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Operation and Maintenance Plan
CFS Alert (ALT), Nunavut

In support of the
Nunavut Water Board Licence
No. 3BC-ALT1015

November 2010

Prepared for:
1 Canadian Air Division,
Department of National Defence

Prepared by:
Environmental Services
Defence Construction Canada

Canada

Table of Contents

LIST OF APPENDICES

ACRONYMS

8 Wing	8 Wing Trenton
Alert	CFS Alert
BOD	Biological Oxygen Demand
BRI-NRC	Biotechnology Research Institute of the National Research Council of Canada
CBO	Canadian Base Operator
cBOD	Carbonaceous Biological Oxygen Demand
CFS	Canadian Forces Station
COD	Chemical Oxygen Demand
DND	Department of National Defence
HazMat	Hazardous Material
LWPH	Lower Pumphouse
NWB	Nunavut Water Board
O&M	Operation and Maintenance
pH	Measure of acidity and alkalinity
PHC	Petroleum Hydrocarbon
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
SNP	Surveillance Network Program
TDGR	Transportation of Dangerous Goods Regulation
WHMIS	Workplace Hazardous Materials Information System

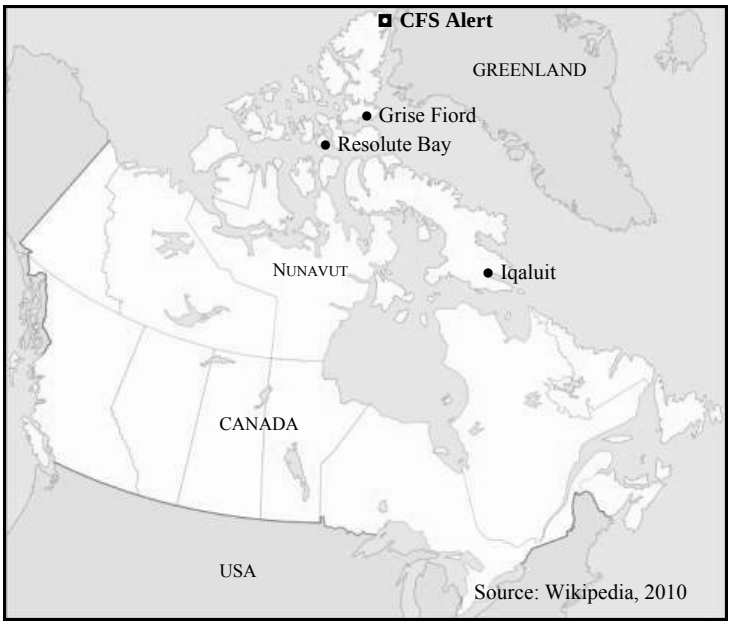
1. INTRODUCTION

1.1. Purpose

This document has been prepared in response to the requirements of the Nunavut Water Board (NWB) for the submission of an Operation and Maintenance (O&M) Plan, under Licence number 3BC-ALT1015, issued to the Department of National Defence (DND) on August 5, 2010 (refer to Appendix B). This new Class B Water Licence issued by the NWB allows for the use of water and the disposal of waste during operation and maintenance of Canadian Forces Station (CFS) Alert ("Alert"). This Plan has been prepared in accordance with the *Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories*, published in 1996. Implementation of this O&M Plan will commence upon written NWB approval.

1.2. Location

Alert is located on the north-eastern tip of Ellesmere Island within the Qikiqtani Region of Nunavut (Latitude 82°30'1"N/ Longitude 62°20'37"W; UTM Easting 552375.7996584666, Northing 6874583.726844844; map sheet number 120E05). Alert is situated on the coast of the Lincoln Sea, a water body part of the Arctic Ocean. The nearest communities to Alert are Grise Fiord and Resolute Bay, and are located approximately 780 km and 1080 km from the station. Alert was originally established as a High Arctic Weather Station in 1950, and is currently a remote camp maintained by DND which has been in continuous operation since 1958.



1.3. Geophysical Environment

Soils, Geology and Terrain
The surface horizon at Alert and surrounding area consists of tundra soils comprised of clay, silt and some gravel. The soil in this region is classified as a cryosol comprised of clayey silt. The region is underlain by shale and slate. Alert infrastructure (i.e., roads, buildings, etc.) is constructed on fine to course gravel fill material. The terrain at Alert is rugged and the station is surrounded by hills and valleys.

Climate
The polar climate is semi-arid. Alert experiences cool summers and cold winters, with prevailing winds from the west. The mean annual daily temperature is -18°C, with summer months having a mean daily temperature of 1°C and winter months having a mean daily temperature of -32°C. Alert experiences the most precipitation (in the form of rain and snow) during the months of July, August and September. Alert receives on average approximately 154 mm of precipitation annually. Mean monthly temperatures and precipitation data are as follows:

Mean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°C)	-32.4	-33.4	-32.4	-24.4	-11.8	-0.8	3.3	0.8	-9.2	-19.4	-26.4	-30.1
Precipitation (mm)	6.8	6.3	7.0	10.3	11.0	11.1	27.8	21.2	23.4	12.3	9.7	6.8

Source: Environment Canada, 2010.

Permafrost
Alert is located in a permafrost region classified as continuous permafrost. To date the maximum permafrost depth measured was 480 m in 1997. The active permafrost layer referred to as the permafrost table is at a depth of approximately 1 m from the ground surface (BRI-NRC, 2008).

Hydrology
Alert is located in a continuous permafrost region and lacks significant surface vegetation; therefore runoff is the primary water drainage process at the site. Runoff at the main station flows primarily to the east into Dumbell Bay and Parr Inlet, which are joined to Lincoln Sea. The sea is covered with pack ice year-round.

1.4. Location of Waste Facilities

Waste facilities at Alert include a sewage terrace system and the following four landfills: Main Station Landfill, Millionaire's Dump, Battery Dump and Dump 3. Refer to Figure 1, Appendix A for the location of these waste facilities at Alert.

1.5. Population Projections

The population at Alert generally ranges between 50-100 people throughout the year. Environment Canada is co-located at Alert and has a permanent station for various high arctic weather, flora and fauna studies. During summer months the population approaches 200 people

due to temporary visitors to the station (e.g., consultants, contractors, and visiting personnel), and during times of military exercises the population can expand to 400 people. The station's population is anticipated to remain the same over the next 5 years.

1.6. Contact List

Personnel responsible for the operation and maintenance of the sewage and solid waste facilities are as follows:

Facility	Position	Telephone No.
Sewage Terrace System	CFS Alert H_2O – Canadian Base Operator (CBO) (Contractor) Water Plant Supervisor	(613) 945-3145 ext 3215
Sewage Terrace System Solid Waste Facilities	CFS Alert Site Manager – CBO (Contractor) Site Manager	(613) 945-3145 ext 3262
Sewage Terrace System	8 Wing Construction & Engineering - Water, Fuel, Environment Supervisor	(613) 392-2811 ext 7498 or 2198

2. BACKGROUND

2.1. Water Supply

The community at Alert obtains its drinking water from Upper Dumbell Lake, a freshwater lake located approximately 2.5 km southwest of the core complex of the station (refer to Figure 1, Appendix A). The water intake pipe is located at a depth of 5 m and is comprised of a 250 mm high-density polyethylene tube containing a pump; the intake is equipped with a screen with a mesh size of 3 mm. The NWB has authorized the use of up to 185 m^3/day from the lake.

Upper Dumbell Lake has a surface area of 364 hectares and an average depth of 7.6 metres. Winter ice depth varies between 1,800 mm to 2,750 mm. Break-up is mid-July and freeze-up is early September. Runoff during open water was gauged at 13,600 m^3/day. The summer temperature reaches 4^oC and the winter temperature ranges from 0^oC to 2^oC at the bottom[1]. Upper Dumbell Lake discharges to Lower Dumbell Lake, then through an unnamed stream to the ocean.

Raw water is pumped continuously from Upper Dumbell Lake and transported via an aboveground heated insulated high-density polyethylene waterline approximately 2.5 km to the Water Treatment Plant in the core complex (refer to Figure 1, Appendix A). The water is treated with Kinetico's Macrolite media pressure filters and an ultraviolet purification treatment, then chlorinated and continuously pumped to storage reservoirs (2 x 227m^3 reservoir tanks). From the reservoir tanks water is either distributed out to the complex via a single pipe loop system throughout the station (refer to Figure 2, Appendix A), or returned to Upper Dumbell Lake to prevent freezing in the pipes and at the intake. Unused water at the termination of the water supply pipe within the complex is used as the feed for the fire sprinkler system for the main complex. Excess water from the storage reservoirs is discharged into the sewage pipeline. Bleeders are currently used to keep water lines flowing.

2.2. Sewage

Until recently sewage generated at the station was collected by a network of pipelines and discharged from an outfall in an area with a significant slope, approximately 250 m from the receiving body Parr Inlet. During the summer of 2010 a Sewage Terrace System, comprised of five terraces, was constructed between the sewage outfall and Parr Inlet. The old sewage outfall located to the south of the terrace system is no longer in use and has been decommissioned.

Sewage at the station is collected by a network of heated insulated high-density polyethylene gravity pipelines that collect sewage and wastewater from the buildings onsite (i.e., bathroom, kitchen, workplace, etc.) and discharges to the outfall (refer to Figures 2 and 3, Appendix A). The quantity of wastewater (containing sewage) discharged to the sewage outfall is estimated based on the water usage at the station.

[1] Arctic Water Supply System, E.G. Taylor, quoted by CFS Alert Water Treatment Plant Operation and Maintenance Manual, 1 Construction Engineering Unit, CFS Winnipeg, January 1979.

There is no activity or waste source at Alert that would indicate anything other than a normal domestic waste loading. The wastewater contains general residential-type waste, faeces, domestic cleaning compounds, and garburated food waste. Hazardous materials are not permitted to be disposed in the sewer. The sewage is diluted with unused drinking water and excess waste drinking water produced and bled from the water treatment plant, and then discharged to the terrace system from the sewage outfall. There is no primary or secondary treatment of sewage prior to discharge. The collection system is designed and operated conservatively to prevent freezing in the pipes.

2.3. Solid Waste

Garbage is collected daily in sealed containers or plastic bags. All combustible garbage is taken to the incinerator building and incinerated as required. Once cool, only ashes and clinker are disposed in the Main Station Landfill. The Main Station landfill is covered as time/equipment is available. Other dumps onsite include the Millionaire's Dump for disposing of large metals and bulky wastes, Dump 3 for disposing of vehicle parts and other metallic objects, and the Battery Dump formerly used to dispose of batteries (refer to Figure 1, Appendix A). No data exists for determining the composition of the solid waste generated at the station.

Recyclables such as aluminum cans and glass bottles are collected and shipped to 8 Wing Trenton, Ontario for recycling. Some hazardous materials generated at the station, such as batteries, are collected and stored in HazMat overpacks and shipped to 8 Wing Trenton for management and disposal.

There are no abandoned solid waste sites at the station; however, historically solid waste practices did not always meet current standards and as a result there are several areas of potential contamination. A delineation program led by the Royal Military College in Kingston, Ontario, is in place to characterize site contamination. It is understood that the station is moving toward an appropriate clean-up.

3. SEWAGE TREATMENT FACILITY O&M PLAN

3.1. Description

An engineered Sewage Terrace System is the type of facility used to dispose of sewage at the station. This system is located to the east of the station (refer to Figure 1) and is comprised of the outfall from the sewage pipe, hill side terracing, and once vegetation has established, a wetland at the base of the terrace.

Sewage is untreated and continuously flows from the outfall pipe and travels down grade approximately 200 to 250 m to the east through the terrace system prior to entering the receiving body Parr Inlet; refer to Figure 3 for as-built engineering drawing of terrace system. The terracing system length of approximately 500 m allows for sufficient dispersal of the sewage (or sludge) over the entire length of the system. The sediments settle and biodegrade during the summer through increased surface area exposure to aeration and natural ultraviolet-light exposure).

3.2. Operation and Maintenance Protocols

The purpose of Operation and Maintenance Plan for this system is to maintain continuous operation, prolong system life, prevent freezing of the sewer lines and ensure the treatment area performs as intended. The following table outlines the frequency and tasks to be completed to operate and maintain the sewage disposal facility.

Frequency	Tasks
Daily	▪ Check sewer lines, monitor temperatures throughout the station. ▪ Remove accumulated ice at the sewage outfall by hand/backhoe to prevent freezing of effluent and any damage related to ice jamming or ice lifting of the outfall pipeline (2-3 times/week during subzero temperatures).
As required	▪ Repair terraces, prevent channelling (summer). ▪ Repair/replace snow fencing to prevent snow accumulation at the Sewage Terrace System.
Monthly	▪ Sampling of effluent (during times of flow). ▪ Report sewage volumes.
Annually	▪ Report sampling results and sewage volumes.

The Sewage Terrace System was constructed during the summer of 2010 and therefore maintenance records have not yet been developed. Maintenance records shall include the details of any maintenance undertaken on the terrace system.

Weed and insect control is not required at the site. Birds and mammals such as wolves have been frequently observed in the area of the sewage outfall and terrace system. For over 25 years the Canadian Wildlife Service has been conducting an annual avian study on the birds attracted

to the waste water particles in the upper portion of the treatment area to gain a better understanding of high Arctic avian populations and the continuing effects of climate change.

3.3. Safety Procedures

Safety procedures have not yet been formalized for the sewage facility. Access to the sewage disposal area is not restricted; however, the following safety measures were put into operation for the sewage pipeline:

- A permanent rope lifeline has been constructed to aide operators walking along the sewage pipeline (between the Water Treatment Plan and the sewage outfall).
- The sewage outfall area is well lit.

4. SOLID WASTE O&M PLAN

4.1. Description

The following table identifies the contents, location, and the dimensions of the landfills and dumps onsite, and respective distances and directions from water and airport runway.

Landfills	Contents	Location	Dimensions	Distance from	
				Water Body	Airfield
Main Station Landfill	Solid domestic waste, incinerator ash, clinker	North of core complex	100x75 m	200 m west of Dumbell Bay	600 m south
Millionaire's Dump	Metals (larger metals, bulky wastes, etc.)	South of core complex	100x100 m	500 m west of Alert/Parr Inlet	2.2 km south
Dump 3	Vehicle parts, wire, other metallic objects	South of core complex	150x200 m (estimate)	200 m west of Alert/Parr Inlet	2.1 km south
Battery Dump	Depleted batteries*	South of core complex	75x75 m	700m west of Alert/Parr Inlet	2.5 km south
HazMat Barrel Compound	Empty metal drums/bins, other bulky metallic objects	South of core complex	30x60 m	400 m west of Alert/Parr Inlet	1.8 km south

* Depleted and spent batteries are shipped to 8 Wing Trenton and are no longer disposed of onsite.
N/A: Not available.

Since these solid waste facilities were constructed prior to licence conditions, as-built drawings are not available. The Main Station Landfill site was designed to manage surface water runoff and eliminate surface and subsurface contamination. Surface water that appears outside the disposal area is routed around the berms. Berms and ditches are repaired as required during summer months to maintain effective surface water runoff.
Conditions that could potentially affect normal operations of the solid waste disposal activities include: flooding in low-lying areas during spring melt, severe winter storms and high winds, and/or lack of qualified personnel (i.e., certification, qualifications, expertise) to handle (i.e., store, transport, dispose) specialized wastes.

4.2. Operation and Maintenance Protocols

The community of Alert produces numerous types of solid waste which include paper/cardboard, plastics (including styrofoam), hazardous waste, food waste, recyclables, metal waste and wood materials. Waste is manually segregated onsite. Disposal procedures are waste specific and include:

- Dry combustible materials (e.g., papers and cardboard) are compressed into bales and incinerated onsite.
- Plastic waste materials (e.g., containers and bags) are shredded and disposed of in the Main Station Landfill.
- Waste oils are disposed of in the waste oil burner to heat the maintenance building.
- Hazardous wastes such as fuel, glycol and oil rags are collected and incinerated.
- Hazardous materials such as batteries are collected, packaged and shipped to Trenton for further management/recycling; refer to Section 5.0 for further information on the disposal procedures for hazardous waste.

- Food waste such as bones and shells are incinerated to prevent attracting animals.
- All other food waste (i.e., non-bones/shells) is garburated, diluted and discharged through the waste water system to the sewage terrace system.
- Recyclables including aluminium cans and glass bottles are shipped to Trenton for further recycling.
- Metal waste materials are disposed of onsite at the Millionaire's Dump.
- Untreated wood materials are incinerated.
- Remaining waste (e.g., plastics, treated wood, etc.) is disposed on onsite at the Main Station Landfill, or Dump 3 (refer to Figure 1, Appendix A for specific locations of the landfills at the station).

The composition of waste generated at Alert is not recorded; however, waste records are maintained for all Hazardous Materials (HazMat) Disposal and Incineration activities at Alert.

Solid waste maintenance activities for Alert are identified and outlined as follows:

Activity	Procedures
Waste Collection	▪ Garbage is collected daily in sealed/secured in containers or plastic bags. ▪ For collection of Hazardous Waste refer to Section 5.
Segregation	▪ Domestic, metal and recyclable waste materials are manually separated. ▪ Food waste (except bones and shells) is garburated. ▪ Metal waste materials are isolated and disposed of at the Millionaire's Dump.
Waste Compaction	▪ All dry paper and cardboard waste are compacted into bails and incinerated in the incineration building. ▪ All plastic bags are shredded in the compaction room before disposal at the Main Station landfill.
Preventing Windblown Debris	▪ Waste placed in sealed containers or indoors. ▪ Main Station Landfill and Millionaire's Dump are capped annually with clean gravel (from the quarry).
Fencing and Signs	▪ No fencing or signs for the landfills due to strong winds. ▪ Safety signs and access control signs indoor for the incinerator building and compaction room.
Odour Control	▪ Deodorizing products are generally used daily in the compaction room. ▪ Cleaning/washing of compaction room occurs after every use (i.e., daily). ▪ There are no controls for odour at the dump aside from capping activities. ▪ Capping with gravel/fill material occurs at least annually, near the end of the summer season.
Burning*	▪ *Incinerator:* Incineration of dry waste, fuel/waste oils, other combustible wastes at Incinerator Building generally daily or as required (i.e., at least once a week). Ashes and clinker are disposed in the Main Station Landfill. ▪ *Open Air Bonfires:* Only non-treated wood materials (i.e., crates, pallets, scrap wood) are burned onsite in designated areas; bonfires are weather dependent and take place approximately 6-7 times per year.

* Alternatives to burning are dependent on the type of waste. Hazardous waste (i.e., fuel, waste oil) would be shipped by air to Trenton, and wood materials would be disposed of in the landfill.

