaminated equipment: electric motors, fans, electric heaters, pumps, screens, auto parts, etc.
Incinerator ash	Ash from the incinerator
Sewage	Sewage
Grey water	Water from kitchen, washing machine, sinks.

Table 2. Hazardous wastes and pollutants.

Waste Type	Examples
Petrochemicals	Diesel, jet fuel, gasoline, various oils
Solvents	Varsol, cleaning products
Contaminated soil	Contaminated soil/snow/water
Electronics	Computer parts, circuit boards, transformers
Fluorescent tubes	Regular and compact fluorescent tubes
Batteries	Dry cell batteries, button batteries, lead-acid based batteries

2.3 Waste Management Activities

Waste management operations at the Aston Bay Property comprise a number of activities with the common goal of reducing the amount of waste generated on site and to ensure that any wastes created are reused, recycled, or disposed of in a responsible and appropriate manner. Wastes will be separated at the source into a number of categories including organics (food wastes), materials for incineration, inert recyclables, inert non-combustible materials, and various hazardous materials.

Combustible waste will be burned in a batch feed dual-chamber controlled air incinerator, in accordance with the *Canada-Wide Standards ("CWS") for Dioxins and Furans* by the Canadian Council of Ministers of the Environment (Appendix A), the *Technical Document for Batch Waste*

Incineration by Environment Canada (Appendix E) and the *Environmental Guideline for the Burning and Incineration of Solid Waste* by the Nunavut Department of Environment (Appendix F). Aston Bay will ensure that the incinerator is a model that is specifically designed to be capable of incinerating inert combustible wastes produce at the Property, including sewage. The current incinerator model is: i8-20s Incinerator by Inciner8.

All attempts will be made to reduce the moisture content of waste to be incinerated, which will decrease the amount of smoke produced and increase the completeness of combustion. All waste will be covered and stored inside sheds or other secure buildings to keep rain and snow out of the waste and reduce the attraction for wildlife. If wet waste must be burned, such as organic (food) waste, the wet waste will be mixed with dry waste to reduce the overall moisture content of the batch.

Materials that cannot be incinerated or burned will be stored in appropriate containers until they can be removed from site for treatment and/or disposal at an accredited facility. Pending permission from the Hamlet, residual non-combustible wastes will be disposed of in Resolute Bay. If permission is not granted, the wastes in question will be backhauled to Yellowknife for disposal.

2.4 Waste Recovery and Reuse

Recovery and reuse options at the Aston Bay Property are limited due to the site's remote location and are restricted largely by the technology and equipment available on the Property. However, any available opportunity for waste recovery and reuse will be taken. Table 3 lists several potential waste recovery and reuse opportunities for the Aston Bay Property.

Table 3. Waste recovery and reuse opportunities.

Waste Type	Process
Hydraulic oils	Filtered and cleaned for reuse
Waste fuel	Filtered and used in tent stoves
Metal	Suitable pieces repurposed
Wood	Suitable pieces repurposed

3. Waste Classification and Disposal Plan

3.1 Hazardous Wastes

All opportunities will be taken to reuse or recycle hazardous waste materials. All hazardous wastes will be placed in sealed containers, labeled and stored within “Arctic Insta-Berms”, or similar, for secondary containment until they can be reused or backhauled for recycling or disposal. A hazardous waste storage area will be established adjacent to the main fuel cache. Upon seasonal shutdown all hazardous wastes will be backhauled and disposed of properly.

3.1.1 Used Oil

Waste lubricating oils, from vehicles, generators, pumps, or other equipment will be collected and stored in labeled 205 L steel drums. Used oil will be backhauled to a registered hazardous waste receiver and properly disposed of. See Appendix G for *Environmental Guideline for Used Oil and Waste Fuel* by Government of Nunavut Department of Environment.

3.1.2 Hydraulic Fluid

Whenever possible, hydraulic fluids will be filtered and reprocessed for reuse. Waste hydraulic fluid will be sealed in labeled 205 L steel drums and stored in the hazardous waste storage area until the product can be backhauled to a registered hazardous waste receiver.

3.1.3 Contaminated or Expired Fuels

Contaminated or expired fuels, such as Jet B aviation fuel, should remain clearly labeled and tightly sealed in their original containers within the fuel storage area. The fuels may be combusted in tent stoves or moved to the hazardous waste storage area for backhaul to a registered hazardous waste receiver.

3.1.4 Solvents

Whenever possible, non-toxic alternatives will be used in place of petroleum-based solvents. Excess or waste solvents will be packaged in clearly labeled, original, tightly sealed containers, or manufactured containers designed for solvent transport. Waste solvents will be stored in the hazardous waste storage area until backhauled to a registered hazardous waste receiver.

3.1.5 Contaminated Soil, Snow, and Ice

Any contaminated soil, snow, or ice will be cleaned up immediately in accordance with the Aston Bay Property "Spill Prevention and Response Plan." All contaminated soil, snow, and ice will be sealed in 205 L steel drums and stored in the hazardous waste storage area to await backhaul to a registered hazardous waste receiver.

3.1.6 Used Rags and Sorbents

Used rags and sorbents will be placed in clearly labeled, tightly sealed containers, such as 205 L steel drums, and stored in the hazardous waste storage area until disposal or backhaul is possible. Rags and sorbent pads will be incinerated on site. Granular sorbent will be stored in drums and backhauled to a registered hazardous waste receiver.

3.1.7 Empty Hazardous Material Containers and Drums

Empty containers will be stored in a designated area and returned to the supplier. Drums may alternatively be drained, air dried, backhauled to a recycling facility. Any residual fuels drained will be burned in tent stoves or consolidated into drums and backhauled to a registered hazardous waste receiver.

3.1.8 Waste Batteries

Generation of waste batteries will be reduced by properly maintaining batteries to prolong life and by replacing non-rechargeable batteries with rechargeable alternatives whenever possible. Even with proper maintenance, all batteries will eventually deteriorate and reach the end of their useful life. Waste batteries must be properly handled to avoid spillage of corrosive materials and the release of metals into the environment. See Appendix H for the *Environmental Guideline for Waste Batteries* by the Government of Nunavut Department of Environment.

Dry cell batteries are used in equipment such as hand-held radios and GPS units, flashlights, and cameras. Some of these types of devices utilize rechargeable battery packs, but others use general dry cell battery types such as AAA to D cells, 6- or 9-volt consumer batteries, and button batteries. Specific containers will be set up in the office, common spaces, and drill sites to collect dry cell batteries. The batteries will be placed in appropriate shipping containers and backhauled to an off-site recycling facility.

Waste lead acid batteries and rechargeable batteries will be temporarily stored in a 205 L plastic drum, within the hazardous waste storage area. These types of batteries can only be stored in this manner in quantities of 1000 kg or less and for periods of less than 180 days. All waste lead acid and rechargeable batteries will be backhauled from site for disposal as necessary to conform to regulations.

3.1.9 Aerosol Cans

Use of aerosol cans at the Aston Bay Property will be limited. Whenever possible, alternatives, such as spray bottles, will be used in place of aerosol cans. Any waste aerosol cans will be collected in specific containers around camp and at drill sites. The cans will be stored in the hazardous waste storage area until backhauled for disposal.

3.1.10 Fluorescent Bulbs and Tubes

Waste fluorescent bulbs and tubes will be packaged in their original (or equivalent) containers and stored in a watertight enclosure in the hazardous waste storage area until backhauled to a hazardous waste recycling or disposal company. Fluorescent bulbs and tubes are considered hazardous waste if broken and should be handled accordingly.

3.2 Inert Non-Combustible Solid Wastes

Labeled bins will be provided at various locations around camp and at drill sites for each type of waste listed below. Effort will be taken to reuse or repurpose any materials before disposal is considered. Non-combustible wastes are backhauled on an ongoing basis throughout the program and upon seasonal shutdown.

3.2.1 Tires and Other Rubber Materials

Waste tires, hoses, and other rubber materials that cannot be repaired or repurposed will be backhauled for recycling or disposal.

3.2.2 Scrap Metal and Glass

Scrap metal and glass will be repurposed for alternative uses whenever possible. Any residual metal or glass that cannot be reused will be placed in 205 L steel drums and backhauled for recycling.

3.2.3 Electronics

Electronics and electrical equipment will be collected and stored in sealed containers within the hazardous waste storage area and removed from site for recycling or disposal.

3.2.4 Vehicles and Other Mechanical Equipment

Vehicles and other mechanical equipment, such as generators, that are no longer usable, will be removed from site for refurbishment or recycling/disposal. Vehicles and equipment awaiting backhaul will be stored in a specially designated, bermed area.

3.3 Inert Combustible Solid Wastes

The Aston Bay Property will use a batch feed dual-chamber controlled air incinerator to dispose of combustible solid wastes. All combustible wastes will be burned in accordance with applicable federal and territorial regulations and the Nunavut Department of Environment *Guideline for the Burning and Incineration of Solid Waste*. Combustible wastes will be incinerated on a regular schedule and upon seasonal shutdown.

3.3.1 Food Waste and Packaging

Dedicated steel bins, lined with plastic garbage bags, will be provided for the collection of food waste and packaging at a number of locations throughout camp and at drill sites. The bins will be secured in place and use locking lids to avoid interference by wildlife. Food waste and packaging will be incinerated daily to minimize the attraction of wildlife. Waste oil and grease collected from the kitchen will be stored in sealed plastic pails and remain in the kitchen until transferred to the incinerator for immediate disposal.

3.3.2 Paper and Cardboard

Use of electronic methods for communication will be encouraged at the Aston Bay Property to minimize the amount of paper used. Effort will be taken to restrict the amount of corrugated cardboard coming to site, and waste cardboard will be reused as needed, possibly as packaging for backhauled materials. Specific containers, located throughout camp, will be used to collect paper and cardboard. Waste paper and cardboard will be incinerated.

3.3.3 Waste Lumber

Whenever possible, lumber will be reused at the Aston Bay Property. Excess waste lumber will be stored in appropriate areas and either backhauled or burned in a burned when the camp is completely removed.

3.4 Greywater

Camp greywater will be stored and treated in an excavated sump, which will allow for slow infiltration into the soil and will be located at least 31 m away from the ordinary high-water mark of a water body. The greywater sumps at Storm Camp are approximately 2'x2' in dimension and approximately 3' deep. They are constructed with plywood walls and filled with loose cobbles to aid in filtration, to support the walls and to prevent slumping. Filters and grease traps will be installed on kitchen drains to ensure solid food wastes do not enter the sumps attract wildlife. The sump and pipe will be inspected at regular intervals for leaks or overflow. Full sumps will be covered with enough material for future ground settlement. Upon seasonal shutdown, if the sumps are not full, they are covered with plywood to be used in the future.

3.5 Sewage

Pacto toilets will be used at Storm Camp. All Pacto bags will be incinerated on site in a batch feed dual-chamber controlled air incinerator. Aston Bay will ensure that the incinerator is a model that is specifically designed to be capable of incinerating this type of waste. Incineration of sewage will occur on a regular schedule. Upon seasonal shutdown, all sewage will be incinerated, and the Pacto structure winterized.

3.6 Drilling Fluids

Recirculation and filtration equipment will be used to minimize the amount of water used and additives released into the environment. Secondary containment for additives will be placed around the hole. Any residual drill fluids will be contained in sumps or an equivalent natural depression, preventing the drill fluids from entering water bodies directly and allow for slow infiltration into the soil. Sumps will be positioned a minimum of 31 metres from the normal high-water mark of any water body. Sumps will be positioned down slope from the drill collar in such a manner that runoff flows into the sump. Full sumps will be covered with enough material for future ground settlement. Biodegradable drill additives will be used whenever possible. See Appendix B of Aston Bay's "Spill Prevention and Response Plan" for the MSDS of possible drill additives used.

4. Site Facilities

4.1 Hazardous Waste Storage Area

The hazardous waste storage area will be located adjacent to the main fuel cache, away from any structures and a minimum of 31 metres from the normal high-water mark of any water body. It will be used for storage of any hazardous wastes until they can be backhauled for recycling or disposal. All hazardous wastes will be sealed in appropriate, clearly labeled, watertight containers, such as 205 L steel or plastic drums.

All containers housing hazardous waste will be stored within “Arctic Insta-Berms”, or similar, for secondary containment. These types of berms utilize chemical and fire-resistant fabric (generally polyurethane coated nylon or vinyl coated polyester material) designed for extreme arctic temperatures and puncture resistance. “RainDrain” or similar hydrocarbon filtration systems will be used to safely remove any water collected inside the berms, and as a safeguard against any potential overflows of contaminated water.

All waste storage areas will be clearly marked and labeled with appropriate signage. Within the storage area, wastes will be segregated by type, and labeled to ensure safety for handlers and appropriate disposal.

4.2 Incinerator

The Aston Bay Property will utilize a batch feed dual-chamber controlled air incinerator to dispose of combustible solid wastes. If sewage will be incinerated, Aston Bay will ensure that the incinerator is a model that is specifically designed to be capable of incinerating this type of waste. These types of incinerators typically produce the highest quality burn, with the least amount of ash and airborne particles. Residual ash backhauled and disposed of appropriately.

All combustible wastes will be incinerated in accordance with applicable federal and territorial regulations and the Nunavut Department of Environment *Guideline for the Burning and Incineration of Solid Waste.*

5. Training

All on site management and any personnel required to handle hazardous wastes must have valid First Aid, WHMIS, and Transportation of Dangerous Goods (“TDG”) training. Site and job-

specific training will be provided to all personnel who are required to handle waste materials. All employees and contractors will receive training in emergency response and spill response, as outlined in the Aston Bay Property "Emergency Response Plan" and "Spill Prevention and Response Plan", respectively. Personnel responsible for operating or maintaining the incinerator will receive hands on training to ensure the equipment is operated safely and efficiently.