4.3. Safety Procedures

Solid waste at Alert is generally managed to prevent animals from eating station waste. Upon arrival to the station, all personnel receive the solid waste orientation. Safety procedures for waste facility operators include adequate training (e.g., WHMIS, etc.) and the appropriate personal protective equipment (PPE) to be worn to handle waste and spills.

5. HAZARDOUS WASTE O&M PLAN

5.1. Description

Hazardous wastes at the station may include: paint, batteries, pcb (present and/or suspected), waste oil, waste oil drums, waste fuel, coolant, glycol, oil rags, oil-antifreeze mixture, oil filters, and aerosol cans.

5.2. Operation and Maintenance Protocols

All hazardous materials at Alert are managed in accordance with the *CFS Alert Hazardous Material (HazMat) Management Plan* dated September 2010 (refer to Appendix C). The *CFS Alert HazMat Management Plan* defines cradle-to-grave HazMat management (e.g., distribution, storage, application, etc.) and provides direction to all personnel at Alert. All HazMat wastes are identified, collected, segregated/stored, labelled, and disposed by the CBO HazMat Coordinator.

HazMat wastes are stored at registered storage sites, and as outlined in the *CFS Alert HazMat Management Plan* (Appendix C) in accordance with the following:

- Indoors, flammable HazMat is stored in approved flammable storage cabinets or in a manner approved by the Station Fire Safety.
- Refillable compressed gas cylinders are secured upright.
- HazMat is labelled in accordance with the WHMIS guidelines.
- Incompatible classes of hazardous materials are physically separated.
- HazMat storage areas are subject to approval by the Station Fire Chief.

Procedures outlining the return and disposal of HazMat waste to 8 Wing Trenton are attached in Annex D of Appendix C. These procedures provide a waste transfer template which is completed and accompanies return waste during the transfer. The following information is required on HazMat waste transfers: dates of waste collection, description, volume, generator of wastes, method of storage, name of carrier transferring waste and contact. Manifests for off-base shipping conform to the Transportation of Dangerous Good Regulation (TDGR). Disposal records are maintained for all HazMat waste onsite at Alert.

5.3. Safety Procedures

This station specific HazMat Plan applies to all personnel working at Alert, including integral, lodger, contractors and sub-contractors. Hazardous wastes on site are handled only by WHMIS-trained qualified personnel (i.e., CBO HazMat Coordinator, HazMat Technician) wearing appropriate personal protective equipment (PPE). MSDS are maintained and accessible to personnel on site.

Spill prevention measures, spill response procedures including initial response, containment methods, emergency contacts and incident reporting are outlined in the: (i) *CFS Alert HazMat Management Plan* (Appendix C), and (ii) *CFS Alert Spill Contingency Pla*n (Appendix D).

6. LANDFARM MANAGEMENT PLAN

6.1. Description

The Landfarm was constructed in August 2007 for the purposes of remediating soil contaminated with 22,000L Petroleum Hydrocarbon (i.e., JP-8 heating fuel). The Landfarm is located approximately 25 m east of Lancaster Drive, southeast of the Lower (i.e., Airfield) Fuel Tank Farm (refer to Figure 1, Appendix A). It is 40 m X 90 m in size with a capacity of 3,750 m^3 (refer to Figure 4, Appendix A), and is comprised of the following:

- Berm Liner: 3-layers of Arctic-NT Polyvinyl Chloride (PVC).
- Berm Material: Limestone (i.e., fine screening from Alert's Quarry).
- PHC Contaminated Soil: Type B soil layered 1.2 to 1.4 m thick.
- Controlled Soil: Located in the southeast corner of the Landfarm.

6.2. Operation and Maintenance Protocols

The Landfarm operates year-round as part of the ongoing ex-situ bioremediation project under the Contaminated Sites Program, operated by the Biotechnology Research Institute of the National Research Council of Canada (BRI-NRC). The Landfarm is self-contained; therefore, no water is pumped outside of the Landfarm. Due to polar desert condition any water within the berm (e.g., produced from snowmelt) is used to hydrate the contaminated soil.

In the event that a hydrocarbon spill occurs at the station, contaminated soil is placed in the Landfarm onsite. Records are maintained for soil placed in the Landfarm identifying the volume and concentration of hydrocarbons in the soil.

Ongoing monitoring of the Landfarm involves:

- Two sampling rounds/year during the summer months (June to August).
- Approximately 10 samples are collected/round.
- Samples sent to the BRI-NRC Laboratory in Montreal and analysed using the following methods:
    i) Micro-organism Enumeration by Most-Probable Analysis (MPA) through incubation.
    ii) Polymerase Chain Reaction (PCR) of hydrocarbon degradation potential of Indigenous Microbial Populations.
    iii) Microcosm Studies: Radio-labelled substrates for determining mineralization activity, and cold (non-radioactive) analysis.
    iv) Total residual hydrocarbon concentration (F1-F4 fraction) analysis.

BRI-NRC prepares and submits annually a Monitoring Report (i.e., summarizing the results of the soil analysis) to 8 Wing Environmental Management.

As per the NWB licence, DND will seek confirmation from the Government of Nunavut, Department of Environment prior to the final disposal or use of the treated landfarm soils, as the disposal/use is dependent on the Treatment Objective.

6.3. Safety Procedures

This station specific HazMat Plan applies to all personnel working at Alert, including integral, lodger, contractors and sub-contractors. Hazardous wastes on site are handled only by WHMIS-trained qualified personnel (i.e., CBO HazMat Coordinator, HazMat Technician) wearing appropriate personal protective equipment (PPE). MSDS are maintained and accessible to personnel on site.

Spill prevention measures, spill response procedures including initial response, containment methods, emergency contacts and incident reporting are outlined in the: (i) *CFS Alert HazMat Management Plan* (Appendix C), and (ii) *CFS Alert Spill Contingency Pla*n (Appendix D).

7. MONITORING PROGRAM

7.1. Monitoring Stations

The Alert Monitoring Program is scheduled to commence within one month of NWB approval of the Quality Assurance and Quality Control (QA/QC) Plan (refer to Appendix E). The Surveillance Network Program (SNP) at Alert consists of the following 11 monitoring stations:

Station No.	Monitoring Station	Monitor	Frequency of Sampling
ALT-1	Water Supply at Raw Water Intake (i.e., Pumphouse)	Quantity	Daily
ALT-2	Discharge Point at the Sewage Outfall	Quality	Monthly*
ALT-3	Final Discharge Point of the Sewage Treatment Facility (at weir box prior to entry into Parr Inlet)	Quality	Monthly during summer
ALT-4	Runoff and Leachate from the Main Station Landfill	Quality	Annually
ALT-5	Runoff and Leachate from the Battery Dump	Quality	Annually
ALT-6	Runoff and Leachate from the Millionaire's Dump	Quality	Annually
ALT-7	Runoff and Leachate from Dump 3	Quality	Annually
ALT-8	Discharge from Lower (i.e., Airfield) Fuel Tank Farm (secondary containment)	Quality	Prior to release of effluent
ALT-9	Discharge from Upper Fuel Tank Farm (secondary containment)	Quality	Prior to release of effluent
ALT-10	Discharge from Day Fuel Tank Farm (secondary containment)	Quality	Prior to release of effluent
ALT-11	Discharge from the Landfarm	Quality	Prior to release of effluent

* Timing of sampling to correspond with sampling of ALT-3.

7.2. Monitoring of Water Supply

Water usage in cubic metres is to be recorded daily and reported annually to the NWB.

7.3. Monitoring of Sewage Treatment Facility

Sampling procedures for the sewage effluent are provided in the QA/QC Plan dated November 2010 (refer to Appendix E). Sewage samples are to be analysed for BOD_5, total suspended solids, oil and grease and pH. Analytical results of effluent discharged from the Sewage Treatment Facility will be reported against and are not to exceed the effluent quality standards provided by the NWB. Results are to be reported annually to the NWB.

COD-BOD Parameters
DND commits to meeting the spirit and intent of the National Compliance Standards for sampling and compliance, and previously put forth a compliance proposal to the NWB to establish the site-specific relationship between COD, cBOD, and TSS. The purpose of this compliance proposal was to meet the requirements of the NWB given the transportation

difficulty and practicality of meeting the short life of BOD samples. At present, onsite testing for COD is not feasible.

The NWB has identified in the licence requirements that sewage effluent samples are not to exceed BOD_5 criteria. AGAT Laboratories Ltd. (AGAT) in Mississauga has identified a maximum storage time (i.e., sample expiry) of 4 days for cBOD and BOD_5 samples. DND will analyse sewage effluents samples for BOD_5; however, should DND choose to monitor COD in lieu of traditional criteria (cBOD and BOD_5) an amendment application must be submitted to the NWB accompanied by site-specific information and the relationship between the parameters (i.e., COD, cBOD, BOD_5).

7.4. Monitoring of Solid Waste Facilities

Sampling procedures for the leachate are provided in the QA/QC Plan dated November 2010 (refer to Appendix E). Sampling stations have been identified to monitor contaminants in the leachate from each of the four landfills/dumps at the station. Results are to be reported annually to the NWB.

7.5. Monitoring of Landfarm and Tank Farms

Sampling procedures for the Landfarm are provided in the QA/QC Plan dated November 2010 (refer to Appendix E).

In addition to the ongoing BRI-NRC Landfarm Soil Monitoring Program, effluent samples will be collected and analysed by AGAT for benzene, toluene, ethylbenzene, lead, oil and grease and phenols, prior to the release of effluent from the Landfarm.

Prior to the release of effluent from the secondary containments for the tank farms, samples will be analysed by AGAT for benzene, toluene, ethylbenzene, lead, oil and grease and phenols.

An Inspector will be notified at least 10 days prior to discharging effluent compliant with the NWB standards from the Landfarm and secondary containments for the tank farms; effluent is to be discharged on the land in areas at a minimum distance of 31 m from the high water mark.

Results of effluent sample analysis are to be reported to the NWB annually.

8. INSPECTIONS, MODIFICATIONS, AND PLANS

8.1. Facility Inspections

Engineered water and waste facilities will be inspected annually during the summer (i.e., July or August); any required maintenance will be addressed.

8.2. Facility Modifications

The NWB is to be notified in writing at least 60 days prior to the commencement of the modifications to the water supply and waste disposal facilities. Modifications are to be consistent with the terms of the Licence (Appendix B).

8.3. Review of O&M Plan

This document shall be reviewed annually by DND to ensure that this plan remains current and consistently reflects the operations, activities and technology at Alert. Revisions required to this document shall be made as necessary, and shall be submitted to the NWB in the form of an addendum in the Annual Report.

The NWB requires notification of any changes to the operating plans or conditions associated with this project at least 30 days prior to implementation.

8.4. Abandonment and Restoration Plan

An Abandonment and Restoration Plan, to address closure, will be prepared and submitted to the NWB for approval 6 months prior to the abandonment of a water and/or waste facility at Alert.

9. REFERENCES

Biotechnology Research Institute of the National Research Council of Canada (BRI-NRCC). *Detailed Characterization and Econet Update of Multiple Sites at CFS-Eureka and CFS-Alert, Nunavut, Volume III – CFS-Eureka.* March 31, 2008.

Department of National Defence (DND). *Construct Bio Pile, CFS Alert, Nunavut, Fuel Oil Clean-Up Program 2007 (Map).* August 2007.

Department of National Defence (DND). *General Site Plan (Map)*. August 22, 1999.

Duong, D. and R. Kent. *Guidelines for the Preparation of am Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories*. October 1996.

Environment Canada (EC). National Climate Data and Information Archive, Canadian Climate Normals 1971-2000. Website: www.climate.weatheroffice.gc.ca/climate_normals/results_e.html?StnID=1731&autofwd=1 (accessed October 6, 2010).

FSC Architects & Engineers. *CFS Alert Wastewater Treatment Plant – As-Built Drawings*. September, 2010.

FSC Architects & Engineers. *Canadian Forces Station Alert, Nunavut Water Board Water Licence Application – Supplementary Information*. November 2009a.[2]

FSC Architects & Engineers. *Operation and Maintenance Plan for Canadian Forces Station Alert – Version 1.2*. March 2009b.

Nunavut Water Board (NWB). *Letter, RE: NWB Licence No. 3BC-ALT1015.* August 5, 2010.

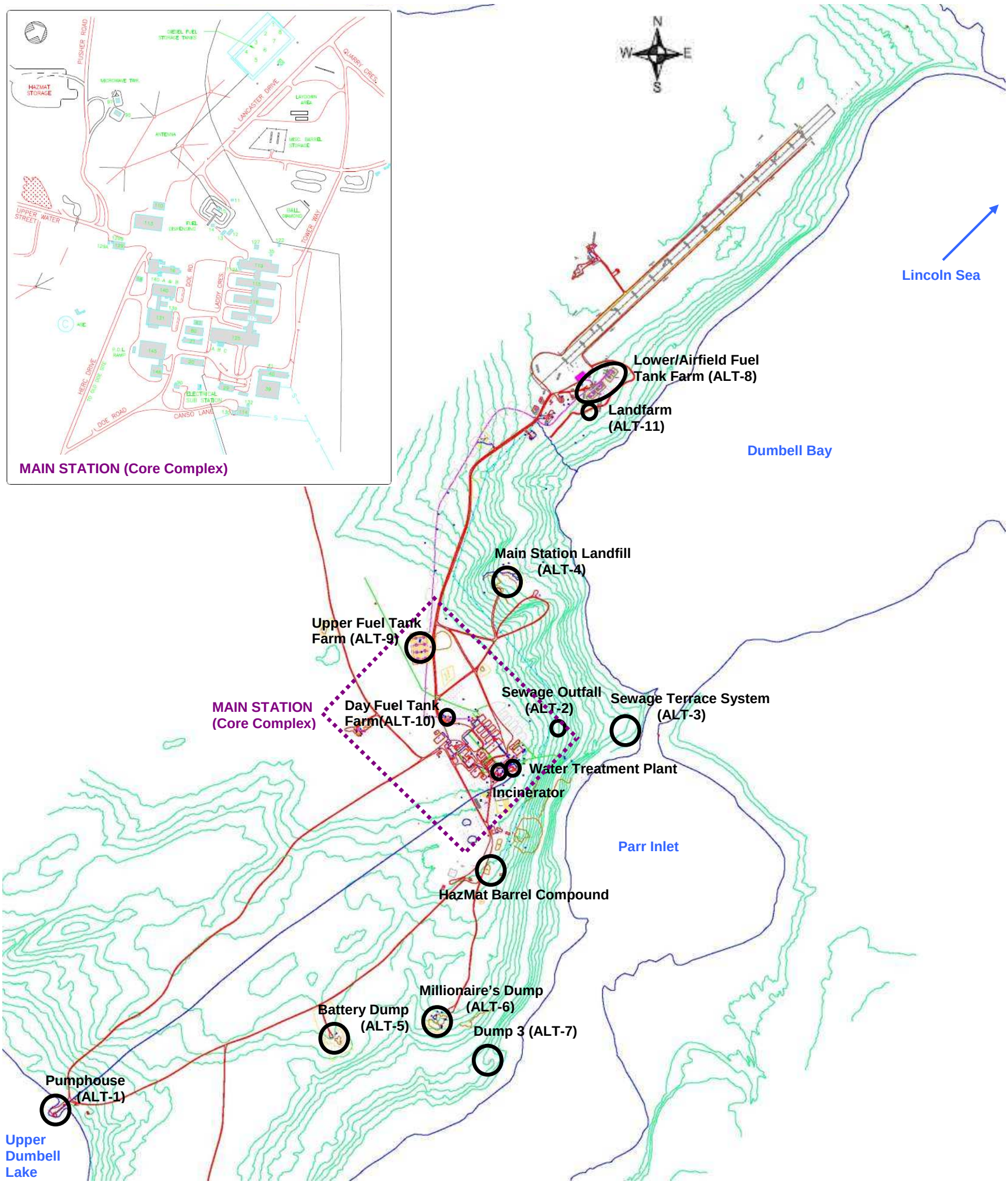
Nunavut Water Board (NWB). *NWB Licence No. 3BC-ALT1015.* August 4, 2010.

Wikipedia. *Alert, Nunavut*. Website: http://en.wikipedia.org/wiki/Alert,_Nunavut (accessed October 11, 2010).

[2] Permission was provided by 1 Canadian Air Division Headquarters to include information verbatim from the Supplementary Information report prepared by FSC Architects & Engineers in the preparation of this Operation and Maintenance Plan.