6. Inspection and Monitoring

Inspections of the hazardous waste storage area and other waste storage facilities will be conducted daily. Daily inspections will include an assessment of the condition of waste receptacles and storage containers, checking for any damaged or leaking containers or berms, and ensuring that waste is collected and stored in the correct containers and storage areas. More detailed weekly inspections will be conducted to ensure the hazardous waste inventory is up to date, secondary containment is in place and in good condition, and spill kits are fully stocked and available. These inspections will be completed in conjunction with those outlined in the Aston Bay Property "Fuel Management Plan." An example of a daily/weekly Inert and Hazardous Waste Containment Inspection form is attached in Appendix B. Any leaks or spills will be treated as outlined in the "Spill Prevention and Response Plan." The Project Supervisor is responsible for supervising the monitoring and inspection program and keeping a detailed inventory of all hazardous wastes on site.

Appendix A: Figures

Figure 1 Aston Bay Property location.

Figure 2. Aston Bay Project Extent and drilling areas.

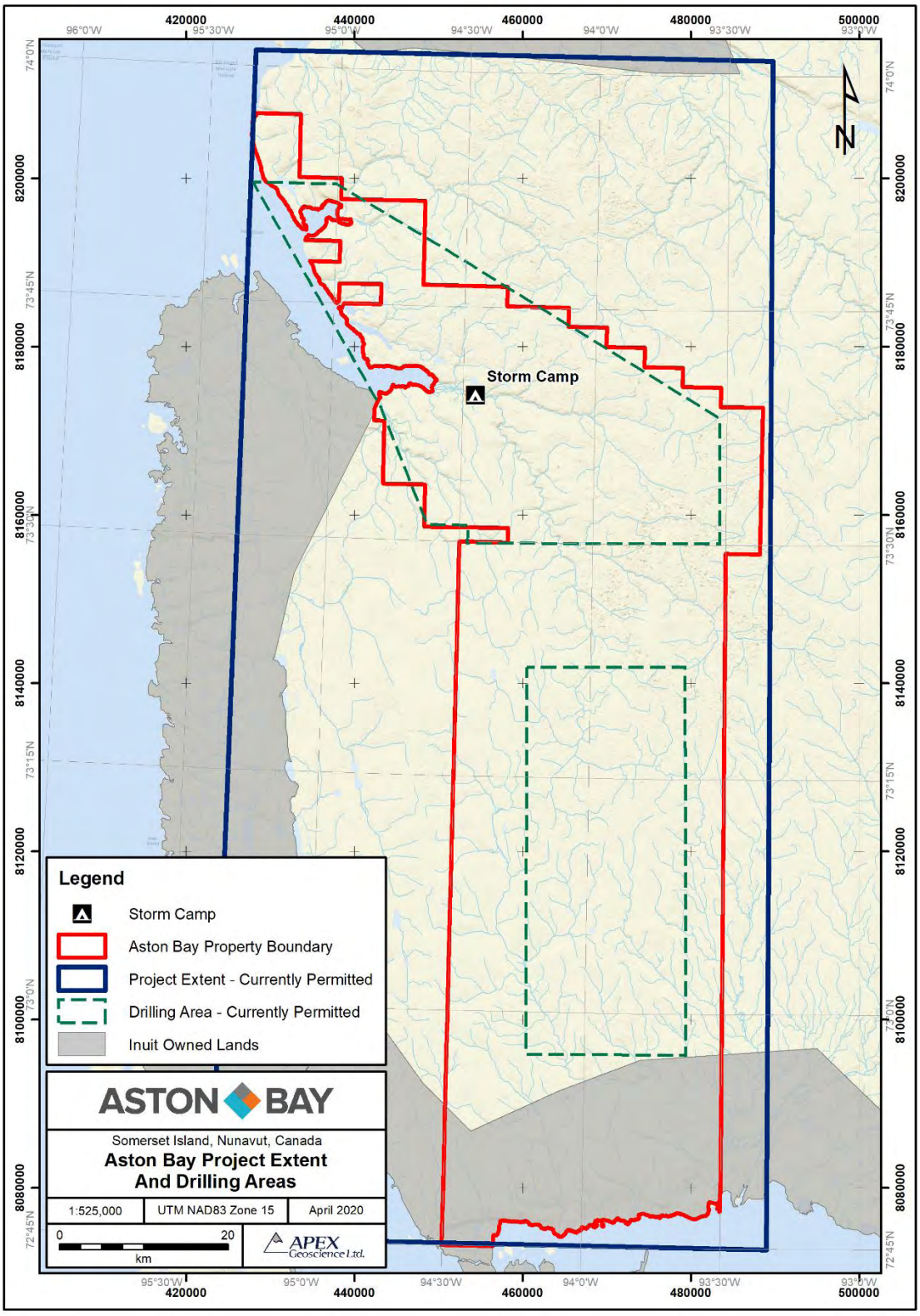

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Figure 3. Aston Bay Property mineral tenures.