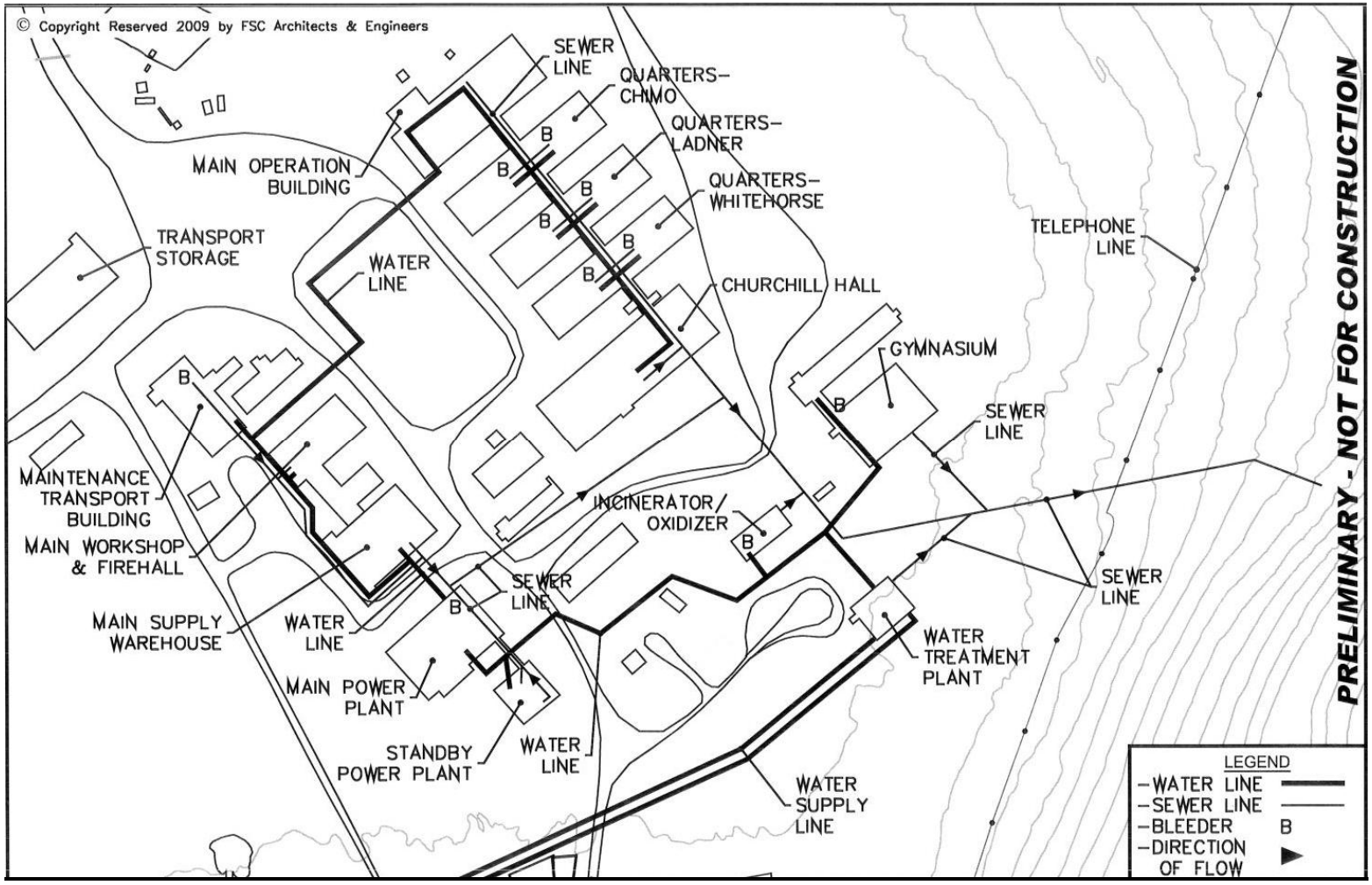
Appendix A: Figures

Defence Construction Canada
Construction de Défense Canada



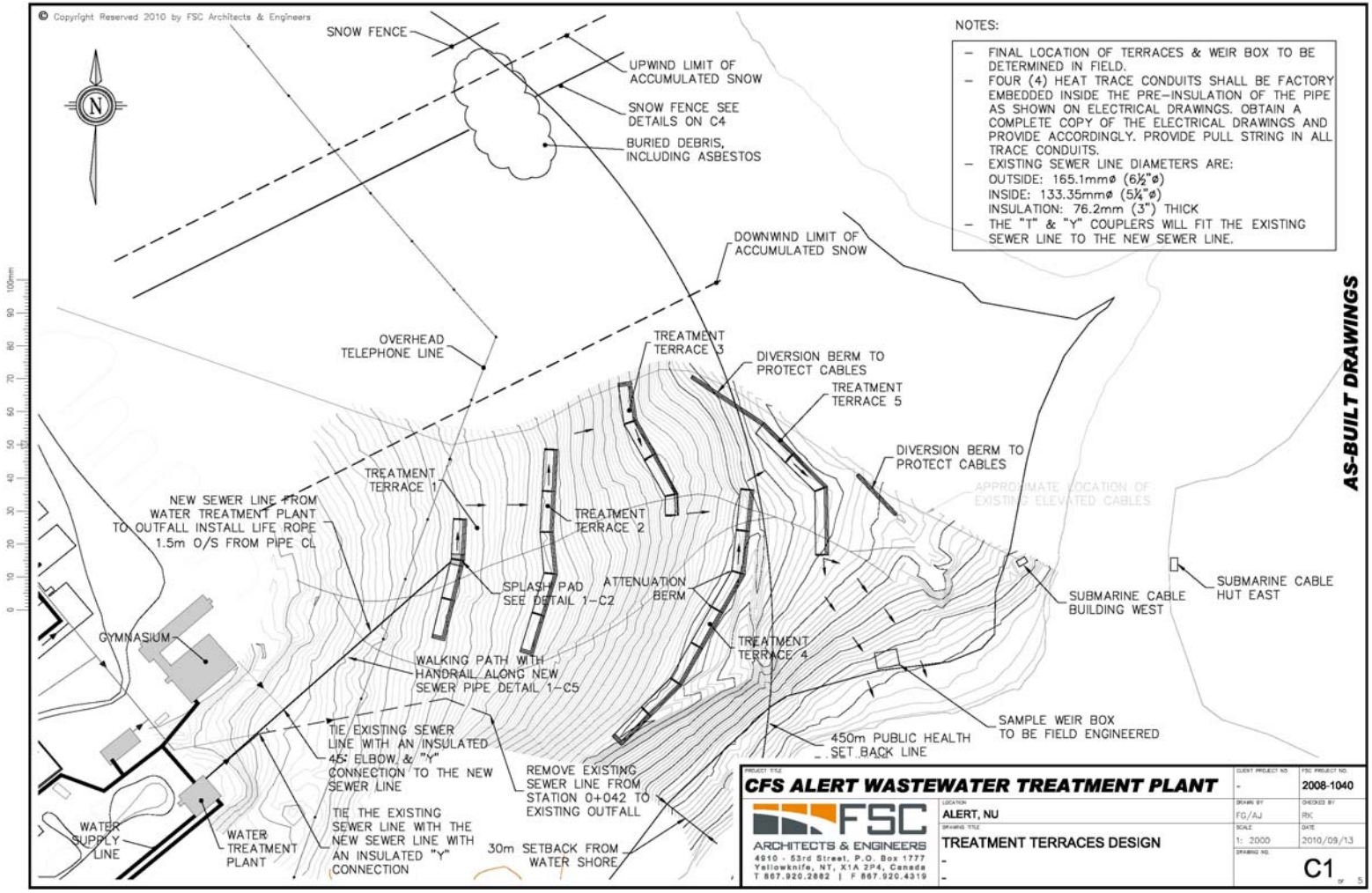
Title: CFS Alert Site Overview	**Date:** November 2010
Project: Operation and Maintenance Plan, CFS Alert	**Figure:** Figure 1
Client: Department of National Defence	**Source:** DND, 1999

Defence Construction Canada
Construction de Défense Canada



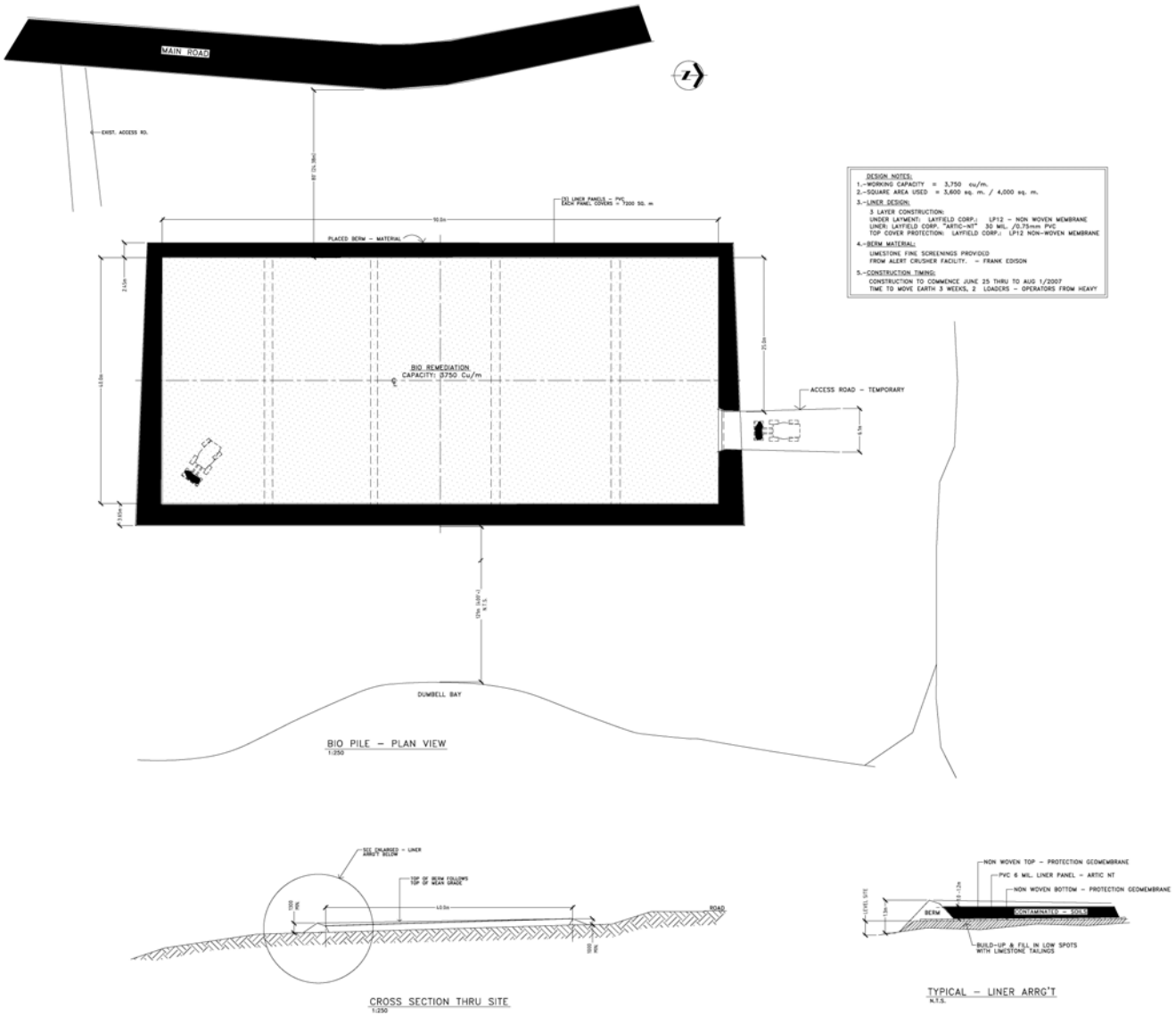
Title: Preliminary Design - Water Treatment Plant, Water and Sewage Pipelines, CFS Alert	**Date:** November 2010
Project: Operation and Maintenance Plan, CFS Alert	**Figure:** Figure 2
Client: Department of National Defence	**Source:** FSC Architects & Engineers, 2009

Defence Construction Canada
Construction de Défense Canada



Title: As-Built Drawing - Sewage Terrace System, CFS Alert	**Date:** November 2010
Project: Operation and Maintenance Plan, CFS Alert	**Figure:** Figure 3
Client: Department of National Defence	**Source:** FSC Architects & Engineers, 2010

Defence Construction Canada
Construction de Défense Canada



Title: Landfarm Design, CFS Alert

Project: Operation and Maintenance Plan, CFS Alert

Client: Department of National Defence

Date: November 2010

Figure: Figure 4

Source: DND, 2007

Appendix B: NWB Licence No. 3BC-ALT1015

P.O. Box 119
Gjoa Haven, NU X0B 1J0
Tel: (867) 360-6338
Fax: (867) 360-6369

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NUNAVUT WATER BOARD
NUNAVUT IMALIRIYIN KATIMAYINGI
OFFICE DES EAUX DU NUNAVUT

File No.: **3BC-ALT1015**

August 5, 2010

Colonel R.C. Baker
Director A4 Construction Engineering
Department of National Defence
1 Canadian Air Division
PO Box 17000 Stn Forces
Winnipeg, MB
R3J 3Y5

Email: Raymond.baker@forces.gc.ca

RE: NWB Licence No. 3BC-ALT1015

Dear Colonel Baker,

Please find attached Licence No. **3BC-ALT1015** issued to the Department of National Defence – 1 Canadian Air Division by the Nunavut Water Board (NWB) pursuant to its authority under Article 13 of the *Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada* (Nunavut Land Claims Agreement or NLCA). The terms and conditions of the attached Licence related to water use and waste disposal are an integral part of this approval.

If the Licensee contemplates the renewal of this Licence, it is the responsibility of the Licensee to apply to the NWB for its renewal. The past performance of the Licensee, new documentation and information, and issues raised during a public hearing, if the NWB is required to hold one, will be used to determine the terms and conditions of the Licence renewal. Note that if the Licence expires before the NWB issues a new one, then water use and waste disposal must cease, or the Licensee will be in contravention of the *Nunavut Land Claims Agreement* (*NLCA*) and the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (*NWNSRTA*). However, the expiry or cancellation of a licence does not relieve the holder from any obligations imposed by the licence. The NWB recommends that an application for the renewal of this Licence be filed at least three (3) months prior to the Licence expiry date.

If the Licensee contemplates or requires an amendment to this licence, the NWB may decide, in the public interest, to hold a public hearing. The Licensee should submit applications for amendment as soon as possible to give the NWB sufficient time to go through the amendment process. The process and timing may vary depending on the scope of the amendment, however a minimum of sixty (60) days is required from time of acceptance by the NWB. It is the

…/2

responsibility of the Licensee to ensure that all application materials have been received and acknowledged by the Manager of Licensing.

The NWB strongly recommends that the Licensee consult the comments received by interested persons on issues identified. The NWB notes that, among other items, the Government of Nunavut, Department of Environment requires the Licensee to apply appropriate technologies to ensure complete combustion of wastes, and the use of a duel chamber, controlled air flow incinerator is recommended. This information is attached for your consideration.[1]

Sincerely,

Thomas Kabloona
Nunavut Water Board
Chair

TK/dc/pb

Enclosure: Licence No. **3BC-ALT1015**
Comments

cc: Distribution – Qikiqtani

1 Environment Canada, December 15, 2010; Indian and Northern Affairs Canada, December 22, 2010; Fisheries and Oceans Canada, January 4, 2010; Government of Nunavut – Department of Culture, Language, Elders and Youth, December 14, 2010 and Government of Nunavut – Department of Environment, February 5, 2010.

TABLE OF CONTENTS

DECISION

LICENCE NUMBER: 3BC-ALT1015

This is the decision of the Nunavut Water Board (NWB) with respect to an application dated November 16, 2009 for a new Water Licence made by:

DEPARTMENT OF NATIONAL DEFENCE – 1 CANADIAN AIR DIVISON

to allow for the use of water and disposal of waste during operation and maintenance of the Canadian Forces Station Alert, located on Ellesmere Island within the Qikiqtani Region, Nunavut and generally located at the geographical coordinates as follows:

Latitude: 82° 30' 1"N Longitude: 62° 20' 37"W

DECISION

After having received a positive land use plan conformity determination[2] from the Nunavut Planning Commission on February 8, 2010, and following notification of exemption from screening[3] by the Nunavut Impact Review Board on February 8, 2010, the NWB decided that the application could proceed through the regulatory process. In accordance with S.55.1 of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act (NWNSRTA)* and Article 13 of the *Nunavut Land Claims Agreement (NLCA)*, public notice of the application was given and interested persons were invited to make representations to the NWB.

After reviewing the submission of the Applicant and comments provided by interested parties, the NWB, having given due regard to the facts and circumstances, the merits of the submissions made to it and to the purpose, scope and intent of the *NLCA* and of the *NWNSRTA*, waived the requirement to hold a public hearing, and determined that:

Licence Number 3BC-ALT1015 be issued subject to the terms and conditions contained therein. (Motion #: ~~2010-12-L11~~ 2010-13-L11)

SIGNED this 4th day of August 2010 at Gjoa Haven, NU.

Thomas Kabloona
Nunavut Water Board
Chair

TK/dc/pb

[2] NPC Conformity Determination, February 8, 2010
[3] NIRB Screening Exemption, February 8, 2010

I. INTRODUCTION

Canadian Forces Station (CFS)-Alert is located on the north-eastern tip of Ellesmere Island, approximately 817 km from the geographic North Pole. The nearest communities are Grise Fiord, 780 km to the south and Resolute Bay, 1079 km to the southwest. CFS-Alert was first established in 1958 by the Canadian Military and has since been in continuous operation. In addition to the military installation, Environment Canada has a permanent station on site for various high arctic weather, flora and fauna studies.

CFS-Alert is located within a semi-arid polar climate and is surrounded by hills and valleys. The shoreline is composed primarily of slate and shale with pack ice year round. The daily average temperature is -33.4°C in January and 3.3°C in July.

The facilities at CFS-Alert are designed with a water intake and distribution system via pipe throughout the complex and the waste is collected by a wastewater piping system prior to discharge at the sewage outfall. To keep lines from freezing, bleeders have been installed.

II. PROCEDURAL HISTORY

The Nunavut Water Board (NWB) received a new water licence application from the 1 Canadian Air Division Headquarters (Department of National Defense or DND) on November 16, 2009. Following an internal completeness review of the application, the NWB requested additional information from the Licensee on November 26, 2009.

Following receipt of additional information provided by DND on November 26, 2009, the NWB notified parties on the same day and distributed the file for review. On February 1, 2010, the NWB notified the parties the file name was changed from 3BM-ALT---- to 3BC-ALT---- being specific to a camp operation rather that a municipal activity. Following a thirty (30)-day public review period, and after reviewing all submissions, the new Licence 3BC-ALT1015 has been issued.

III. GENERAL CONSIDERATIONS

The following section outlines the issues identified by the NWB and raised by interested parties during the review period and provides the background on the terms and conditions imposed within the body of the licence.

A. Term of Licence

In accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* s.45 (Act), the NWB may issue a licence for a term not exceeding twenty-five years. In determining an appropriate term of a water licence, the Board considers a number of factors including, but not limited to; the results of INAC site inspections and the corresponding compliance record of the Applicant, as well as intervener comments provided during the application review process. Given that this is a new application, the NWB has relied mostly on the comments provided by

parties during the review process and prior inspections that have been carried out at the facility.

The applicant has requested a 5 year licence and the NWB finds that a five (5) year term is appropriate in this case. The licence term will allow the Licensee to properly carry out the terms and conditions of the licence, to the satisfaction of the NWB.

B. Annual Reporting

The NWB has imposed on the Licensee, the requirement to produce an Annual Report. These Reports are for the purpose of ensuring that the NWB has an accurate annual update of the Licensee's activities related to water use and waste disposal during a calendar year. This information is maintained on the Public Registry and is available to interested parties upon request. A *"Standardized Form for Annual Reporting"* is to be used by the Licensee and is available from the NWB file transfer protocol (FTP) site under the Public Registry link at the NWB Website.

Website Public Registry:
(**ftp://nunavutwaterboard.org/ADMINISTRATION/Standardized%20Forms/**).

This form provides the basis for annual reporting and format, however individual licences with project specific reporting requirements will need to provide the additional information through appendices.

The NWB requires as part of the 2011 annual report, a site map detailing the location of each monitoring point identified under Part J, Item 1.

C. Water Use

CFS-Alert obtains its water from Upper Dumbell Lake which is approximately 2.5 km from the water treatment plant. At the treatment plant, water is pressure filtered and chlorinated and pumped to two storage reservoirs, each with a capacity of 227 cubic metres.

Although the camp population can vary significantly, due to the requirement to keep lines from freezing up, CFS-Alert employs bleeders throughout its water distribution system and the bleeders keep the water demand fairly stable. The NWB has authorized a volume of One Hundred and Eighty Five (185) cubic metres of water to be used each day from Upper Dumbell Lake.

In review of the application, it was not clear to the NWB whether the water intake is equipped with a proper fish screen of acceptable quality in accordance with the Department of Fisheries and Oceans guidelines. The Licensee is advised that Part C, Item 4 of the Licence requires all water intake hoses to be equipped with a screen of an appropriate mesh size to ensure that fish are not entrained and shall withdraw water at a rate such that fish do not become impinged on the screen.

Due to high per capita water use, the Department of National Defence has committed to reduce bleeder rates by 25% by 2015 and to review water use and sewage production with the goal of

reducing water use.

D. Waste Disposal

Sewage Waste

Camp sewage is collected via a piping system similar to the water system. Waste food is garburated and disposed of along with the sewage. Currently sewage is untreated and discharges to an outfall located 250 metres from the receiving body, Parr Inlet, in an area that has significant slope.

The Licensee had contracted FSC Architects and Engineers to undertake a study in December 2008 to look at various options for sewage treatment. Based on the study, the Licensee has provided conceptual level drawings of an overland flow system that utilizes terraces to trap and delay effluent prior to entering Parr Inlet. This system is intended to not interfere with ongoing avian studies in the sewage treatment area.

In their comments, Environment Canada (EC) raised concerns regarding the operation of the sewage treatment system. For similar projects in Nunavut, the NWB has required that the Licensee submit, for review and approval, an Operation and Maintenance Manual for wastewater treatment facilities. Within ninety (90) days following issuance of the Licence, the Licensee is required to submit for Board Approval, an Operations and Maintenance (O&M) that includes a Plan for the Sewage Treatment Facility as required by Part H, Item 1. The O&M Manual shall be developed in accordance with the *Guidelines for the Preparation of an Operations and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories,* (Duong and Kent, 1996) and other regulatory guidelines as deemed appropriate.

The Licensee did not submit proposed Effluent quality discharge criteria for review. This is apparently due to the danger in sampling at the current outfall location and due to the difficulties in sampling within timelines required by QA/QC procedures. To overcome these difficulties, the Licensee has proposed two different ways to determine sewage quality. Option one is with the general knowledge of the inputs to effluent, to link per capita water use, population and systemic water use to determine Engineering normals that can predict raw sewage quality.

The other proposed option is to collect Chemical Oxygen Demand (COD), Carbonaceous Biochemical Oxygen Demand (cBOD) and Biological Oxygen Demand (BOD_5) data to develop a site specific relationship between the two parameters. As COD can be easily assessed, it could potentially be sampled in lieu of cBOD which is more difficult in the north due to timelines between sampling and receipt at an approved laboratory. Standard BOD_5 has been included within the licence conditions. If the Licensee wishes to monitor for COD in lieu of traditional criteria, an amendment application must be submitted, accompanied by site specific information and a report that identifies the relationships between the parameters and the level of certainty in the relationship.

In order to protect the receiving environment, the NWB has included Effluent quality discharge criteria for Total Suspended Solids (TSS) and BOD_5 that are consistent with the *Guidelines for the discharge of treated municipal wastewater in the Northwest Territories,* 1992 (NWT Guidelines) and considering the submission of Environment Canada. Effluent discharge quality has been set based on annual summer release to a marine environment, bay or Fiord, with a wastewater flow representing >600 L/person/day (wastewater collects/freezes for 9-10 months of the year and then discharges via the overland flow, during 2-3 months of the year in the summer while thawing and continuous discharge from the facility takes place). The pH of the discharge is consistent with note (h) of the NWT Guidelines, to be in the range of 6-9. Monitoring for fecal coliform bacteria has not been included within the licence and effluent quality, based on the NWT Guidelines where there is a concern only if the discharge affects a fishery or an area of water contact recreation, none of which were identified during the application process.

Solid Waste

CFS-Alert identified four separate landfills within the application that include the Battery Dump, the Millionaire's Dump, the Main Station Landfill and Dump 3. DND indicated in the application that combustible solid waste is incinerated and the resulting ash (non-combustible residue) is deposited in the Main Station Landfill. For the landfill facilities currently in use, the NWB requires that stamped, as-built engineered drawings be submitted for review and in order to ensure that the facility is properly designed. Also, to ensure that materials are properly segregated and that the landfill is properly maintained, the Licensee is required to submit as part of the O&M Manual mentioned above, an O&M Plan for the Solid Waste Disposal Facilities.

Finally, where there are other landfill areas on site that have reached capacity or are no longer in use, the Licensee is required to submit an Abandonment and Restoration Plan for those facilities.

Landfarm

In response to INAC concerns regarding the reported spills on site, including a considerable spill that occurred in 2006 involving 22,000 litres of JP-8 heating fuel, the applicant provided information indicating that an engineered soil remediation facility (supplementary information, sec.VI, Item 4) or Landfarm is present at the facility. Although no comments were received regarding the facility, a Landfarm facility is required to be included in the licence and any discharges regulated that may directly or indirectly impact freshwaters. A Landfarm Management Plan has been requested as part of the overall Operations and Maintenance Manual for the facility under the Licence. The requirements are detailed under Part H, Item 1(c). Effluent quality limits have been included under Part D as well as monitoring requirements under Part J. The final disposal/use of the treated soils is dependent on its purpose (Treatment Objective) and is to be confirmed with the Government of Nunavut, Department of Environment.

Hazardous Waste

The GN-DOE requested that hazardous materials stored on-site should be clearly marked. This recommendation is intended to help prevent possible injuries to camp personnel and/or damage to the containers. All hazardous waste should be accompanied by hazardous waste manifests with the appropriate information (generator number, carrier number, and receiver number) and removed from site annually to avoid an accumulation of these wastes on-site.

E. Spill Contingency Plan

The Spill Contingency Plan submitted with the renewal application has been approved with this Licence. However, the Plan was noted to be deficient in several areas and must be updated to address minor deficiencies. The Licensee is to submit to the Board for review, within ninety (90) days of issuance of the licence, a revised Spill Contingency Plan.

The NWB also notes that Fuel Storage Facilities on-site consist of an airport fuel tank farm, an upper fuel tank farm and a day fuel tank connected by a pipeline. Section 4 (4.3) of the Spill Contingency Plan indicates that the Fuel Storage Facilities are provided with berms for containment of any spilled materials. Conditions along with effluent limits have been included within the licence for the discharge of contained materials and water accumulation.

F. Abandonment and Restoration Plan

To ensure that all existing end-of-life facilities are reclaimed in an appropriate manner, the NWB includes as a Licence requirement, an Abandonment and Restoration Plan. Following the issuance of the licence, an abandonment and restoration plan is to be submitted within six (6) months for Board approval, to address the closure of the landfills no longer in use, other on-site facilities no longer in use and site debris. The requirement for an abandonment and reclamation plan is included under Part I, Item 1 of the Licence. In addition, the Licensee is required under Part I, Item 2, to submit to the Board for approval, six (6) months prior to the abandonment of the CFS-Alert site or the planned closure of the current Water Supply Facilities and/or Waste Disposal Facilities, an Abandonment and Restoration Plan to address the closure.

G. Monitoring

To ensure consistency with other similar projects licensed in Nunavut, the Board requires that the Licensee establish, implement and report on the Monitoring Program outlined in Part J of the licence.

A Monitoring Plan is required as part of the Operations and Maintenance Manual, considered under Part H, Item 1. This Plan is to include a site map, identifying the locations of the monitoring stations for project facilities as per Part J, Item 1 as well as monitoring stations within the downstream environment of the overland flow system to assess the performance of the system between the Sewage Outfall and the Sewage Treatment Facility final point of discharge, during the licence term.

In addition, the Board has included the requirement for a submission for review of the Board, within ninety (90) days of issuance of the Licence, a Quality Assurance/Quality Control Plan that provides documentation of proper methods for field sampling, preservation, shipping/sample control and is accompanied by an approval letter from an accredited laboratory responsible for the analytical requirements of the Licence. This requirement is detailed under Part J, Item 12.

NUNAVUT WATER BOARD
WATER LICENCE

Pursuant to the Nunavut Waters and Nunavut Surface Rights Tribunal Act and the Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada, the Nunavut Water Board, hereinafter referred to as the Board, hereby grants to

DEPARTMENT OF NATIONAL DEFENCE – 1 CANADIAN AIR DIVISION
(Licensee)

PO BOX 17000, STN FORCES, WINNIPEG, MB, R3J 3Y5
(Mailing Address)

hereinafter called the Licensee, the right to alter, divert or otherwise use water or dispose of waste for a period subject to restrictions and conditions contained within this Licence:

Licence Number/Type:	**3BC-ALT1015 TYPE "B"**
Water Management Area:	NUNAVUT 04
Location:	CFS-ALERT, ELLESMERE ISLAND QIKIQTANI REGION, NUNAVUT
Classification:	MUNICIPAL UNDERTAKING
Purpose:	DIRECT USE OF WATER AND DEPOSIT OF WASTE
Quantity of Water use not to Exceed:	ONE HUNDRED AND EIGHTY FIVE (185) CUBIC METRES PER DAY
Date of Licence Issuance:	AUGUST 4, 2010
Expiry of Licence:	JULY 31, 2015

This Licence, issued and recorded at Gjoa Haven, Nunavut, includes and is subject to the annexed conditions.

Thomas Kabloona,
Nunavut Water Board
Chair

PART A: SCOPE, DEFINITIONS AND ENFORCEMENT

1. **Scope**

This Licence allows for the use of water and the disposal of waste for an undertaking classified as Municipal, as per Schedule II of the *Regulations,* at the Canadian Forces Station Alert, located on the northeast tip of Ellesmere Island, located approximately at Latitude: 82° 30' 1"N and Longitude: 62° 20' 37"W within the Qikiqtani Region, Nunavut.

a. This Licence is issued subject to the conditions contained herein with respect to the taking of water and the depositing of waste of any type in any waters or in any place under any conditions where such waste or any other waste that results from the deposits of such waste may enter any waters. Whenever new Regulations are made or existing *Regulations* are amended by the Governor in Council under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*, or other statutes imposing more stringent conditions relating to the quantity or type of waste that may be so deposited or under which any such waste may be so deposited, this Licence shall be deemed, upon promulgation of such Regulations, to be subject to such requirements; and

b. Compliance with the terms and conditions of this Licence does not absolve the Licensee from responsibility for compliance with the requirements of all applicable Federal, Territorial and Municipal legislation.

2. **Definitions**

"**Act**" means the *Nunavut Waters and Nunavut Surface Rights Tribunal Act;*

"**Addendum**" means the supplemental text that is added to a full plan or report usually included at the end of the document and is not intended to require a full resubmission of the revised report.

"**Amendment**" means a change to original terms and conditions of this Licence requiring correction, addition or deletion of specific terms and conditions of the Licence; modifications inconsistent with the terms of the set terms and conditions of the Licence;

''**Appurtenant Undertaking**'' means an undertaking in relation to which a use of water or a deposit of waste is permitted by a licence issued by the Board;

"Board" means the Nunavut Water Board established under the *Nunavut Land Claims Agreement* and the *Nunavut Waters and Nunavut Surface Rights Tribunal Act;*

"Fuel Storage Facilities"; means the four 242,500L Diesel Fuel Arctic tanks located at the airfield and associated piping to the Upper Tank Farm comprised of the eight

457,900L tanks and associated piping, which feed a 30,500L day tank, as described in the Application for Water Licence dated November 16, 2009.

"Engineer" means a professional engineer registered to practice in Nunavut in accordance with the Engineering, Geological and Geophysical Act (Nunavut) S.N.W.T. 1998, c.38, s.5;

"Greywater" means all liquid wastes from showers, baths, sinks, kitchens and domestic washing facilities, but does not include toilet wastes;

"Inspector" means an Inspector designated by the Minister under Section 85 (1) of the *Act*;

"Landfarm"; means the engineered soil remediation facility designed to contain and treat contaminated soils as described in the Response to INAC dated February 15, 2010 and submitted in support of the Application for Water Licence dated November 16, 2009

"Licensee" means the holder of this Licence;

"Modification" means an alteration to a physical work that introduces a new structure or eliminates an existing structure and does not alter the purpose or function of the work, but does not include an expansion;

"Nunavut Land Claims Agreement (NLCA)" means the *"Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada*", including its preamble and schedules, and any amendments to that agreement made pursuant to it;

"Overland Flow System" means the proposed treatment method of the engineered facility, as described in the Application dated November 16, 2009 and drawings C1 and C2 of Appendix E, which includes a number of boxed terraces and berms designed to increase the sewage flow travel length and retention time, providing improved treatment;

"Regulations" means the *Northwest Territories Water Regulations sor/93-303 8th June, 1993,* omitting Section 5, Water Use or Waste Deposit Without a Licence;

"Sewage" means all toilet wastes and greywater;

"Sewage Outfall" means the location and method of sewage discharge directly to the land prior to the Sewage Treatment Facility;

"Sewage Treatment Facility" means the proposed method of sewage treatment outlined in the application dated November 16, 2009 utilizing an engineered Overland

Flow System as described in drawings C1 and C2 of Appendix E to the application with a final discharge point located prior to entry into Parr Inlet;

"Solid Waste Disposal Facilities" means the facility landfills including the Battery Dump, Millionaire's Dump, Dump 3 and the Main Station Landfill as described in the Application for Water Licence dated November 16, 2009;

"Spill Contingency Plan" means a Plan developed to deal with unforeseen petroleum and hazardous materials events that may occur during the operations conducted under the Licence;

"Toilet Wastes" means all human excreta and associated products, but does not include greywater;

"Treatment Objective" means the treatment objective for the Landfarm which is based on the Canadian Council of Ministers of the Environment (CCME), 2001 *Canada – Wide Standard for Petroleum Hydrocarbon in Soil*, for Industrial land use; or as determined by the Government of Nunavut, Environmental Protection Service based on the 2002 *Environmental Guideline for Site Remediation*;

"**Type A Soil**" means soil contaminated with hydrocarbons in which the primary petroleum product present in the soil as determined by laboratory analysis consists of lubricating oil and grease;

"**Type B Soil**" means soil contaminated with hydrocarbons in which the primary petroleum product present in the soil as determined by laboratory analysis consists of fuel oil and/or diesel fuel and /or gasoline;

"Waste" means, as defined in S.4 of the *Act*, any substance that, by itself or in combination with other substances found in water, would have the effect of altering the quality of any water to which the substance is added to an extent that is detrimental to its use by people or by any animal, fish or plant, or any water that would have that effect because of the quantity or concentration of the substances contained in it or because it has been treated or changed, by heat or other means;

"Waste Disposal Facilities" means the Sewage Outfall, Sewage Treatment Facility, Solid Waste Disposal Facilities and the Landfarm;

"Water Supply Facilities" means the facilities described in the Supplementary Information report, Sec. 3 The Water System, Ver. 1.0, dated November 2009 and prepared by FSC Architects and Engineers for Defence Construction Canada, submitted as supplementary information with the Application, consisting of the water intake and pumping system at Upper Dumbell Lake, water filtration and chlorination with storage in two 227m^3 Raw Water Tanks. Distribution to the facility is via a single pipe system.

3. **Enforcement**

   a. Failure to comply with this Licence will be a violation of the *Act*, subjecting the Licensee to the enforcement measures and the penalties provided for in the *Act*;

   b. All inspection and enforcement services regarding this Licence will be provided by Inspectors appointed under the *Act*; and

   c. For the purpose of enforcing this Licence and with respect to the use of water and deposit or discharge of waste by the Licensee, Inspectors appointed under the *Act,* hold all powers, privileges and protections that are conferred upon them by the *Act* or by other applicable law.

PART B: GENERAL CONDITIONS

1. The Licensee shall file an Annual Report on the appurtenant undertaking with the Board no later than March 31st of the year following the calendar year being reported, containing the following information:

   a. A summary report of waste disposal activities;
   b. A list of unauthorized discharges and a summary of follow-up actions taken;
   c. An up-to-date copy of the Spill Contingency Plan, including contact information;
   d. The location of waste deposition in accordance with Part J, Item 2.
   e. A description of all progressive and or final reclamation work undertaken, including photographic records of site conditions before, during and after completion of operations;
   f. A summary of all information requested and results of the Monitoring Program; and
   g. Any other details on waste disposal requested by the Board by November 1 of the year being reported.

2. The Licensee shall notify the NWB of any changes in operating plans or conditions associated with this project at least thirty (30) days prior to any such change.

3. The Licensee shall, for all Plans submitted under this Licence, include a proposed timetable for implementation. Plans submitted, cannot be undertaken without subsequent written Board approval and direction. The Board may alter or modify a Plan if necessary to achieve the legislative objectives and will notify the Licensee in writing of acceptance, rejection or alteration of the Plan.

4. The Licensee shall, for all Plans submitted under this Licence, implement the Plan as approved by the Board in writing.

5. The Licensee shall review the Plans referred to in this Licence, as required by changes

in operation and/or technology, and modify the Plan accordingly. Revisions to the Plans are to be submitted in the form of an Addendum to be included with the Annual Report.

6. Every Plan to be carried out pursuant to the terms and conditions of this Licence shall become a part of this Licence, and any additional terms and conditions imposed upon approval of a Plan by the Board become part of this Licence. All terms and conditions of the Licence should be contemplated in the development of a Plan where appropriate.

7. The Licensee shall ensure a copy of this Licence is maintained at the site of operations at all times. Any communication with respect to this Licence shall be made in writing to the attention of:

   (a) Manager of Licensing:
   Nunavut Water Board
   P.O. Box 119
   Gjoa Haven, NU X0B 1J0
   Telephone: (867) 360-6338
   Fax: (867) 360-6369
   Email: licensing@nunavutwaterboard.org

   (b) Inspector Contact:
   Water Resources Officer, INAC
   Nunavut District, Nunavut Region
   P.O. Box 100
   Iqaluit, NU X0A 0H0
   Telephone: (867) 975-4295
   Fax: (867) 979-6445

8. The Licensee shall submit one paper copy and one electronic copy of all reports, studies, and plans to the Board. Reports or studies submitted to the Board by the Licensee shall include a detailed executive summary in Inuktitut.

9. The Licensee shall review the Plans referred to in this Licence, as required by changes in operation and/or technology, and modify the Plan accordingly. Revisions to the Plans are to be submitted in the form of an Addendum to be included with the Annual Report.

10. The Licensee shall ensure that any document(s) or correspondence submitted by the Licensee to the Board is received and acknowledged by the Manager of Licensing.