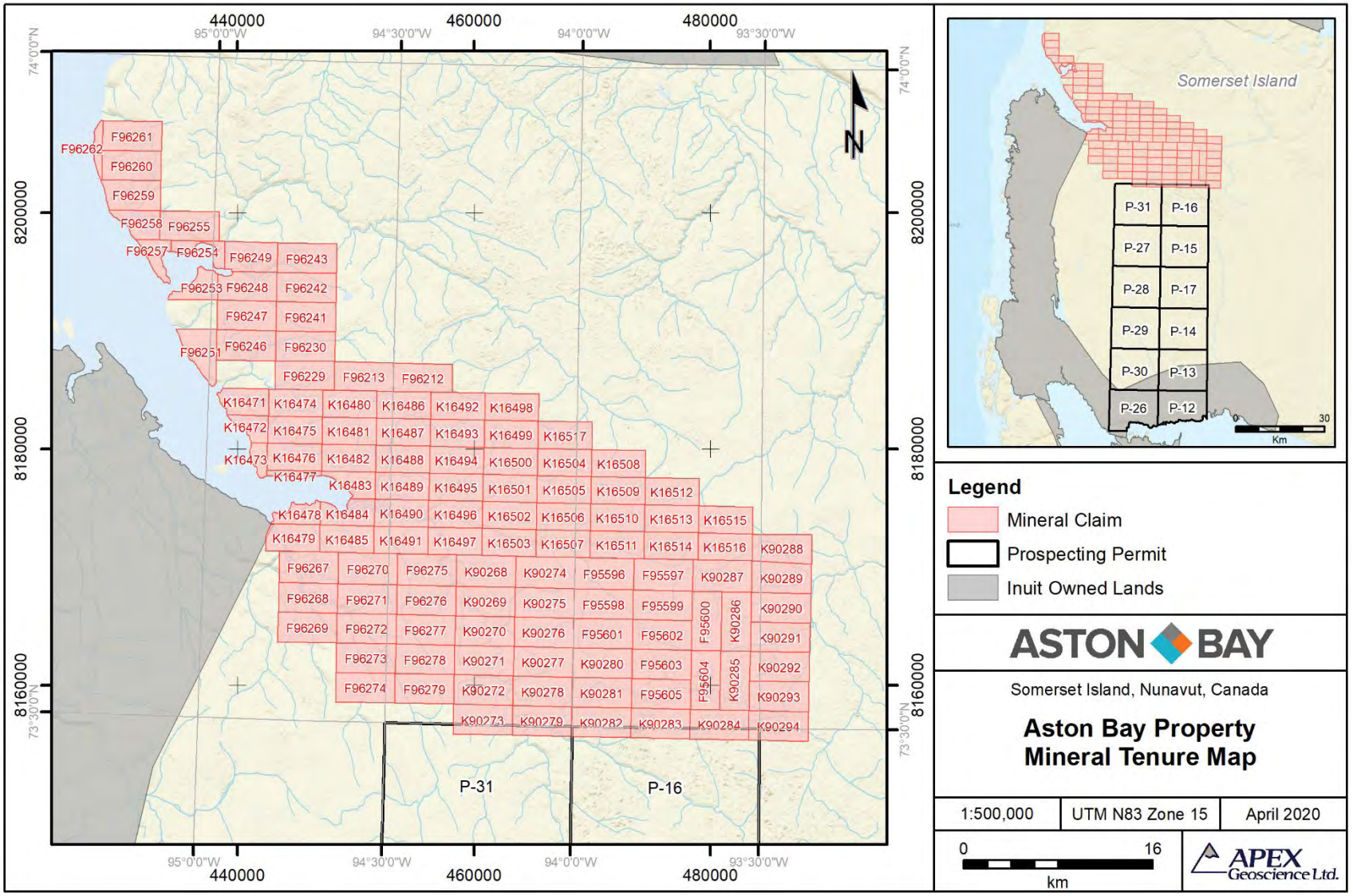

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Figure 4. Storm Camp and airstrip locations.

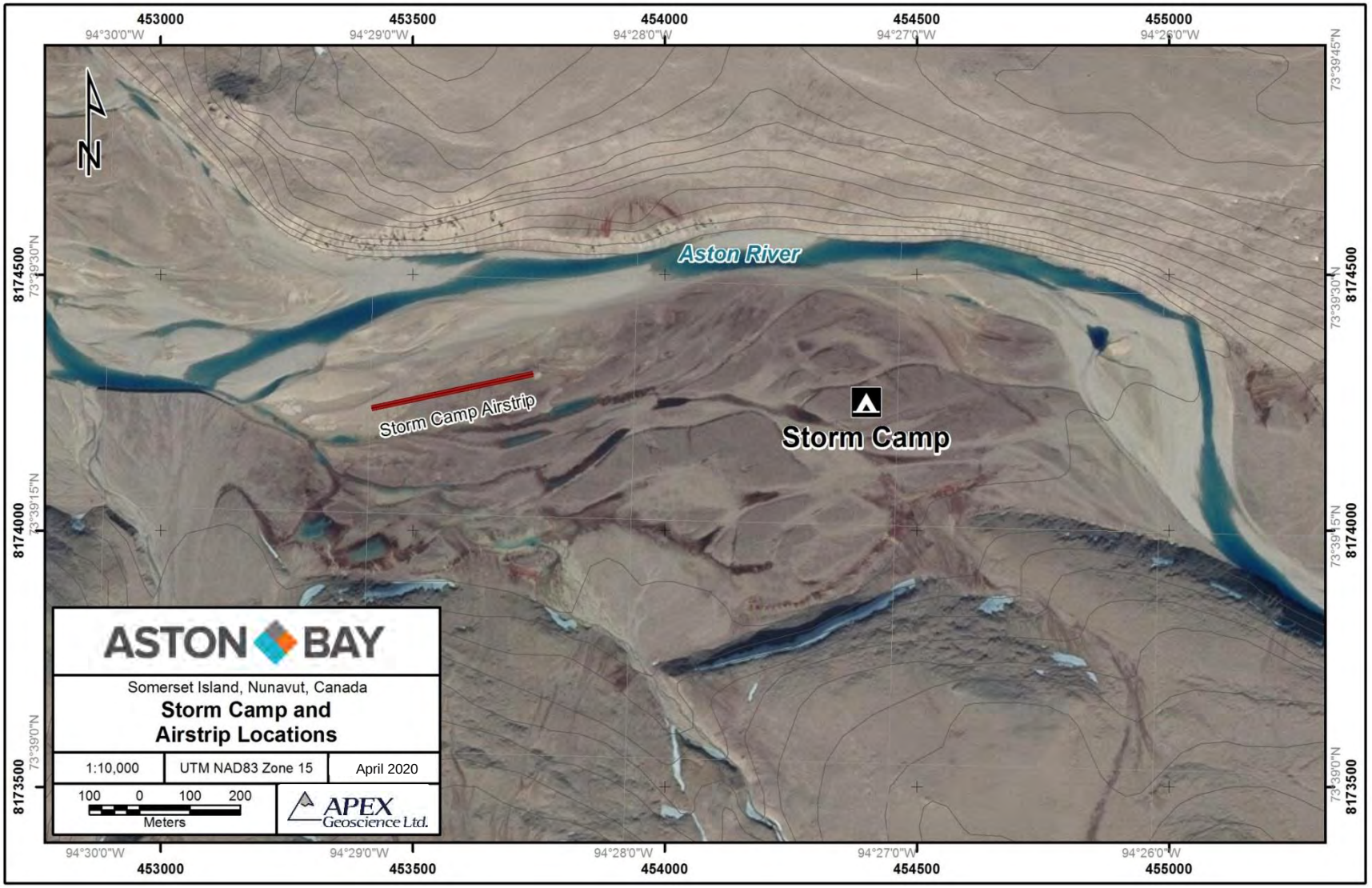
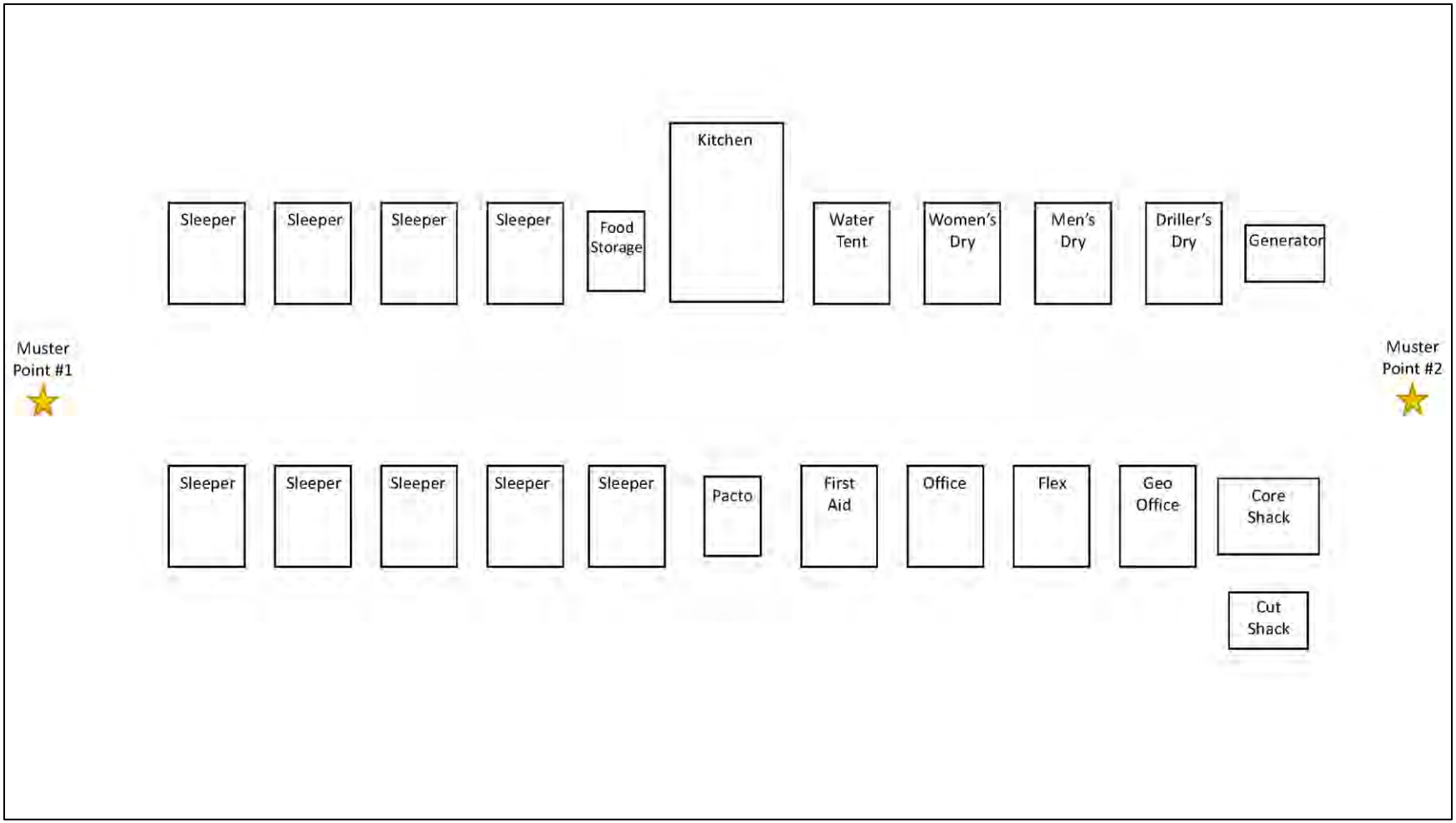