11. This Licence is assignable as provided for in Section 44 of the *Act*.

PART C: CONDITIONS APPLYING TO WATER USE

1. The Licensee shall obtain all water for facility use from Upper Dumbell Lake. Total water use shall not exceed one hundred and eighty five (185) cubic metres per day.

2. Streams cannot be used as a water source unless authorized and approved by the Board in writing.

3. If the Licensee requires water in sufficient volume that the source water body may be drawn down the Licensee shall, at least thirty (30) days prior to commencement of use of water, submit to the Board for approval in writing, the following: volume required, hydrological overview of the water body, details of impacts, and proposed mitigation measures.

4. The Licensee shall equip all water intake hoses with a screen of an appropriate mesh size to ensure that fish are not entrained and shall withdraw water at a rate such that fish do not become impinged on the screen.

5. The Licensee shall not remove any material from below the ordinary high water mark of any water body unless authorized.

6. The Licensee shall not cause erosion to the banks of any body of water and shall provide necessary controls to prevent such erosion.

7. Sediment and erosion control measures shall be implemented prior to and maintained during the operation to prevent entry of sediment into water.

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

1. The Licensee shall locate areas designated for waste disposal at a minimum distance of thirty one (31) metres from the ordinary high water mark of any water body such that the quality, quantity or flow of water is not impaired, unless otherwise approved by the Board in writing.

2. The Licensee is authorized to deposit incinerator ash and clinker into the Main Station Landfill.

3. The Licensee is authorized to deposit larger metals and bulky wastes in the Millionaire's Dump.

4. The Licensee is authorized to dispose of all acceptable food waste, paper waste and untreated wood products in an incinerator and waste oil is authorized to be disposed of in a waste oil burner, unless otherwise approved by the Board in writing.

5. The Licensee shall not open burn plastics, wood treated with preservatives, electric wire, Styrofoam, asbestos or painted wood to prevent the deposition of waste materials of incomplete combustion and/or leachate from contaminated ash residual, from impacting any surrounding waters, unless otherwise approved by the Board in writing.

6. The Licensee shall backhaul and dispose of all hazardous wastes generated through the course of the operation in an approved waste disposal facility.

7. The Licensee shall maintain records of all waste backhauled and records of confirmation of proper disposal of backhauled waste. These records shall be made available to an Inspector upon request.

8. The Licensee shall direct all Sewage to the Sewage Treatment Facility and Overland Flow System unless otherwise approved by the Board in writing.

9. Discharge at Monitoring Program Station ALT-3 shall not exceed the following Effluent quality limits:

Parameter	Maximum Concentration of any Grab Sample
BOD_5	80 mg/L
Total Suspended Solids	70 mg/L
Oil and grease	5 mg/L and no visible sheen
pH	between 6 and 9

10. The Licensee shall treat where practicable, Type B Soil, to the Treatment Objective, in the Landfarm, or as otherwise approved by the Board in writing.

11. Effluent discharged from the Fuel Storage Facilities and the Landfarm at monitoring program stations ALT-8, 9, 10 and 11 shall not exceed the following Effluent quality limits:

Parameter	Maximum Concentration of any Grab Sample
Benzene (µg/L)	370
Toluene (µg/L)	2
Ethylbenzene (µg/L)	90
Lead (µg/L)	1
Oil and Grease (mg/L)	15 and no visible sheen
Phenols (µg/L)	20

12. Water from the Fuel Storage Facilities and the Landfarm, that is acceptable for discharge under Part D, Item 11, may be released on land at a location as per Part D, Item 1, or as otherwise designated by an Inspector.

13. If effluent does not meet the Effluent quality limits of Part D, Item 11, it shall be considered hazardous waste and disposed off-site at an approved facility.

14. The Licensee shall provide at least ten (10) days notice to an Inspector, of the intent to discharge effluent from the Fuel Storage Facilities or the Landfarm.

PART E: CONDITIONS FOR CAMPS, ACCESS INFRASTRUCTURES AND OPERATIONS

1. The Licensee shall not store material on the surface or banks of frozen streams or lakes except what is for immediate use.

2. All activities shall be conducted in such a way as to minimize impacts on surface drainage and the Licensee shall immediately undertake any corrective measures in the event of any impacts on surface drainage.

3. With respect to access road, pad construction or other earthworks, the deposition of debris or sediment into or onto any water body is prohibited. These materials shall be disposed a distance of at least thirty one (31) metres from the ordinary high water mark in such a fashion that they do not enter the water.

PART F: CONDITIONS APPLYING TO MODIFICATIONS AND CONSTRUCTION

1. The Licensee may, without written consent from the Board, carry out Modifications to the Water Supply Facilities and Waste Disposal Facilities provided that such Modifications are consistent with the terms of this Licence and the following requirements are met:

   a. the Licensee has notified the Board in writing of such proposed Modifications at least sixty (60) days prior to beginning the Modifications;
   b. such Modifications do not place the Licensee in contravention of the Licence or the *Act*;
   c. the Board has not, during the sixty (60) days following notification of the proposed Modifications, informed the Licensee that review of the proposal will require more than sixty (60) days; and
   d. the Board has not rejected the proposed Modifications.

2. The modifications for which all of the conditions referred to above have not been met can be carried out only with written approval of the Board.

3. Licensee shall provide as-built plans and drawings of the Modifications referred to in this Licence within ninety (90) days of completion of the Modification. These plans and drawings shall be stamped by an Engineer.

4. The Licensee shall, within ninety (90) days following issuance of the Licence, provide to the Board as-built design drawings, signed and stamped by an Engineer for the Solid Waste Disposal Facilities and the Landfarm.

5. The Licensee shall, within ninety (90) days following the construction and commissioning of the Sewage Treatment Facility, provide to the Board, as-built design drawings, signed and stamped by an Engineer.

PART G: CONDITIONS APPLYING TO SPILL CONTINGENCY PLANNING

1. The Board has approved the Plan entitled "Spill Contingency Plan, Canadian Forces Station Alert, Nunavut" dated March 2009. As a number of deficiencies were noted, the Licensee shall submit to the Board, within ninety (90) days following issuance of the Licence, a revised Plan that addresses the following:

   a. The Plan should reference the Government of Nunavut, Department of Environment Waste Manifest tracking system used for the movement of hazardous wastes from generator to receiver;
   b. Plan should include a properly scaled topographical map providing information on the site facilities in relation to water bodies and drainage with emphasis on fuel and waste storage areas, locations of spill kit(s) and related spill response equipment;
   c. All spills, regardless of volume, are to be reported if the spill:
      - is near or into a water body;
      - is near or into a designated sensitive environment or sensitive wildlife habitat;
      - poses an imminent threat to human health or safety, or
      - poses an imminent threat to a listed species at risk or its critical habitat.
   d. Section 5.1.6 is to be revised and updated with reporting requirements as in Part G, Item 5 of this Licence;
   e. Include a copy of the NT/NU Spill Report Form (complete with guide), required to be used in the event of a spill and reporting (available on NWB FTP site); and
   f. Update the contact information for INAC, GN-DOE and in section 5.5 (see respective submissions and Part G, Item 5 of this Licence).

2. The Licensee shall prevent any chemicals, petroleum products or wastes associated with the project do not enter water. All sumps and fuel caches shall be located at a distance of at least thirty one (31) metres from the ordinary high water mark of any adjacent water body and inspected on a regular basis.

3. The Licensee shall ensure that any equipment maintenance and servicing be conducted only in designated areas and shall implement special procedures (such as the use of drip pans) to manage motor fluids and other waste and contain potential spills.

4. If during the term of this Licence, an unauthorized discharge of waste occurs, or if such a discharge is foreseeable, the Licensee shall:

   a. Employ the Spill Contingency Plan;
   b. Report the spill immediately to the 24-Hour Spill Line at (867) 920-8130 and to

the Inspector at (867) 975-4295; and

c. For each spill occurrence, submit to the Inspector, no later than thirty (30) days after initially reporting the event, a detailed report that will include the amount and type of spilled product, the GPS location of the spill (including map), and the measures taken to contain and clean up the spill site.

PART H: CONDITIONS APPLYING TO OPERATIONS AND MAINTENANCE

1. The Licensee shall submit to the Board for approval, within ninety (90) days of issuance of the Licence, an Operations and Maintenance Manual prepared where appropriate, in accordance with the *"Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories; 1996"*. The Manual shall take into consideration the comments received during the application review process and contain the following plans:

   a. Sewage Treatment Facility Operation and Maintenance Plan (to include the management of sludge along the flow path);
   b. Solid Waste Operation and Maintenance Plan;
   c. Landfarm Management Plan; prepared in consultation with Environment Canada with respect design, siting, operation, monitoring, sampling and analytical methods, decommissioning and closure as well as record keeping and reporting; and
   d. Monitoring Program, which shall include the QA/QC Plan as required under Part J, Item 12 and details covering the monitoring program described under Part J of this licence, including maps and any additional monitoring stations to assist in the evaluation of the Sewage Treatment Facility and the recommendations provided in the supplementary application information, sec. 7, with respect to DND's commitments and compliance proposal.

2. An inspection of all engineered facilities related to the management of water and waste shall be carried out annually in July or August by a Geotechnical Engineer. The engineer's report shall be submitted to the Board within sixty (60) days of the inspection, including a covering letter from the Licensee outlining an implementation plan addressing each of the Engineer's recommendations.

3. The Licensee shall perform more frequent inspections of the engineered facilities at the request of an Inspector.

PART I: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION OR TEMPORARY CLOSING

1. The Licensee shall submit to the Board for approval, within six (6) months of Licence issuance, an Abandonment and Restoration Plan for any landfills no longer in use, other on-site facilities no longer in use and areas where debris is encountered. The Plan shall

be prepared in accordance with applicable sections of the "Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories (1990)".

2. The Licensee shall submit to the Board for approval, six (6) months prior to the abandonment of the CFS-Alert site, or the planned closure of facilities including the current Water Supply Facilities and Waste Disposal Facilities, an Abandonment and Restoration Plan prepared in accordance with applicable sections of the "Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories (1990)".

3. The Licensee shall revise the Plan referred to in Part I, Items 1 and 2 if not approved. The revised Plan shall be submitted to the Board for approval within thirty (30) days of receiving notification of the Board's decision.

4. The Licensee shall complete the restoration work within the time schedule specified in the Plan, or as subsequently revised and approved by the Board.

5. Areas that have been contaminated by hydrocarbons shall be reclaimed to meet objectives as outlined in the Government of Nunavut's Environmental Guideline for Site Remediation, January 2002. The use of reclaimed soils from the Soil Remediation Facility may be carried out only upon consultation and approval by the Government of Nunavut, Department of Environment and an Inspector.

PART J: CONDITIONS APPLYING TO THE MONITORING PROGRAM

1. The Licensee shall maintain Monitoring Stations at the following locations:

Monitoring Program Station Number	Description	Status
ALT-1	Water Supply at Raw Water Intake (or Pumphouse)	Active (Volume)
ALT-2	Discharge Point at the Sewage Outfall	Active (Quality)
ALT-3	Final Discharge Point of the Sewage Treatment Facility at weir box or similar structure, prior to entry into Parr Inlet	Active (Quality)
ALT-4	Runoff and leachate from the Main Station Landfill	Active (Quality)
ALT-5	Runoff and leachate from the Battery Dump	Active (Quality)
ALT-6	Runoff and leachate from the Millionaire's Dump	Active (Quality)

ALT-7	Runoff and leachate from Dump 3	Active (Quality)
ALT-8	Discharge from airfield fuel tank farm secondary containment	Active (Quality)
ALT-9	Discharge from upper fuel tank farm secondary containment	Active (Quality)
ALT-10	Discharge from day fuel tank farm secondary containment	Active (Quality)
ALT-11	Discharge from the Landfarm	Active (Quality)

2. The Licensee shall determine, in consultation with the Inspector, the GPS co-ordinates (in degrees, minutes and seconds of latitude and longitude) of all locations where wastes associated with operations and maintenance operations are deposited and have been deposited. Locations shall be reported in the Annual Report.

3. The Licensee shall measure and record in cubic metres at Monitoring Program Station ALT-1, the daily and annual quantities of water utilized for all purposes.

4. The Licensee, for the purposes of determining flow and monitoring requirements under Part J, Items 5 and 6, carry out inspections of the facilities a minimum of once per week during the months of June, July, August and September. Inspection records shall be maintained for review upon request of an Inspector or the NWB.

5. The Licensee shall during periods of flow at Monitoring Program Station ALT-3 (weir box), analyze samples monthly from the Sewage Treatment Facility for the purpose of demonstrating compliance with the parameters listed under Part D, Item 9.

6. The Licensee shall analyze samples collected annually during periods of runoff or seepage at Monitoring Program Stations ALT-4, 5, 6 and 7. Samples are to be analyzed for the following parameters:

TPH (Total Petroleum Hydrocarbons)
PAH (Polycyclic Aromatic Hydrocarbons)
BTEX (Benzene, Toluene, Ethylbenzene, Xylene)

BOD	Faecal Coliforms
pH	Conductivity
Total Suspended Solids	Oil and Grease
Nitrate-Nitrite	Ammonia Nitrogen
Total Phenols	Total Alkalinity
Total Hardness	Calcium
Magnesium	Potassium
Sodium	Sulphate
Total Arsenic	Total Cadmium
Total Copper	Total Chromium

Total Iron	Total Lead
Total Mercury	Total Nickel

7. The Licensee shall measure and record the volume of all soil, from all locations entering the Landfarm at Monitoring Program Station ALT-11.

8. The Licensee shall assess and record the concentration of petroleum hydrocarbon contaminated soil entering the Landfarm (ALT-11) from all sources, as per the CCME *Canada-Wide Standard for Petroleum Hydrocarbons in (PHC) in Soil.*

9. The Licensee shall analyze samples, prior to the release of effluent from the Fuel Storage Facilities and the Landfarm, at Monitoring Program Stations ALT-8, 9, 10 and 11 respectively, for the purpose of demonstrating compliance with the parameters and limits listed under Part D, Item 11.

10. All sampling, sample preservation and analyses shall be conducted in accordance with methods prescribed in the current edition of *Standard Methods for the Examination of Water and Wastewater*, or by such other methods approved by the Board in writing.

11. All analyses shall be performed in a laboratory accredited according to ISO/IEC Standard 17025. The accreditation shall be current and in good standing.

12. The Licensee shall within ninety (90) days following issuance of the Licence, submit to the Board a Quality Assurance/Quality Control (QA/QC) Plan. The Plan shall include up-to-date field sampling methods to all applicable standards, acceptable to an accredited laboratory as required by Part J, Item 10 and Part J, Item 11. The Plan shall include a covering letter from the accredited laboratory confirming acceptance of the Plan for analyses to be performed under this Licence

13. The Licensee shall annually review the QA/QC plan submitted under Part J, Item 12 and modify it as necessary. Revised plans shall be submitted to the NWB with an approval letter from an accredited lab that meets standards set in Part J, Item 10 and 11.

14. The Licensee shall include in the Annual Report required under Part B, Item 1 all data, monitoring results and information required by this Part.

P.O. Box 119
Gjoa Haven, NU X0B 1J0
Tel: (867) 360-6338
Fax: (867) 360-6369

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NUNAVUT WATER BOARD
NUNAVUT IMALIRIYIN KATIMAYINGI
OFFICE DES EAUX DU NUNAVUT

October 4, 2010

NOTICE OF ERRATA – LICENCE 3BC-ALT1015

To all Parties:

PART G: CONDITIONS APPLYING TO SPILL CONTINGENCY PLANNING

Change 1 d. to read "……as in Part G, Item 4 of this licence."

Change 1 f. to read "……and Part G, Item 4 of this licence."

Original signed by:

Phyllis Beaulieu
Manager of Licensing
Nunavut Water Board

Appendix C: CFS Alert – Hazardous Materials Management Plan

CFS ALERT

HAZARDOUS MATERIAL MANAGEMENT PLAN

SEPTEMBER 2010

TABLE OF CONTENTS

CFS ALERT HAZARDOUS MATERIAL MANAGEMENT PLAN

INTRODUCTION

1. This Hazardous Material Management Plan details the policies, guidelines and procedures of CFS Alert Hazardous Material (HazMat) Management Program and applies to all CFS Alert units, both integral and lodger and all contractors and sub-contractors. This plan is in compliance with both federal and provincial government policies, and it reflects the intent of Canadian Forces Policy documents and the Department's Sustainable Development Strategy (SDS 2000).

PURPOSE

2. The purpose of the Hazardous Material Management Plan is to define "cradle-to-grave" HazMat management and provide direction to all personnel at CFS Alert.

POLICY

As stated in the SDS 2000, the department will "Develop and implement hazardous material management plans at all Bases/Wings by 31 March 2004… Hazardous material management plans facilitate the proper procurement, storage, transportation, use and disposal of hazardous materials. Plans should give due consideration to pollution prevention to ensure responsible management of hazardous materials." Units are responsible to meet the applicable federal legislation, regulations and guidelines, and strive to meet or exceed any applicable provincial and municipal legislation, regulations and guidelines which are more stringent, with respect to the management of hazardous materials. International agreements such as those entered into with the International Civil Aviation Organization (ICAO), International Maritime Organization (IMO), and the North Atlantic Treaty Organization (NATO) Standards Agreements (STANAGs) will also be adhered to, subject to operational requirements, as approved by 1 Canadian Air Division.

APPLICABILITY

3. Annex A states the Department of National Defence Code of Environmental Stewardship. These principles shall be adhered to by all personnel at CFS Alert.

SCOPE

4. This plan is organized in a manner which reflects the complete life cycle of HazMat. The life cycle of HazMat includes: identification of the requirements, acquisition, replacement trails, distribution, use in the workplace, storage, waste collection, and finally disposal, including all the transportation and handling

activities that take place between the various phases. The order in which the following information is presented should not be construed as an order of priority.

5. Background. Over 70,000 chemicals are now available in the market place, either as raw materials or manufactured into products. Over 100 new chemicals are added to the list each year. We are challenged to safely manage these products through their entire life cycle. To meet this challenge, this HazMat management plan must be followed to maintain the health and safety of personnel, protect property and preserve the environment.

6. Civil Legal Liabilities. A person who causes damage to the environment and/or contravenes federal, provincial or municipal law endangers human health, is liable on conviction in court to a fine, imprisonment or both. It is the responsibility of all personnel to meet or exceed all legislated requirements and exercise due diligence in managing HazMat in a responsible manner.

8. Definitions. Several common terms are used throughout this instruction. A list of definitions is provided in Annex B.

HAZMAT MANAGEMENT ORGANIZATION

9. Every supervisor, whether DND or service provider, is responsible for the HazMat used by their employees.

TOTAL QUALITY HAZMAT MANAGEMENT

10. This portion of the Plan is segregated into the key elements of the life cycle management (LCM) of HazMat. The objective of the overall program is to achieve Total Quality HazMat Management (TQHM). The four "R" concept (reduce, reuse, recycle, rethink) of environmental management will be monitored throughout the plan. Each sub-heading will include a specific objective and desired result.

11. Identification of Requirement. Requirements planning is the first element in the TQHM process. Users must identify the desired products, quantity and desired delivery date. Users shall review their product inventory, increase the frequency of ordering and decrease the quantity per order.

12. HazMat Replacement Trials. Users are encouraged to conduct a continuous review of the products in use. The review process should identify products which may be eliminated or replaced with products less harmful to human health or to the environment. The goal of every user is to hold an inventory with a minimum number of total line items and to continuously seek out replacement products which have a reduced potential negative effect on human health and/or the environment.

13. Alternative products which are less harmful to human health and the environment and potentially meet job specifications shall be subjected to a trial by a user and, if found suitable, adopted for use.

14. HazMat replacement trials must be conducted in a controlled, orderly manner. The protocol to track the replacement of "environmentally friendly products" will include:

    a. identification of product intended to be replaced;

    b. identification of possible replacement products;

    c. research of other trials previously conducted by others;

    d. results of the trial and plans for future application of the new products; and,

    e. a report of the final results.

15. Distribution. The TQHM distribution phase addresses both the safe movement of the HazMat and the distribution of Material Safety Data Sheets (MSDS) to the users.

16. It is the user's responsibility to ensure that they receive a MSDS for each line item demanded before they accept it. If there is any doubt as to whether a user has a copy of a MSDS, another copy shall be issued. Updated and received copies of MSDS's shall be distributed with the next shipment delivered to the user or by mail, whichever is faster.

17. All material delivered to a user site must be adequately packaged to prevent an uncontrolled release in the event of a spill. Any vehicle which is used to transport HazMat must be equipped with:

    a. equipment to secure the shipment;

    b. a transportation of Dangerous Goods qualified vehicle operator trained in spill response procedures; and,

    c. mobile communication capability.

18. Serviceable Product Storage. The following rules apply to serviceable HazMat storage:
    a. Flammable HazMat (indoors) must be stored in an approved flammable storage cabinet or in a manner approved by the Station Fire Safety and Prevention Section;

b. Refillable compressed gas cylinders must be secured in an upright position;

c. HazMat must be labelled in accordance with the Workplace Hazardous Materials Information System (WHMIS) guidelines;

d. Incompatible classes of hazardous materials must be physically separated. Compatibility charts should be posted in HazMat storage areas.

e. All HazMat storage areas are subject to siting approval by the Station Fire Chief. (Annex C).

19. The secondary containment standard is 110% of the volume of the largest container plus 10% of aggregated capacity of all other containers within the storage area. The goal is to prevent the uncontrolled release of HazMat into the environment.

20. All containers less than 200 liters in volume must be protected from the weather to maintain container integrity.

21. Storage Site Registration. All HazMat storage sites at CFS Alert must be registered. The registration procedure requirements include: completing the form provided at Annex D; obtaining siting recommendations from 8 Wing Env O; siting approval from the Station Fire Chief and the 8 Wing Env O.

22. The HazMat registration program identifies the location of each storage site, storage standards in effect and the responsible person in charge of the HazMat storage area. A HazMat inventory form will be used to record stock numbers (if applicable), properties and quantities of HazMat stored. The inventory must be reviewed and updated regularly by the unit supervisor.

23. Application/Use. The Workplace Hazardous Material Information System (WHMIS) was developed to ensure that employees are aware of the hazardous products used in their workplace. Supervisors must ensure that employees are adequately trained in the use of products and the personal protective equipment (PPE).

24. All employees retain the right to know about the hazardous material used in their workplace and it is the supervisor's responsibility to ensure that they know. Every employee shall have direct access to the MSDS’s for the products in their immediate work area.

25. The appropriate PPE must be worn during the handling, application or clean up of HazMat. Directions supplied by the manufacturer for safe product use and spill response/clean up must be adhered to.

26. HazMat Waste Segregation and Identification. Hazardous wastes, as defined in Annex B, must not be allowed to enter a sanitary sewer, storm drain, or be disposed of in general refuse containers. DND, CBO or contractor generated HazMat waste must be identified, collected and disposed of through the CBO HazMat Coordinator.

27. HazMat wastes must be accurately segregated and identified.

28. All HazMat waste will be labelled in accordance with the Transportation of Dangerous Goods Regulations. In addition to TDGR labelling requirements, a complete DSRO-100(7-90) Hazardous Waste Label, NSN 7690-21-907-5618, shall be applied to any containers used for waste collection at the time of the initial use of the container. A sample DSRO-100 label is provided at Annex F.

29. Wastes that are not regulated by TDGR but meet the definition of hazardous waste in Annex B, only require a completed DSRO-100 Hazardous Waste Label.

30. The goal of waste segregation and identification is to reduce or eliminate disposal costs. If properly segregated, several HazMat waste commodities are recyclable and may have resale or credit value. The cost to identify and dispose of mixed or unknown hazardous waste often exceeds the value of the original product.

31. Empty HazMat Containers Disposal.

    All empty Hazmat containers must meet the "empty container" definition at Annex B.

32. Waste Storage. A minimum quantity of HazMat waste shall be stored at the registered storage sites.

    a. Batteries – All old zinc HADCS batteries have been neutralized and incinerated. The ash from the incineration is currently sealed in 45-gallon drums, identified and placed in the HazMat Barrel Farm until the suitable landfill mentioned above is constructed.
    All other batteries – These are to be properly packaged, sorted and shipped south as they have expended their lifetime. These include the new lead acid gel HADCS batteries.

    b. Glycol – Used and expired Glycol will be burnt in the incinerator. All glycol contained entrapped in spent absorbent material is currently incinerated. Glycol includes all vehicle anti-freeze, SRl from HRS and aircraft de-icing fluid.

c. Waste Oil – Used oil is burnt in the used oil burner located in the SE corner of the Maintenance building (B17). Once empty, BFurnO notifies CBO HazMat Co-ordinator of the drum waste number so that the HazMat Register can be updated and CBO Trashman can pick up the waste drum for disposal.

d. PCB's – Any PCB's found on the station will be reported to 8Wing Environment once they are put into the PCB Storage Building and then again when they are shipped to 8 Wing Supply in Trenton.

e. Fuel – Waste fuel (waste DF8 and gasoline) is used by CBO personnel to light the burn pit, any bone fires and the incinerator. These locations are permanent to limit any possible contamination from burns.

f. Aerosol Cans – Trashman disposes of these cans. They are punctured then incinerated, to remove residual and then disposed of in the Millionaire's dump. Only Trashman can perform this task as he maintains the proper environmentally friendly disposal unit and has the proper training. Aerosols that are unsafe to dispose of on site are shipped to 8 Wing Supply in Trenton for proper disposal.

g. Waste Glycol and Fuel Drum Disposal – Waste glycol and fuel drums should be opened using a manual drum deheader (barrel opener) and drained completely. They may then be crushed and disposed of at Millionaire's dump.

h. If the proper deheader tool is used, the drums will not require venting or incinerating after being opened and emptied. Absorbent pads should be placed in the bottom of the crusher during the process. The pads may then be incinerated.

i. Waste Oil Drum Disposal – Waste oil drums must be drained, incinerated and crushed before placing them into the Millionaires dump.

j. Paint – Waste paint must be sent south for disposal. Whenever possible, consolidate load by pouring paint into 45 gallon drums. The paint crusher is located at the Incinerator Bldg (B29).

k. Oil Rags, Absorbent Pads & Absorbal – These materials are incinerated with miscellaneous burns and/or dry garbage.

l. Miscellaneous Hazardous Materials – Proper disposal of all items will be under the advice and direction of the CBO HazMat Co-ordinator. All materials that cannot be disposed of locally will be shipped to 8 Wing Supply for proper disposal.

33. Waste Disposal Documentation. All shipments of HazMat waste destined for CBO's waste collection sites shall be accompanied by a MSDS and a Hazardous Waste Certification (Annex E) signed by the originator. This form must be completed accurately and in accordance with the TDGR.

34. Manifests for off-base shipments of HazMat waste must conform with TDGR, federal, provincial and municipal regulations. CFS Alert Traffic is responsible for shipping hazardous material.

35. Waste Transportation. The HazMat technician (TrashMan) will ensure that the waste collection process is completed in a safe, efficient manner and in compliance with all applicable regulations. The Hazmat technician is responsible for the waste collection process as well as vehicle operations which include securing the cargo and trailer for safe movement.

HAZMAT WASTE DISPOSAL

36. Waste Transfer Site Management. All HazMat stored at the user level, shall be stored in accordance with DND document A-LM-187-004/JS-001. The primary function of each storage site is to provide safe, temporary storage of HazMat waste. A balance between economical disposal and frequently inventory turn-over is the desire goal.

37. Hazmat waste shall be consolidated to achieve an economy of scale and conform to industry disposal standards and accepted practice. As hazardous material becomes available, CBO will dispose of it as it is identified. A list of barrels at CFS Alert is located in the end month Site Managers report which is located on the S:\Drive.

38. Waste Holding Sites:

    a. HAZMAT Barrel Compound: located approximately 500 m east of the Worm Farm C-Span (B-65). At no time are unauthorized personnel permitted at this location. For access, contact CBO HazMat Coordinator. The only waste allowed at this site is battery ash, decommissioned fuel tanks awaiting destruction, and the newer drummed waste lead acid gel HADCS batteries which were brought to Alert from the IDA site (these must be in overpacks. Note: "Ida" is the name, designated by the Canadian Forces, for a microwave communication relay tower that forms the High Arctic Data Communication System (HADCS) between CFS Alert and CFS Eureka. There are five (5) towers that form the communications link between CFS Alert and CFS Eureka, called, in sequence from CFS Alert: Grant, Ida, Victor, Yankee, and Whiskey. The five (5) names do not have special meaning and are only place names.

b. Flammable Storage Containers: These two sea containers are located between the HAPS (B-125) and Incinerator Building (B-29). At no time are unauthorized personnel permitted to place waste into these buildings. For access, contact the CBO HazMat coordinator.

c. Incinerator Building (B-29): The loading dock located immediately north of this building contains barrels that are being prepared for incineration in the near future. They are processed and controlled by the CBO HazMat Coordinator.

d. PCB Storage Unit: This sea container is located NE of the Worm Farm (B-65) and is controlled by CBO. Access to this building is strictly prohibited for health and safety concerns. Only personnel familiar with PCB handling and storage will be permitted to enter under the direction of the CBO HazMat coordinator. This building is also registered with Environment Canada and plotted on their database with GPS grids and at no time is to be moved without the consent of the 8Wing Env O.

SPILL RESPONSE PLANNING

39. Planning for a Potential Spill. A chemical spill requires immediate and decisive action. Any user which stores, handles, or uses HazMat requires a spill plan. The spill planning process shall consist of both spill prevention and spill reaction planning.

40. The objective of spill prevention planning is to review current or new work practices. HazMat spills are preventable through detailed work design and education. High risk work practices must be identified and re-designed and have a well defined reaction plan in place to minimize the impact of an uncontrolled release.

41. Reporting Format.

a. All spills are to be reported immediately to the Site Manager, Smokey (Fire Chief), H20, HazMat Coordinator, SWO and CO through normal Chain of Command.

b. HazMat Coordinator is to fill out CFS Alert Spill Report for all spills regardless of quantity and forward to Site manager for review then furtherance to CO.

c. Site Manager so ensure CFS Alert Spill Report is completed accurately and forwarded by e-mail within 24 hours to KovanenDL@CFBTrenton WEnv@Trenton

d. Site Manager ensures Spill Report is signed by the CO

e. Spills must be reported to ensure that the appropriate site clean-up is initiated. Spill reports provide an opportunity to learn from the incident and plan to prevent further occurrences.

AUDIT/SELF INSPECTION PROGRAM

42. To ensure that this plan is successfully implemented, elements of this plan must be incorporated into "established inspection checklists". People living or working at CFS Alert must comply with this plan to maintain the health and safety of personnel, protection of property, and the preservation of the environment.

CONCLUSION

43 It is important that personnel responsible for the management of the program monitor progress systematically and conduct spot checks. It is especially important for managers to ensure that existing and new personnel involved in the handling of hazardous materials are fully trained and explicitly briefed on the systems in place at CFS Alert. The program stresses feedback from personnel handling hazardous materials. Increased emphasis must be placed on holding regular work site meetings, and a forum for feedback must be provided concerning the safe handling and disposal of hazardous materials. As hazardous material becomes available, CBO will dispose of them as they are identified.

ANNEX A

CODE OF ENVIRONMENTAL STEWARDSHIP

The Canadian Forces, and the Department of National Defence, commit to:

Integrate environmental concerns with operational, financial, safety, health, economic development and other relevant concerns in decision making;

Meet or exceed the letter and spirit of all applicable federal environmental laws and where appropriate, to be compatible with provincial and international standards;

Improve the level of awareness within the Canadian Forces and the Department of National Defence for the environmental and health benefits and risks of operational decisions, and to encourage and recognize the actions of personnel;

Apply environmentally responsible management practices to hazardous material used in operations, including biological products with specified regard for acquisition, handling, storage, safety in use, transportation and disposal of such material;

Ensure that environmental considerations are integrated into procurement policies and practices;

Seek cost effective methods of reducing the consumption of raw material, toxic substances, energy, water and other resources, and reducing the generation of waste and noise associated with day-to-day operations; and,

Acquire, manage and dispose of lands in a manner that is environmentally sound, including the protection of ecologically significant areas.

ANNEX B

DEFINITIONS

Act
The Transportation of Dangerous Goods Act (TDGA 1992).

Bulk or In Bulk

Dangerous goods confined only by a large container (more than 454 liters) or a transport unit without intermediate containment or packaging.

Carrier

Any person who engages in transporting dangerous goods, whether or not for pay or reward.

Compatibility Chart

Identifies the classes of hazardous materials that can be transported and stored together without significantly increasing either the probability of an accident or, for a given quantity, the magnitude of the effects of such an accident.

Consignment

Dangerous goods transported in a transport unit from one consignor at one location to one consignee at another location.

Consignee

The person to whom a consignment is being, or is intended to be, transported to usually requiring consignee's signature.

Consignor

The person who offers the shipment for transport (normally the shipper).

Container
Any portable device less than 454 liters in volume in which Hazmat is stored.

Dangerous Good

Materials regulated by TDGA 1992 which may be any of the chemicals identified by name in Schedule II of the TDG regulations or may have chemical properties such that they fall within one of the nine TDG classes.

Documents

The form meeting the requirements of Part IV of the Regulations, describing the dangerous goods contained in a consignment.

Empty Container

A container that contains less than 2.5 centimeters of residue remaining at the bottom of the container or less than 1% of the original contents, whichever is the lesser amount.

HazMat

The abbreviation for hazardous materials, which includes dangerous substances, dangerous goods, hazardous commodities and hazardous products such as poisons, pesticides, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or any other material that can, if not handled properly, endanger human health/well-being, property or the environment.

HazMat Classifications

There are two sets of classifications within the general definition of HazMat, one under the TDGA 1992, which in turn led to the development of the Workplace Hazardous Materials Information System, 1998, (WHMIS). Although similar in many ways, the differences in definition, application and labelling between these two systems and associated classifications must be understood:

1. TDGA 1992 has nine classes numbered 1 to 9 inclusive, with numbered divisions, eg. Class 3, Division 2 would be listed as 3.2. In shipping and storage (eg. 2nd and 3rd line handling) the TDG class and labelling system is used; and

2. Hazardous Product Act (and WHMIS) has six classes alphabetically identified from A to F inclusive, with numbered divisions, e.g. Class D, Division 1 would be listed as D1. Distribution to users and workplace activities (e.g. first line handling) will use the WHMIS class and labelling system.

Hazardous Wastes

Includes those wastes which are potentially hazardous to human health, property and/or the environment due to their nature and quantity, and which require "special" disposal techniques. They are usually hazardous materials which have no further use or they may be derived from a hazardous material which has become contaminated. The term "special waste" may be used in some provincial and territorial jurisdictions in place of hazardous or HazMat waste and may dictate "special" handling or disposal procedures.

Labels

Small diamond-shaped safety marks placed on packages and small containers to identify the nature of the hazard associated with the product or material.

Lists

List I and List II in Schedule II of the Regulations, listing the proper shipping names and classifications of dangerous goods.

NA

"North American" prefix used in conjunction with a four digit number to identify dangerous goods. NA numbers are in the 9000 series.

Net Explosive Quantity (NEQ)

The actual amount of explosives contained in an explosive device, less the packing.

Material Safety Data Sheet (MSDS):

The MSDS is a supplier-produced document providing detailed technical, hazard and precautionary information with respect to a hazardous (controlled) product and which describes potential health effects of exposure to the product, recommended personal protection for workers, hazard evaluations related to use, storage and handling techniques, first aid and emergency procedures.

Packing Group

Indicates the degree of danger of a product or substance. Group I, greater danger; Group II, moderate danger; Group III, minor danger and Group X, the packing procedures which should be carried out in the interest of the physical or chemical properties of dangerous goods.

Packaging

The appropriate dunnage or container to ensure that dangerous goods can be safely transported.

Placard

Large diamond-shaped safety markers used on a vehicle or large container to identify the hazard associated with dangerous goods.

Plan

Refers to the HazMat Management Plan which is a wing user guide on Hazmat, developed in accordance with ACO 36-55.

Primary Function

The premier classification of a dangerous good that takes precedence over any other classification.

Product Identification Number

A four-digit United Nations or North American number used to identify dangerous goods.

Residue

The film or sludge remaining in a storage or transportation container when hazardous or other material has been removed to the maximum extent possible.

Shelf Life Controlled Product

A product with specific storage standards or limitations (ie light, temperature, time) that demand special storage and has a limited lifetime within which the product maintains its optimum effectiveness for which it was designed.

Shipping Name

The name for a regulated dangerous good as it appears in Lists I and List II of Schedule II of the TDGA 1992 Regulations. It is usually selected by the manufacturer, using the classification process.

Special Provisions

Special provisions listed in Schedule III of the TDGA 1992 Regulations that must be followed when transporting the specific item.

Subsidiary Classification

Other classifications that identify the secondary or tertiary of dangerous goods.