Figure 5. Storm Camp map.



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Appendix B: Example Daily and/or Weekly Hazardous Waste Containment Inspection Record

Inert and Hazardous Waste Container Storage Inspection Checklist

Each Day/week, place a "Yes" next to all inspection items that meet the Aston Bay Property WMP rules. Place a "No" next to all inspection items that do not meet the rules.
Please provide specific comments on all "No-marked"items. When inspection is completed, inspector must initial at the bottom of the table.
Report all No-marked items to appropriate supervisor immediately.

Inert Wastes

Name and Location of Waste Storage Area:

Inspection Item	Mon	Tue	Wed	Thur	Fri	Sat	Sun	Inspector	Comments on Inspected Item
Wastes Segregated by Type (ie. food, recyclable, combustible, etc)									
Number of Containers in Unit									
Containers Marked/Labeled Properly									
Containers Dated Properly									
Containers Observed with Closed Tops or Bungs									
Containers Observed to be free of leaks/staining									
Containers Observed to be free of Dents or Corrosion									
Area Clean and Safe									
Emergency equipment available									
Emergency equipment in good condition									

General Comments:

Hazardous Wastes

Name and Location of Waste Storage Area:

Inspection Item	Mon	Tue	Wed	Thur	Fri	Sat	Sun	Inspector	Comments on Inspected Item
Number of Containers in Unit									
Containers Marked/Labeled Properly									
Containers Dated Properly									
Containers Observed with Closed Tops or Bungs									
Containers Observed to be free of leaks/staining									
Containers Observed to be free of Dents or Corrosion									
Containers in Secondary Containment System									
Secondary Containment System free of Water or Other Liquids									
Secondary Containment System free of Leaks/Holes/Tears									
Area Clean and Safe									
Emergency equipment available									
Emergency equipment in good condition									

General Comments:

Appendix C: Canada-Wide Standards for Dioxins and Furans

Canadian Council of Ministers of the Environment

CANADA-WIDE STANDARDS

for

DIOXINS AND FURANS

Endorsed by CCME Council of Ministers, April 30-May 1, 2001, Winnipeg

CANADA-WIDE STANDARDS
for
Dioxins and Furans

PREAMBLE

Dioxins and Furans

Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), commonly known as dioxins and furans, are toxic, persistent, bioaccumulative, and result predominantly from human activity. Due to their extraordinary environmental persistence and capacity to accumulate in biological tissues, dioxins and furans are slated for virtual elimination under the *Canadian Environmental Protection Act (CEPA*), the federal *Toxic Substances Management Policy (TSMP) and* the CCME *Policy for the Management of Toxic Substances.*

The presence of dioxins and furans in the Canadian environment can be attributed to three principle sources: point source discharges (to water, air and soil), contamination from *in situ* dioxins and furans, and loadings from the long-range transportation of air pollutants (LRTAP).

LRTAP is the focus of multilateral conventions and bilateral accords at the international level.

Dioxin and furan contamination found in soil, water, sediments, and tissues (*in situ* contamination), is the subject of national guidelines for dioxins and furans. These guidelines outline ambient or "alert levels" which may be used by jurisdictions as benchmarks for the management and monitoring of dioxins and furans already present in the environment.

Point source discharges to water have been the target of aggressive federal and provincial regulation, as well as industry innovation and change. Discharges of dioxins & furans to the aquatic environment reached non-measurable levels in 1995.

Development of the Canada-wide Standard

The Canada-wide Standards process has focussed on anthropogenic sources that are releasing dioxins and furans to the atmosphere and soil in a continuous process.

In January 1999, the Federal/Provincial Task Force on Dioxins and Furans released the *Dioxins and Furans and Hexachlorobenzene Inventory of Releases* which documented the current understanding of anthropogenic sources in Canada releasing dioxins and furans. The *Inventory of Releases* lists emissions from over 20 sectors by province and territory, and provides national summaries for each sector.

Initial efforts have focused on atmospheric releases, the most complete component of the Inventory. Six priority sectors, varying from regional to national in scope, accounting for about 80% of national emissions have been identified as priorities for early action. These are waste incineration (municipal solid waste, hazardous waste, sewage sludge and medical waste); burning salt laden wood in coastal pulp and paper boilers in British Columbia; residential wood combustion; iron sintering; electric arc furnace steel manufacturing; and conical municipal waste combustion in Newfoundland.

To date, CWSs have been developed for the coastal pulp and paper boiler and the incineration sectors. CWSs for the remaining priority sectors will be completed in 2001. Additional source sectors, many of which contribute very small amounts of dioxins and furans emissions, will also be addressed in 2001 as will releases to soil.

Development of CWSs for dioxins and furans has taken into consideration environmental benefits, available technologies, socio-economic impacts, opportunities for pollution prevention and collateral benefits from reductions in other pollutants.

In recognition of the ultimate goal of virtual elimination, pollution prevention is being encouraged as the preferred method for avoiding the creation of dioxins or reducing releases to the environment.