Transportation of Dangerous Goods Act

TDGA 1992 provides extensive guidelines for labelling, packing, shipping, preparation of shipping documents and manifests, emergency response planning, training and certification to anyone who handles, ships or offers for shipment dangerous goods by road, rail, air or marine modes of transport.

UN Number

The "United Nations" product identification prefix used in conjunction with a four-digit number to identify dangerous goods.

Un-rinsed Empty Container

An empty container that has not been rinsed three times using, for each rinse, a clean solvent that is in an amount equal to 10% of the container volume and that is capable of removing the contained HazMat.

Weatherproof Container

A container affixed to the outside of a transport unit, intended to hold dangerous goods documentation if the unit contains dangerous goods and is parked in an unattended area with the tractor removed.

Waste

Any product included in the List II of Schedule II of the TDGA 1992 regulations that is intended to be discarded.

Workplace Hazardous Materials Information System (WHMIS)

Essentially the "worker's right to know" legislation WHMIS is a system of identification of controlled (hazardous) products and delivery of hazard information to every workplace where controlled products are in use. WHMIS specifically requires that suppliers classify their products according to standardized hazard classes and that they provide a Material

Safety Data Sheet (MSDS) for every controlled product sold or imported into a Canadian workplace. In turn, employers are responsible for ensuring that HazMat used at their workplace(s) is properly identified, labelled and accompanied by a MSDS. Employers are also responsible for workers fully understand WHMIS labels and MSDS's and can apply this information to their work practices. Workers must comply with training requirements.

ANNEX C (APPENDIX 1)

INSPECTION AND THE SAFE STORAGE AND HANDLING OF HAZARDOUS MATERIALS

Ref: A-LM-187-004/JS-001

YES	NO	ITEM	COMMENT
		Material Safety Data Sheets (MSDSs) in place and valid?	
		Employees are hazardous trained in handling substances?	
		Emergency procedures known and practiced?	
		Adequate Personal Protective Equipment available and used?	
		Employees familiar with equipment used?	
		Accidents and spills reported promptly?	
		Emergency showers and eye wash facilities available?	
		Section's Standard Operating Procedures (SOPs) in place?	
		Emergency Response Kits with absorbent material, mops, etc., available within the section?	
HOUSEKEEPING			
		Floors and stairways are free from spills (water, oil, chemicals, etc.)?	
		Treads on stairs or floor mats are still effective?	
		Tripping hazards reported or corrected?	

YES	No	ITEM	COMMENT
		Cleanliness and order maintained in the storage areas at all times?	
		Proper disposal of unlabeled, contaminated or used hazardous materials?	
		Hazardous materials and containers inspected on regular basis for defects and leakage?	
		Inspection logs being maintained?	
		Packaging material and empty containers immediately removed from storage area?	
		Waste receptacles properly marked and easily located?	
STORAGE AREAS			
		Storage areas well lit with two clearly marked exits?	
		Hazardous storage areas well ventilated?	
		Hazardous materials that require cool/dehumidified conditions are stored under such conditions?	
		Open flame, smoking or any type of localized heat prohibited in the hazardous area?	
		Mixing or transfer of hazardous materials done outside the storage areas and in authorized "recouping" areas?	
		Authorized specification containers being used?	
		Containers inspected for rust, corrosion and leakage?	
		Damaged containers removed immediately or repackaged properly?	
		Safe tracking heights being observed?	
LABELING OF CONTAINERS			
		Approved hazard labels and identification system used for labelling all hazardous materials?	

YES	NO	ITEM	COMMENT
		All containers clearly and properly labelled as to their contents?	
		Labels firmly attached to the packages?	
GAS CYLINDERS			
		All gas cylinders secured against falling?	
		Gas cylinders stored away from direct localized heat, open flames and sparks?	
		Gas cylinders stored in a cool, dry place away from corrosive materials or highly flammable substances?	
		Empty cylinders marked "empty" and stored separately from full cylinders?	
		Valves of empty cylinders closed?	
		Valves caps securely in place to protect the valve stem and the valve when storing or moving cylinders?	
		Hand truck available or accessible for transporting gas cylinders?	
FIRST AID AND SAFETY EQUIPMENT			
		Adequate eye wash stations available, stocked and inspected?	
		Adequate safety showers available and functional?	
		Adequate spill control equipment available and serviceable?	
		Fire extinguishers at the fire points with properly dated inspection tags?	
		Smoke/fire sensors, automatic alarms and vapour alarms available, working, and properly inspected?	
		Adequate ventilation equipment available and functional?	
		First Aid kits available, stocked and inspected?	

YES	NO	ITEM	COMMENT
		Emergency response numbers posted, telephone location(s) known and telephone(s) working?	
		Hand washing facilities readily available?	
HAZARDOUS MATERIALS STORAGE			
		Hazardous materials stored to prevent exposure to direct sunlight or localized heat?	
		Hazardous materials stored by hazard class?	
		Incompatible materials physically separated from each in accordance with the applicable regulations?	
		MSDS's information on incompatibility of materials available for consultation for safe storage arrangement?	
		Compatibility charts posted?	
ACIDS			
		Large bottles of acid stored on a low shelf or in approved cabinets?	
		Oxidizing acids segregated from organic acids, flammable and combustible materials?	
		Acids kept separate from base and alkaline metals such as sodium or potassium?	
		Spill control plans and equipment available for acid spills?	
BASES			
		Bases stored away from acids?	
		Solutions of inorganic hydroxides stored in polyethylene containers?	
		Spill control plans and equipment available for caustic spills?	

YES	NO	ITEM	COMMENT
OXIDIZERS			
		Oxidizers stored away from flammable and combustible materials and reducing agents such as zinc, alkaline metals and formic acid.	
WATER REACTIVE MATERIALS			
		Dry chemical fire extinguisher system used?	
		Materials kept in a cool, dry place?	
FLAMMABLES			
		All flammable liquids kept in approved storage areas in approved containers?	
		Flammables kept away from any source of ignition, flames, heat or spark?	
		All electrical service equipment explosion-proof?	
		Fire fighting equipment readily available?	
		A static bonding line used to connect the drum and receptacle (decanting) when dispensing flammable liquids into a metal container?	
		All storage containers greater than 5 gallons properly grounded to an approved grounding point?	
		Toxic material, carcinogens and teratogens kept in a secure area accessible only to authorized personnel?	
		Emergency response actions posted?	
SPECIAL IN HOUSE PROBLEMS			
		Identify protective requirements and add to this list?	
MATERIAL HANDLING EQUIPMENT (MHE)			

		Material handling equipment grounded?	
		Material handling equipment checked daily for defective operation?	

YES	NO	ITEM	COMMENT
		The right type of material handling equipment being used around hazardous materials?	
		Moving (electrical) parts guarded?	
		Wiring, switches and fuses free of defects?	
STORAGE AREA			
		Hazardous storage areas properly and prominently marked or identified?	
		Hazardous areas secured at all times when not in use, with access only to authorized personnel	
		Emergency response drills known and practiced by all?	

ANNEX C
HAZMAT STORAGE SITE REGISTRATION PROGRAM

1. Each HazMat storage site must be registered with the Environmental Officer (EnvO). The following information on this form must be completed and all guidelines for safe storage of HazMat must be met.

2. After meeting the pre-approval requirements, the supervisor must request an inspection by the Fire Safety and Prevention Section.

3. A copy of the completed form, together with the Fire Inspector's approval, will be forwarded to the CBO Hazardous Materials Coordinator. A site visit will be arranged to inspect the storage facility. If all storage conditions are met, the form will be forwarded to the EnvO to receive an approval signature on the registration certificate. A sample registration certificate is provided below.

Section Contact
Squadron/Section/Unit:_____

Primary Contact Name:_____ Telephone:_____

Alternate Contact Name:_____ Telephone:_____

Location of Serviceable/Waste HazMat Storage Areas
Serviceable HazMat Storage: The location of each serviceable HazMat storage unit(s) must be shown on an appropriate floor plan of a scale showing required detail.

Waste HazMat Storage: All waste HazMat site(s) must also be identified on a similar drawing.

Inspection Certification and Recommendation (signatures)

Section Contact:_____ Date: _____

CBO Fire Inspector:_____ Date:_____

CBO HazMat Coordinator: _____ Date:_____

Registration Approval

WEnvO:_____ Date:_____

ANNEX D

RETURN OF HAZARDOUS MATERIAL/WASTE FOR DISPOSAL

The following outlines details and procedures for preparation and return of hazardous material/waste for disposal.

Prior to collection for disposal of hazardous material/waste the generator will ensure:

- that each container is clearly labelled or marked to identify contents and if requested, a current Material Data Safety Sheet (MSDS) be made available. If wastes are unknown, the generator will make every attempt possible to identify waste such as questioning others in the workplace, checking the outside of container for any descriptive markings, manufacture name, stock no., etc.

- that containers used are in good condition with proper lids, caps, bungs, etc., and do not leak.

- that containers/drums, when filled, allow a space equal to 5% of the container volume to allow for expansion.

- ensure that containers are in a secure location away from high traffic areas to prevent damage to containers causing accidental spills.

PROCEDURES FOR RETURN AND DISPOSAL OF HAZARDOUS MATERIAL/WASTE

Once wastes are ready for return, as outlined above, the generator will contact the CBO Hazardous Material Coordinator with the following information:

- section or unit and building number
- contact person and telephone number
- waste description
- volume of container
- number of containers

They will then coordinate a pick up or drop off time and if necessary, a special purpose vehicle (SPV), e.g. forklift. The contact person must be available at pick up to certify waste and answer any questions which might arise prior to removal of the HazMat.

ANNEX D
MINIMUM INFORMATION REQUIRED RECORD KEEPING
WASTE TRANSFERS

IT IS HEREBY CERTIFIED THAT CONTAINER SERIAL NO._____ CONTAINS:

DESCRIPTION:_____

STATE:_____

CLASS:_____

PIN (UN or NA): _____

NO. OF CONTAINERS: _____

CONTAINER VOLUME: _____

TOTAL VOLUME: _____

NAME: _____

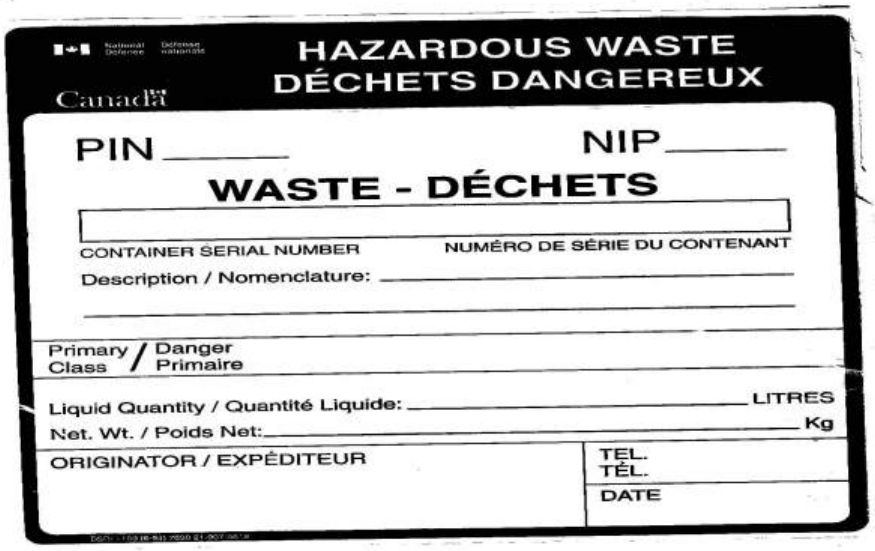
POSITION:_____

UNIT:_____

DATE:_____

SIGNATURE:_____

ANNEX E


National Defence
Défense nationale
Canada
HAZARDOUS WASTE
DÉCHETS DANGEREUX
PIN
NIP
WASTE - DÉCHETS
CONTAINER SERIAL NUMBER
NUMÉRO DE SÉRIE DU CONTENANT
Description / Nomenclature:
Primary Class / Danger Primaire
Liquid Quantity / Quantité Liquide:
LITRES
Net. Wt. / Poids Net:
Kg
ORIGINATOR / EXPÉDITEUR
TEL.
TÉL.
DATE

ANNEX F

CFS ALERT
WEEKLY SAFETY & HAZMAT CHECKLIST

Section :

Date :

ITEM	REMARKS / ACTION TAKEN
GENERAL WORK PLACE CONDITIONS	
FLOORS(SURFACES)	
WORK AREA(CLEANLINESS)	
AISLES/PASSAGEWAYS	
PLATFORMS/SCAFFOLDING	
LADDERS	
STAIRS	
EXITS/EGRESS	
ROADWAYS	
ENVIRONMENTAL	
VENTILATION	
LIGHTING	
NOISE CONTROL	
ERGONOMICS	
FUMES/DUST	
TEMPERATURE	
RESTROOM FACILITIES	
EQUIPMENT	
HAND/PORTABLE TOOLS	
MACHINE TOOLS/GUARDING	
MOBILE EQUIPMENT	
LIFTING GEAR/EQUIPMENT	
MATERIAL HANDLING EQUIPMENT	
PRESSURE VESSELS	
HYDRAULIC POWER SYSTEMS	
PNEUMATIC POWER SYSTEMS	
ELECTRICAL POWER SYSTEMS	
MECHANICAL POWER TOOLS	
HAZARD CONTROLS	
LOCK OUT SYSTEMS	
SIGNS/TAGS	
COLOUR CODING	
MATERIAL LABELING	
MSDS/HMGS	
WARNING SYSTEMS	

ITEM	REMARKS / ACTION TAKEN
EMERGENCY SYSTEMS	
EMERGENCY INSTRUCTIONS	
FIRE PROTECTION	
EYE BATHS/SHOWERS	
FIRST AID STATIONS/KITS	
EMERGENCY RESCUE EQUIPMENT	
PERSONAL PROTECTIVE EQUIPMENT	
EYE PROTECTION	
EAR PROTECTION	
RESPIRATORY PROTECTION	
HEAD PROTECTION	
HAND PROTECTION	
FOOT PROTECTION	
BODY PROTECTION	
FALL PROTECTION	
OFFICE	
FILING CABINETS	
ELECTRICAL CORDS/OUTLETS/LAMPS	
WALL/CEILING FIXTURES	
DESK/FILE DRAWERS	
TRAINING	
INDOCTRINATION	
WHMIS	
PERSONAL PROTECTIVE EQUIPMENT	
FIVE MINUTE SAFETY TALKS	
FIVE MINUTE VIDEOS	
EMERGENCY PROCEDURES FOR AREA	
MATERIALS	
STACKING/STORAGE	
CHEMICALS/FUELS	
COMPRESSED GASES	
WASTE DISPOSAL	

INSPECTOR'S SIGNATURE:

SECTION HEAD'S SIGNATURE _____

Appendix D: Spill Contingency Plan, CFS Alert, Nunavut

Defence Construction Canada
Construction de Défense Canada

Spill Contingency Plan
Canadian Forces Station Alert, Nunavut

In support of the
Nunavut Water Board Licence
No. 3BC-ALT1015

November 2010
Version 2.0

Prepared for:
1 Canadian Air Division,
Department of National Defence

Revised by:
Environmental Services
Defence Construction Canada

Revision Control Page

Revision No.	Revised By	Date	Issue/Revision Description
1.2	FSC Architects & Engineers	March 2009	Draft
2.0	Defence Construction Canada	November 2010	Final

Acronyms

1 CAD	1 Canadian Air Division
8 Wing	8 Wing Trenton
BFDS	Bulk Fuel Delivery System
CARF	Consignment Authorization and Receipt Form
CBO	Canadian Base Operator
CFS	Canadian Forces Station
DFA	Diesel Fuel Arctic
DND	Department of National Defence
ERT	Emergency Response Team
HazMat	Hazardous Materials
HazWaste	Hazardous Waste
INAC	Indian and Northern Affairs Canada
KIA	Kitikmeot Inuit Association
LTF	Lower Tank Farm
MSDS	Material Safety Data Sheet
NT-NU	Northwest Territories- Nunavut
NWB	Nunavut Water Board
O&M	Operation and Maintenance Plan
POL	Petroleum Oil Lubricants
QA/QC	Quality Assurance/Quality Control
SWO	Station Warrant Officer
UTF	Upper Tank Farm
WHMO	Wing HazMat Officer
W Env O	Wing Environment Officer

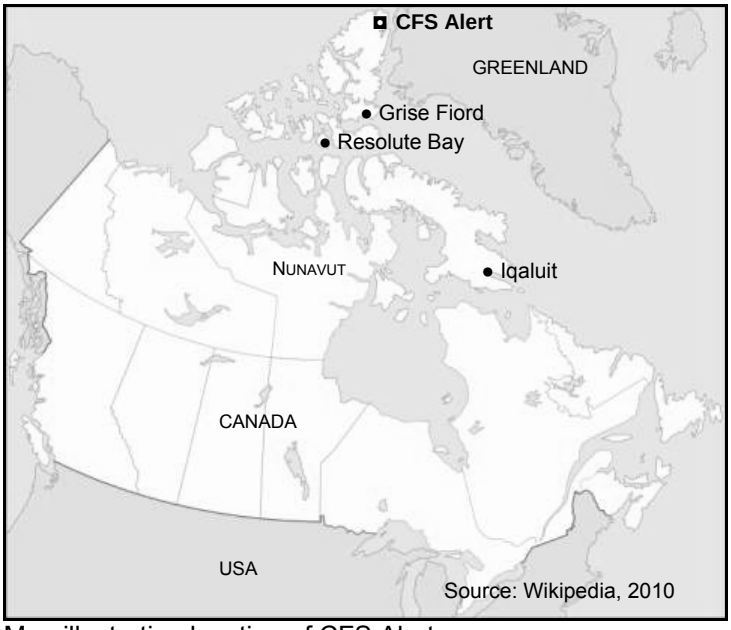
Table of Contents

1 Introduction

This contingency spill plan for Canadian Forces Station (CFS) Alert has been created to address the requirements of the Nunavut Water Board (NWB) under Licence number 3BC-ALT1015, issued to the Department of National Defence (DND) on August 5, 2010.

CFS Alert is situated on the north-eastern tip of Ellesmere Island; approximately 817 kilometres from the geographic North Pole at coordinates (Lat/Long) 82°28' N, 62°30' W. (UTM) Easting 552375.7996584666, Northing 6874583.726844844 (Map sheet number 120E05).

The station has been in continuous operations as part of the Canadian Military since September 1958. Staffing on site typically ranges from 50 to 100 military and civilian individuals, although for short durations the population can rise to 400 during training exercises.



Map illustrating location of CFS Alert.