Wherever possible, work on the dioxins and furans CWSs has been coordinated with other ongoing processes (e.g. Mercury CWS and the Strategic Options Process). A multi-pollutant approach will be carried forward to the remaining sectors while ensuring that dioxins and furans issues are addressed and that the ultimate goal of virtual elimination is kept clearly in mind. Opportunities for a multi-pollutant approach will also be pursued as part of the implementation of the Dioxins and Furans Canada-wide Standard.

During development of the inventory, it was realized that the data on dioxins and furans is limited. The information in the dioxins and furans inventory will be refined and updated on a regular basis through a variety of sources including the National Pollutants Release Inventory (NPRI) as a means of tracking progress and as a means of identifying any future sources of releases that must be addressed.

PART 1:

Pulp and Paper Boilers Burning Salt Laden Wood

Rationale for standard

Unique to British Columbia, the burning of salt laden wood results in an annual release of 8.6 gTEQ/year to the atmosphere or 4.3 percent of the national total of dioxin and furans emissions documented in the inventory of releases prepared under the Canadian Environmental Protection Act.

As a result of mill closures and voluntary industry initiatives that have reduced atmospheric releases, the current total represents a 25% reduction from 1990 releases.

Dioxins and furans emitted from coastal pulp and paper mills are created through the burning of salt contaminated hogged fuel. Logs transported and stored in salt water take up chlorine into the bark. The bark is stripped from the logs and ground up to produce hogged fuel.

This material is then used as boiler fuel to produce heat and electrical energy for the pulp and paper process. Over 1.4 million oven dried tonnes of hogged fuel were used by the coastal pulp and paper industry in B.C. in 1998.

Nature and application:

The CWS for this sector consists of two components. The first component sets out numeric targets and timeframes for reducing emissions from new and existing boilers. This standard applies to boilers burning more than 10,000 oven dry metric tonnes per year of hogged fuel generated from wood transported or stored in salt water. All boilers currently reliant on hogged fuel generated from wood transported or stored in salt water currently consume in excess of 50,000 oven dry metric tonnes annually. As part of the implementation of this standard, procedures will be put in place to report on the salt content of the hogged fuel to ensure compliance with the standard.

The second component sets out a process for further examining pollution prevention opportunities to prevent the creation of dioxins and furans.

Numeric Target and Timeframe for Achieving Target

Dioxin and furan emissions will be less than 100 pg/m^3 TEQ for new boilers constructed after the effective date of this standard.

Dioxin and furan emissions will be less than 500 pg/m^3 TEQ for all existing boilers by 2006. "New" means a total replacement including firebox, heat transfer surfaces and air emission control equipment.

The standard for existing boilers is set pending the acquisition of further test data and controlled studies of boiler operation. Recognizing the ultimate objective of virtual elimination as set out in the Canadian Environmental Protection Act, the mill operators will voluntarily pursue further reductions in emissions during the period of the standard. In doing so the operators will conduct additional studies to identify the reasons for higher dioxin and furan emissions at some locations and explore and, as practicable, implement measures to achieve virtual elimination at all locations. Measures to be explored include physical and process modifications to prevent or reduce dioxin and furan formation as well as emission control upgrades and/or other pollution prevention measures.

Every boiler covered by this standard will be tested twice per year to determine the level of dioxin and furan air emissions for the years prior to 2003 and annually for the years 2003 and thereafter. Testing and reporting will be performed using methods and procedures acceptable to the responsible provincial ministry.

The standard for existing boilers will be reviewed in 2003 based on the results of the additional testing, the additional studies on dioxin and furan creation and opportunities to achieve virtual elimination and the examination of other pollution prevention opportunities.

Pollution Prevention Strategy

In addition to the continuing efforts of pulp and paper mill operators to capture emissions of dioxin and furans, emphasis will be placed on identifying and implementing opportunities to prevent the creation of dioxins and furans. A strategy identifying opportunities to eliminate the formation of dioxins and furans by the coastal pulp and paper industry will be developed through a multi-stakeholder process by December 31, 2001 to provide a framework for continual progress towards the elimination of dioxin and furans.

Recognizing that most opportunities for avoiding the creation of dioxins and furans fall beyond the exclusive influence of the coastal pulp and paper mill operators, preparation of this strategy must engage a wide range of stakeholders.

The range of issues to be addressed in developing the strategy could include:

- maximum allowable salt content for hogged fuel
- removal of chloride from logs
- hogged fuel washing and pressing
- options for blending hogged fuel of different salt levels
- alternatives to log handling, transportation and storage practices that rely on salt water
- impacts of the length of time entailed in transportation and storage on the salt content of hogged fuel
- inclusion of transportation modes and effects in eco-certification criteria
- in-plant opportunities to avoid creation of dioxins and furans
- alternative fuel opportunities and costs
- providing greater opportunities for market intervention by improving the understanding of the costs being imposed on the pulp and paper mills by current log handling and storage practices

Waste Incineration

Rationale for standard

Waste incineration has historically been responsible for a significant portion of the dioxins and furans emitted in Canada. The total release of dioxins and furans from this sector amounts to 44.9 g/ TEQ/y or 22.5% of the total releases to the atmosphere.

Improved exhaust gas controls to reduce emissions of acid gases and fine particulates or activated carbon injection systems have decreased emissions of both mercury and dioxins and furans from the municipal solid waste (MSW) sector. Dioxins and furans emissions from this sector are estimated to be approximately 8.4 g/yr. Many medical waste incinerators have closed for economic or environmental reasons. However, a range of medium-to small-sized facilities remain. Individually these are small sources, but as a sector they are significant, emitting an estimated 28.8 g/yr. Two additional incineration sectors, hazardous waste (7.6 g/yr) and sewage sludge (0.1 g/yr), are also addressed by the CWS.

A Canada-wide Standard for incineration of MSW in conical waste combusters in Newfoundland will be brought forward in 2001. Newfoundland has committed to reviewing the use of these facilities and to considering a phase-out strategy that will reduce emissions of dioxins and furans as well as mercury. These actions are also identified in the Mercury Canada-wide Standard accepted by the Council of Ministers in November 1999.

Actions to reduce national emissions require that any new facilities meet stringent limits, and that the bulk of the emissions from existing facilities be controlled through retrofits with control technology that is efficient at destroying dioxins and furans. Diverting waste from incinerators would result in less incineration overall and thus avoid creation of dioxins and furans. All facilities, and particularly smaller ones, may find that pollution prevention, waste segregation and diversion are options for either achieving the limit, or reducing "end-of-stack" expenditures, and during implementation all facilities should be encouraged to place a priority on reduced inputs rather than controlled releases.

Definitions:

Waste incinerator: a device, mechanism or structure constructed primarily to thermally treat (e.g., combust or pyrolyze) a waste for the purpose of reducing its volume, destroying a hazardous chemical present in the waste, or destroying pathogens present in the waste. This includes facilities where waste heat is recovered as a byproduct from the exhaust gases from an incinerator, but does not include industrial processes where fuel derived from waste is fired as an energy source as a matter incidental to the manufacture of the primary product. For the purpose of the Dioxins and Furans CWS, conical waste combusters are considered separately from other incineration sectors.

Municipal solid waste: any waste which might normally be disposed of in a non-secure landfill site if not incinerated (i.e., including non-hazardous solid wastes regardless of origin), but is not intended to include "clean" wood waste. Clean wood waste means waste from woodworking or forest product operations where the wood waste has not been treated with preservative chemicals (e.g., pentachlorophenol) or decorative coatings.

Medical waste: any waste which includes as a component any Biomedical Waste as defined in the February 1992 CCME Guidelines for the Management of Biomedical Waste in Canada, with the exception that animal wastes derived from animal health care or veterinary research and teaching establishments are excluded.

Determined efforts: Determined efforts include the ongoing review of opportunities for reductions and implementation of in-plant changes and/or emissions control upgrades that are technically and economically feasible and which confer on-going reductions in emissions. Where possible, dioxin and furan emission reductions will be determined by way of a one-time stack test conducted after implementation of the measures. Where testing is not possible or will not provide reliable results, an audit of the dioxin and furan emission reductions associated with waste diversion or other measures is an acceptable alternative. Opportunities for regional consolidation and/or phase-out of smaller facilities may also be considered.

Nature and application:
Emission limits are expressed as a concentration in the exhaust gas exiting the stack of the facility. New or expanding facilities will be expected to comply immediately with the standard, and it will be up to individual jurisdictions to determine what constitutes a significant expansion to trigger the standard. The limits for existing facilities are capable of being met using generally available technology or waste diversion. Larger facilities will be subject to stack testing as described in Annex 1 to verify compliance with the limit. Smaller medical and municipal facilities will have the option of reporting on an audit of the dioxin and furan emission reductions associated with waste diversion or other measures or conducting a one-time stack test, to illustrate progress towards the standard.

Numeric targets:
The following standards are a step towards achieving virtual elimination for dioxins and furans.

For new or expanding facilities of any size, application of best available pollution prevention and control techniques, such as a waste diversion program, to achieve a maximum concentration[1] in the exhaust gases from the facility as follows:

Municipal waste incineration	80pg I-TEQ/m^3
Medical waste incineration	80pg I-TEQ/m^3
Hazardous waste incineration[2]	80pg I-TEQ/m^3
Sewage sludge incineration	80pg I-TEQ/m^3

[1] Stack concentrations of dioxins and furans will be corrected to 11% oxygen content for reporting purposes.
[2] Hazardous waste incinerators include all facilities that burn hazardous waste including low level radioactive waste; however they do not include facilities that use waste derived fuel or used oil.

For existing facilities application of best available pollution prevention and control techniques, to achieve a maximum concentration[1] in the exhaust gases from the facility as follows:

Municipal waste incineration	
> 26 Tonnes/year[3]	80pg I-TEQ/m^3
< 26 Tonnes/year[4]	80pg I-TEQ/m^3
Medical waste incineration	
> 26 Tonnes/year[3]	80pg I-TEQ/m^3
< 26 Tonnes/year[4]	80pg I-TEQ/m^3
Hazardous waste incineration [2]	80 pg I-TEQ/m^3
Sewage sludge incineration	100 pg I-TEQ/m^3

Timeframe for achieving the targets:
Any new or expanding facility will be required to design for and achieve compliance immediately upon attaining normal full scale operation, compliance to be confirmed by annual stack testing..

Based on determined efforts in working towards virtual elimination, existing facilities will be required to meet the standards on the following schedule:

Municipal waste incineration	2006
Medical waste incineration	2006
Hazardous waste incineration	2006
Sewage sludge incineration	2005

Pollution Prevention Strategy:
In addition to the continuing efforts of waste incinerator operators to destroy or capture emissions of dioxin and furans, emphasis will be placed on identifying and implementing opportunities to prevent the creation of dioxins and furans as well as emissions of air pollutants and ash quality generally. As an initial action with shared responsibility by all jurisdictions, strategies identifying opportunities to minimize waste incineration emissions of air pollutants including dioxins and furans will be developed through a multi-stakeholder process by December 31, 2001 to provide a framework for continual progress towards the elimination of dioxin and furans.

Recognizing that many opportunities for minimizing air pollutant and ash emissions and specifically avoiding the creation of dioxins and furans fall beyond the exclusive influence of the operators of waste incinerators, preparation of this strategy must engage a wide range of stakeholders.

[3] Larger facilities must achieve this stack concentration as confirmed by annual testing.
[4] Smaller facilities must make determined efforts to achieve this stack concentration.

The range of issues to be addressed in developing the strategy could include:

- waste diversion initiatives to minimize the generation of wastes destined for disposal (waste reduction, material reuse options)
- waste segregation initiatives aimed at materials with greater potential to generate emissions of dioxins and furans or other air pollutants of concern (e.g., mercury, other heavy metals) and aimed at diverting those wastes to recycling or other non-incineration disposal options
- combustion control strategies to optimize performance of existing combustors at destroying pollutants of concern
- use of alternative disposal or treatment technologies (e.g., anaerobic digestion of wastes with material recovery and combustion of biogas)

PART 2:

Reporting on Progress:
Ministers will receive reports on progress in achieving the CWS by jurisdictions in Spring 2004 and Spring 2008. Ministers will ensure that a single public report is prepared and posted on the CCME web site for public access. The report in 2004 will reflect interim progress on achieving the CWSs. Progress on both implementation of the numeric targets and the activities applied as part of the determined efforts provisions for smaller medical waste and municipal solid waste facilities will be documented. The 2008 report will evaluate whether targets have been met and the effectiveness of the determined efforts with respect to smaller facilities. More details on reporting are available in Annex 1.

Each jurisdiction will detail the means of ensuring achievement of the CWS in a manner consistent with the typical or desired programs for the affected facility/sector, so as not to impose an unnecessary level of reporting duplication.

With a view to continuous improvement towards the goal of virtual elimination, an evaluation of the Dioxin and Furan Canada-wide Standards will be presented to Ministers in Spring 2006. The evaluation will consider new scientific, technical and economic information and provide an assessment of the need to develop the next set of CWS targets and timelines to continue progress toward virtual elimination.

ADMINISTRATION:

Jurisdictions will review and renew Part 2 and Annex 1 five years from coming into effect.

Any party may withdraw from these Canada-Wide Standards upon three month's notice.

These Canada-Wide Standards comes into effect on May 1, 2001.

Annex 1
Dioxins and Furans CWS Reporting Framework

Introduction

Under the Harmonization Accord and its Canada-wide Environmental Standards Sub-Agreement, all jurisdictions are to report to the public and to Ministers on their progress towards achieving the CWSs for dioxins and furans.

This reporting framework is intended to provide a transparent and consistent mechanism for reporting by jurisdictions in a fashion which minimizes resource requirements for government and industry alike, while maximizing the availability of information on achievement of these standards.

The framework addresses:

1) frequency, timing and scope of reporting
2) guidance as to the means of determining compliance/achievement of the CWS
3) common measurement parameters for reporting purposes
4) data management and public reporting

Frequency, timing and scope of reporting

The reporting schedule will be tied into assessing the performance of the governments in meeting the benchmarks and timelines relevant to the standards. A report in 2004 will provide a means for tracking interim progress and report on additional technical studies (e.g. technology feasibility and pollution prevention options for the coastal pulp & paper sector). The 2008 report will indicate compliance with the standards for the coastal pulp and paper boiler and incineration sectors.

Jurisdictions will submit sectoral data for inclusion in the progress reports in a timely manner. To report on achievement of the CWS, a data report along with an assessment of progress will be compiled into a single report for Ministers and a public version will be posted on the CCME web site for public access.

Reports will be limited to information on those facilities which are subject to achievement and/or compliance with the Canada-wide Standards as endorsed by the Ministers of the Environment May 1, 2001 and as implemented variously by the responsible jurisdictions or industries. This information is intended to show compliance rates and performance characteristics in a manner which documents sectoral performance as well as jurisdictional performance. It is not intended to provide a facility-by-facility record of performance.

Means of determining compliance/achievement of the CWS

The Canada-wide Standards for dioxins and furans lend themselves to achievement through voluntary action, or through compliance with regulated or legally enforceable limits. As such, it is necessary to provide some means to ensure that a level playing field exists so that the numeric value provided in the CWS is applied equally or similarly in each jurisdiction. One means to do this is to require identical compliance procedures, but this may require that some jurisdictions apply compliance procedures for dioxins and furans CWSs that are different than those used for locally determined or regulated parameters such as SO_2, PM, ammonia, etc. An example is where the dioxins and furans CWS is expressed as the average of 3 stack tests, whereas a jurisdiction may normally utilize the median value of 3 tests to determine compliance.

In an effort to streamline implementation, each jurisdiction will determine the exact means of ensuring compliance/achievement in a manner consistent with the typical or desired programs for the affected facility/sector. It is anticipated that minor variations in jurisdictional requirements will result in minimal variation across the country which is insignificant with respect to the overall reduction activities which range from 50-99% for various facilities.

Common measurement parameters for reporting purposes

Each facility report will include specific measures corrected so as to be compatible and consistent for the purposes of public reporting. Dioxin and furan emissions must be corrected for the O_2 content of gases, to ensure compliance with the standards.

Each jurisdiction will determine the sector within which each subject facility will be reported. For example, a jurisdiction may determine that a small mixed waste incinerator (for example, burning both medical and municipal waste) may be subject to either standard, based upon the preponderance of waste (>50% as one type) or based upon the provincial designation of facility type. Sectoral assignments will be updated to reflect the most recent characteristics of the facility under consideration prior to reporting.

While little confusion is likely to exist over the implementation of dioxins and furans CWSs for "greenfield" facilities, it is possible that significantly expanded or modified facilities can/should be considered as new for the purposes of achievement/compliance with the dioxins and furans CWS. It will be the responsibility of the jurisdictions to determine at which point a facility no longer qualifies as an "existing" facility and must conform to the standard for "new or expanded" facilities as a result of significant modifications/alterations to the facility operations or physical plant.

Jurisdictions must report measurements that are below the detection limit in a consistent manner. These measurements should be reported as the limit of detection.

Large facilities will generally be required to perform stack tests at an annual frequency in order to demonstrate compliance. However, jurisdictions may vary the stack testing requirements for these facilities in cases where performance has been consistently demonstrated to be below the Level of Quantification (LoQ) as defined by Environment Canada. Where five years' data has been accumulated with all results reported below the LoQ, the stack testing frequency may be revised to a biennial schedule so long as all subsequent test results remain below the LoQ. For the purpose of reporting emissions, the most recent stack test results available should be used. Jurisdictions have the responsibility of deciding whether to implement this variance for all, some or none of the source types subject to these standards.

Data management and public reporting

Reports on achieving the CWSs will include a data report and a report on achievement of the standards. Sectoral and jurisdictional specific data will be supplied in a spreadsheet format to facilitate reporting. A consolidated report will be made available to all jurisdictions and to the Ministers, along with the draft public report, prior to formal release of the public report. The public report will be released upon approval by the Council of Ministers.

Jurisdictions will provide a report in spreadsheet format so that the data report and report on achievement can be prepared along with the public report for review and approval. Reports will be prepared and distributed to all jurisdictions prior to review by Ministers. Along with the report on achievement, a draft public report will be provided for review and consideration prior to the Ministers' meeting at which public release is anticipated. That public report will be posted to the CCME web site upon approval by the Ministers. Jurisdictions are encouraged to provide reference to the CCME web site and/or pointers in their own web sites in order to ensure a single location for dioxins and furans CWSs reporting should errors/miscalculations have to be corrected at some time.

In addition to the consolidated public reporting on dioxins and furans CWSs, jurisdictions must provide a contact for facility-specific information in the advent that the public wishes to access compliance or achievement information. Such data will be supplied in a manner consistent with the normal data-reporting/compliance reporting procedures of the jurisdiction in question - the consolidated spreadsheet will not be made publicly available in that it may include proprietary (business) information.

Canada-wide Standards for Dioxins and Furans Emissions from Waste Incinerators and Coastal Pulp and Paper Boilers

Signed by:

British Columbia	Honourable Ian Waddell
Alberta	Honourable Lorne Taylor
Saskatchewan	Honourable Buckley Belanger
Manitoba	Honourable Oscar Lathlin
Ontario	Honourable Elizabeth Witmer
Environment Canada	Honourable David Anderson
New Brunswick	Honourable Kim Jardine
Nova Scotia	Honourable David Morse
Prince Edward Island	Honourable Chester Gillan
Newfoundland and Labrador	Honourable Ralph Wiseman
	Honourable Tom Lush
Yukon	Honourable Dale Eftoda
Northwest Territories	Honourable Joseph Handley
Nunavut	Honourable Olayuk Akesuk

Note: Québec has not endorsed the Canada-wide Accord on Environmental Harmonization or the Canada-wide Environmental Standards Sub-agreement.

Endorsed by CCME Council of Ministers - April 30-May 1, 2001, Winnipeg

Appendix D: Environmental Guideline for the General Management of Hazardous Waste

Environmental Guideline for the
General Management of Hazardous Waste

Department of Environment
Government of Nunavut

APEX Geoscience Ltd.

GUIDELINE: GENERAL MANAGEMENT OF HAZARDOUS WASTE

Original: April 1999
Revised: January 2002
April 2010
October 2010

This Guideline has been prepared by the Department of Environment's Environmental Protection Division and approved by the Minister of Environment under the authority of Section 2.2 of the *Environmental Protection Act*.

This Guideline is not an official statement of the law and is provided for guidance only. Its intent is to increase the awareness and understanding of the risks and hazards associated with hazardous waste and to assist in its proper management. This Guideline does not replace the need for the owner or person in charge, management or control of a hazardous waste to comply with all applicable legislation and to consult with Nunavut's Department of Environment, other regulatory authorities and qualified persons with expertise in the management of hazardous waste.

Copies of this Guideline are available upon request from:

Department of Environment
Government of Nunavut
P.O. Box 1000, Station 1360, Iqaluit, NU, X0A 0H0
Electronic version of the Guideline is available at http://env.gov.nu.ca/programareas/environmentprotection

Cover Photos: E. Paquin

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