1.1 LICENCEE INFORMATION

Col. R.C. Baker
Director A4 Construction Engineering
1 Canadian Air Division Headquarters
Department of National Defence
PO Box 17000 Stn Forces
Winnipeg, Manitoba, R3J 3Y5

1.2 INFORMATION OF 24 HOUR CONTACT

Alert Commanding Officer

1.3 GENERAL DESCRIPTION OF PROPERTY

Fuel Storage
The station's Petroleum Oil Lubricant (POL) System consists of a Lower (i.e., Airfield) Tank Farm (LTF) located adjacent to the airstrip, an Upper Tank Farm (UTF) midway between the airfield and the station, and a Day Tank at the station. Refer to Figure 1, Appendix A and Photo 1 below. Three types of fuel are used and stored onsite, and include JP-8 aviation fuel, diesel fuel arctic and ultra-low sulphur diesel. Fuel consumption at the station is approximately 2,500,000 L/year, most of which is used for power generation and heating.

CFS Alert flies in all the fuel using CC130 Hercules and C-17 Globemaster aircraft. The Bulk Fuel Delivery System consists of several aluminium tanks that are locked into the aircraft cargo compartment, carrying between 16,000 L to 18,000 L per load. When an aircraft lands, the fuel is transferred to two-455,000 L aboveground storage tanks at the LTF near the airstrip. From the LTF diesel fuel arctic is transferred to the UTF, and then fed to the Day Tank to supply the station. Any refuelling of aircraft is

conducted using fuel from the two-236,000 L JP-8 Aviation Fuel tanks at the LTF. Vehicles are refuelled from the 1-31,400 L ultra-low sulphur diesel at the LTF.

Fuel from the aircraft wings is transferred by the aircraft's pumps into the two JP-8 Aviation Fuel storage tanks assisted by the station's LTF fuel transfer pumps. Fuel from the Bulk Fuel Delivery System (BFDS) tank, which is mounted in the cargo compartment of the aircraft is transferred through a 4-inch receiving/transfer coupler manifold at the back of the aircraft to the DFA tanks. The station then transfers the DFA fuel from the LTF to the UTF.

Photo 1. Upper Fuel Tank Farm at CFS Alert.

Water Supply

The station's potable water is pumped 2.5 kilometres from Upper Dumbell Lake in a 100 mm diametre aboveground insulated/heated high-density polyethylene (i.e., Red pipeline) water line. A 50 mm diametre water line returns water back to the source to prevent the intakes from freezing. The three water intake points are positioned well below the thick ice that forms on the lake. The water is treated, chlorinated and stored in two-227,000 L storage tanks in the Water Treatment Plant Building, and distributed aboveground throughout the Station through an independent water distribution system. Buildings at the station supplied with water are identified in Table 1 below.

Wastewater/Sewage

The station is also serviced by a combined sewage and greywater collection system with insulated/heated high density polyethylene pipeline (i.e., Black pipeline). The system discharges the wastewater into a new Terrace System, which in turn discharges into Dumbell Bay. Buildings at the station connected to the sewage system are identified in Table 1 below.

Table 1. Buildings in Compound on Water and Sewer.

Building	Water	Bleeder	Sewer	Status
Water Treatment Plant	Yes	No	Yes	Operational
Standby Power Plant	Yes	Yes - 1	Yes	Operational
Main Power Plant	Yes	No	Yes	Operational
Main Supply & Warehouse	Yes	Yes - 1	Yes	Operational
Main Workshop & Firehall	Yes	No	Yes	Operational
Maintenance Transport	Yes	No	Yes	Operational
Transport Storage	No	No	No	Operational
Main Ops	Yes	Yes - 1	Yes	Operational
Chimo Quarters	Yes	Yes – 2	Yes	Operational
Ladner Quarters	Yes	Yes – 2	Yes	Operational
Whitehorse Quarters	Yes	Yes – 1	Yes	Operational
Churchill Hall	Yes	No	Yes	Operational
Cold Storage	No	No	No	Operational
Incinerator	Yes	Yes – 1	Yes	Lavatory, toilet, sinks removed; bleeding to keep water/sewer operational
Gymnasium	Yes	Yes – 1	Yes	Operational
Curling Rink	Yes	No	No	Closed – now storage

2 Project Facility Description

2.1 WASTEWATER / SEWAGE

The wastewater collection and discharge system is designed to prevent freezing ups. The wastewater flows under gravity; the system was designed so there are no low locations where the wastewater may accumulate and freeze. There are several different piping arrangements for the wastewater collection system. Each support building has a single wastewater line that joins before crossing the compound at the southeast end to discharge to the wastewater (i.e., sewage) outfall. The main complex has a separate wastewater pipe that collects wastewater from the complex and discharges it to the wastewater (i.e., sewage) outfall. Food waste is disposed of through a garbage disposal unit (i.e., garburator) connected to the wastewater collection system.

2.2 SOLID WASTE

All combustible garbage is compacted, bailed and incinerated before disposal at the dumpsite.

2.3 FUEL STORAGE

CFS Alert fuel storage facility consists of a total of 16 fuel tanks at the following three locations: UTF, Day Tank Farm and LTF. The UTF, comprised of eight tanks, uses gravity to feed the Day Tank which supplies diesel fuel arctic to the main station. The LTF, comprised of seven fuel tanks, is situated adjacent to the airstrip. Refer to Figure 2, Appendix A for the location of the fuel storage tanks. The number of tanks, tank sizes, locations and contents are as follows:

Location	Number & Size of Tanks	Contents
Upper Tank Farm	8 X 455,000 L	Diesel fuel arctic
Day Tank Farm	1 X 31,400 L	Diesel fuel arctic (supplies main station)
Lower (i.e., Airfield) Tank Farm	2 X 455,000 L	Diesel fuel arctic
	1 X 236,000 L	Diesel fuel arctic
	2 x 236,000 L	JP8 aviation fuel
	1 X 236,000 L	Ultra-low sulphur diesel
	1 X 31,400 L	Ultra-low sulphur diesel (day tank for fuelling vehicles)

2.4 CHEMICALS AND HOUSEHOLD DETERGENTS

The only chemicals used on the station are typical household cleaners/detergents for cleaning and laundry and chlorine for treating the station's potable water at the Water Treatment Plant; as a result wastewater from CFS Alert is non-hazardous in nature.

2.5 MATERIAL SAFETY DATA SHEETS

Refer to Appendix B for the Material Safety Data Sheets (MSDS) for diesel and JP8 fuel.

3 Type and Amount of Contaminants Stored at Site

3.1 DOMESTIC SEWAGE

Domestic sewage is not stored on site; it is piped through a gravity collection system to the sewage outfall. There are no lift stations where sewage may accumulate.

3.2 SOLID WASTE

All combustible garbage is compacted, bailed and incinerated before disposal at the dumpsite.

3.3 WASTE LUBRICANTS

All waste lubricants are used to fuel the waste oil furnace in the garage.

3.4 FUEL

As previously indicated diesel arctic fuel, JP8 and ultra-low sulphur fuel are stored in 16 fuel tanks at the station. Refer to Figure 2, Appendix A for tank farm locations at CFS Alert.

3.5 CHEMICALS AND HOUSEHOLD DETERGENTS

All products are purchased in Canada, and where required, registered in accordance with the applicable legislation.

3.6 RADIOACTIVE MATERIALS

No known radiation sources are stored onsite, unless as part of telecommunication systems. They are all removed to the support base for disposal if/when required.

4 Spill Prevention Measures

4.1 DOMESTIC SEWAGE

The sewage system is designed to be in continuous motion to prevent blockage and breakage due to freeze-up. Sewage lines run through heated spaces in the buildings before entering the outfall line. No chemicals, petroleum products or waste other than sewage and garburated food scraps are permitted to be disposed of via the wastewater collection system.

4.2 SOLID WASTE

All combustible garbage is compacted, bailed and incinerated in proper facilities to ensure safe disposal.

4.3 FUEL STORAGE

The two 31,400 L fuel tanks are double-walled; one tank is located in the UTF and one tank in the LTF. All other tanks are housed within containment berms, and include:

Upper Tank Farm:

- Eight 455,000 L diesel fuel arctic tanks

Lower (i.e., Airfield) Tank Farm:

- Two 455,000 L diesel fuel arctic tanks
- One 236,000 L diesel fuel arctic tanks
- Two 236,000 L JP8 aviation fuel tanks
- One 236,000 L ultra-low sulphur diesel fuel tank

Conditions along with effluent limits for the discharge of contained materials and water accumulation in the secondary containment (i.e., berm) at the tank farms are outlined in the CFS Alert's Operation and Maintenance (O&M) Plan and QA/QC Plan. Conditions specify that water will be sampled and analysed from secondary containment prior to the release of effluent to ensure the water meets the NWB criteria.

When transferring fuels only trained personnel operated and supervise the transferring process. Sumps and fuel storage tanks are located at a distance greater than 31 m from any water body high water mark and inspected regularly. Maintenance and servicing of equipment is to be conducted only in designated areas. Secondary containments such as drip pans are to be used to managed vehicle fluids and contain potential spills.

4.4 CHEMICALS AND HOUSEHOLD DETERGENTS

All chemical and household detergents are stored within a proper fire proof and spill proof storage unit. Care is taken when using or transferring these materials. Only containers in good condition and free of defects/damage shall be used.

4.5 HAZARDOUS WASTE

Hazardous waste is shipped from CFS Alert to 8 Wing Trenton in DND transport aircraft (i.e., Supply-HazWaste Facility) and is tracked using DND's Manifest Tracking System. Hazardous waste is shipped only once the Consignment Authorization and Receipt Form (CARF) is completed and identifies whether the cargo is a dangerous good. CARFs (i.e., manifests) are kept on file at the 8 Wing Trenton Supply–HazWaste Facility. This facility receives and properly disposes of hazardous waste through contractors. Refer to Appendix C for the CARF template; form reference number DND 690(5-94), 7530-21-903-1515.

5 Spills

5.1 IN THE CASE OF A SPILL

5.1.1 Initial Response

All spills of fuel or hazardous materials, regardless of size, must be immediately reported to the Emergency Response Team. The Emergency Response Team is comprised of the following responders listed in the sequence of notification: Site Manager or Fire Chief, CBO HazMat Coordinator, CBO Fuel Operator (i.e., Zippo) or CBO Base Furnace Operator (i.e., Heating). CFS Alert must notify the Environmental Officer or Environmental Assistant at 8 Wing Trenton of the spill as soon as possible.

Contact	Telephone No.
CFS Alert	
CBO Site Manager	(613) 945-3145 X3262
Fire Chief (i.e., Smokey)	(613) 945-3145 X3394
Deputy Fire Chief (i.e., Bandit)	(613) 945-3145 X3301
CBO HazMat Coordinator	(613) 945-3145 X3342
CBO Fuel Operator	(613) 945-3145 X3211
CBO Furnace Operator	(613) 945-3145 X3211
Station Warrant Officier	(613) 945-3145 X3218
8 Wing Trenton	
8 Wing Environmental Officer	(613) 392-2811 X3930
8 Wing Environmental Assistant	(613) 392-2811 X3997

Refer to Appendix D for the Roles and Responsibilities of the qualified responders.

Initial response:

1. Containment of a spill is the responsibility of the unit/persons experiencing the incident.
2. Immediately contact the Emergency Response Team (ERT).
3. Secure the area until the ERT arrives to the spill/incident site. The Emergency Response Team handles HazMat spills/incidents and associated clean-up.

Complete a Hazardous Material Incident Report Form upon resolution of the incident. Refer to Appendix E for General Spill Procedures at CFS Alert.

5.1.2 Methods of Containment

The main objective of containment shall be to limit the area affected by the spill and to prevent its spread to adjoining waterways or surface drainage systems.

1. **Containment dikes or berms** – constructed of impermeable or absorbing materials will be the main method of containing spills on land.

2. **Dams** – a system that is useful for small streams is to dam the stream with earth material.

3. **Containment booms –** a barrier to contain or deflect the spill, and floatation or support to maintain the position in the water. To keep the boom effective within a current, position the boom in a diversionary manner deflecting the spill to a recovery location. For fast-moving streams, the boom must be angled quite sharply to prevent losses under the boom.

4. **Trenches or storage pits** – used for temporary storage of spilled liquids and as intercepting channels for large spills. This can be used when the spill zone has a significant slope.

5. **Spills on pavement –** tend to spread very quickly and flow towards drainage systems. In most cases, it is important to prevent this from happening, or at least minimizing the amount of the spill that enters surface drains and catch basins.

6. **Small spills** – to be cleaned with absorbent material in granular or blanket form to immobilize and absorb the spilled fluid.

7. **Spills in winter** – frozen ground is much less permeable to fluids, and therefore spilled material will flow differently in winter than in summer. These spills will be contained when possible with berms of snow. When the entire spill is absorbed with snow, the snow will be deposited within a containment area. Cold temperatures will inhibit the flow of most liquids, but de-icing fluids and most jet fuels will resist freezing. Spills on or in ice-covered streams and ponds require special techniques depending on whether the spilled material sinks, floats or dissolves.

8. **Spills on water** – spills that reach the watercourses will spread quickly, so speed of action is essential for containment. Only floating substances are amendable to containment, those that sink or dissolve are not likely to be controlled once they reach a watercourse. A containment boom is the method of containment if the spilled material floats.

5.1.3 Initial Incident Reporting

All spills are immediately reported to the Emergency Response Team.

Major fuel spills are to be reported by message using a Significant Incident Report. All hazmat spills that require a Significant Incident Report shall have an Air Command Hazardous Material Incident Report completed and forwarded to Command within 14 days. (Refer to http://admfincs.mil.ca/admfincs/subjects/daod/2008/3_e.asp for more information on SIRs).

5.1.4 Decontamination Action

1. Ensure the spill has been stopped and contained.
2. Remove all contaminates to designated area.
3. If the spill happens in the winter mark the extent of the contamination to provide a guide for the inspector in the summer months.
4. During summer season a site inspector will take soil samples as necessary and submit the appropriate analysis to determine course of remediation action, if any.

5.1.5 Site Inspection

During the summer months, a qualified site inspector will complete a site inspection, take soil samples and submit them for appropriate analysis where necessary. The site inspector in conjunction with the 8 Wing Environmental Officer will develop a remediation plan, where required.

5.1.6 Reporting Action

In the event of a spill:

1. The Spill Contingency Plan will be employed by all station personnel.
2. The Canadian Base Operator (CBO), HazMat Coordinator or Site Manager will complete the CFS Alert Spill Report for all spills regardless of size, and submit the Spill Report to 8 Wing Trenton Environmental Management within 24 hours by fax/e-mail.
3. 8 Wing Trenton Environmental Management is responsible for reporting to required legislative authorities to prevent any potential financial or disciplinary penalties. CFS Alert does not report to outside departments/agencies, as such, 8 Wing will:
    - Report the spill to the Northwest Territories- Nunavut (NT-NU) 24 Hour Spill Line (867-920-8130), that exceed the guidelines in Table 2 (below).

- Complete and submit the Northwest Territories-Nunavut (NT-NU) Spill Response Form to the Inspector within 30 days after initially reporting the event (refer to Appendix F for spill report form).
- Indian and Northern Affairs Canada (INAC) Field Operations Manager (867-975-4295).
- Enter the 1 Canadian Air Division (1 CAD) Hazardous Materials Incident Report Spreadsheet for SpillNet (refer to Appendix F for spill report spreadsheet).

4. The Site Manager will ensure the Spill Report is signed by the Commanding Officer (CO) or delegated authority.
5. Spills must be reported to ensure that the appropriate site clean-up is initiated. Should any remediation for a spill be undertaken onsite a qualified site inspector shall fill out a daily process report.

Table 2. 8 Wing will report all spills to the NT-NU Spill Line that exceed the below guidelines.

Classification	Hazard	Reportable Quantity
1	Explosives	All
2.1	Compressed Gas (flammable)	100 L
2.2	Compressed Gas	100 L
2.3	Compressed Gas (toxic)	All
2.4	Compressed Gas (corrosive)	All
3	Flammable Liquids	50 L
4	Flammable Solids	1 kg
5.1 PG I & II	Oxidizer	1 kg or 1 L
PG III	Oxidizer	50 kg or 50 L
5.2	Organic Peroxide	1 kg or 1 L
6.1 PG I	Acute Toxic	1 kg or 1 L
PG II & III	Acute Toxic	5 kg or 5 L
6.2	Infectious	All
7	Radioactive	Any discharge or radiation level exceeding 10 mSv/h at the package surface and 200 uSv/h at 1 m from the package surface
8	Corrosive	5 kg or 5 L
9.1	Miscellaneous (except PCB mixtures)	50 kg
9.1	PCB Mixtures	500 g
9.2	Aquatic Toxic	1 kg or 1 L
9.3	Wastes (chronic toxic)	5 kg or 5 L

5.2 SPILL RESPONSE TRAINING

Training is to be conducted annually. All DND personnel at CFS Alert will be trained and made available to assist the Emergency Response Team. Personnel will be trained in the following:

1. Spill awareness & prevention
2. Methods of detection
3. Types of spills & seasonal conditions
4. Report procedures & Initial responses
5. Spill response kit
6. Clean-up & site remediation

7. Occupational health & safety, protective equipment & selection
8. Safe operation of Machinery & tools
9. Construction of a containment berm using soil or snow & plastic liner

5.3 SPILL KITS

Spill kits and absorbent materials are kept and maintained at several specified locations at CFS Alert at all times. Refer to Figure 2, Appendix A illustrating the spill kit locations at CFS Alert. Spill kits and locations include:

Location	Spill Kits
Airfield Fuel Tank Farm (B112)	▪ Full-size Tri-wal spill kits (i.e., 10 kits total).
HazMat Team Trailers (B12) - *adjacent to Day Fuel Tank Farm*	
Building 65 (B65)	
Vehicle Maintenance Building (B17)	▪ Three large spill kits. ▪ Spill pads and approximately 80 bags of absorbent for oils. ▪ Four medium-sized spill kits.
CHIMO Hall Furnace Room (B115)	▪ Spill kit
Ladner Hall Furnace Room (B116)	▪ Spill kit
Whitehorse Hall Furnace Room (B117)	▪ Spill kit

Spill kits* should contain at a minimum the following contents:

- 12 Fuel absorbent pads / pillows
- 2 Gloves
- 3 Bags absorbal
- 1 Drain cover
- 1 Non-sparking shovel
- 10 garbage bags
- 2 goggles
- 1 water proof package containing the Emergency Response Plan

*Spill kit contents subject to change based on site specific requirements (e.g., tank properties and characteristics).

5.4 EXTERNAL EMERGENCY CONTACTS

NT-NU 24-Hour Spill Report Line (867) 920-8130

INAC Field Operations Manager (867) 975-4295

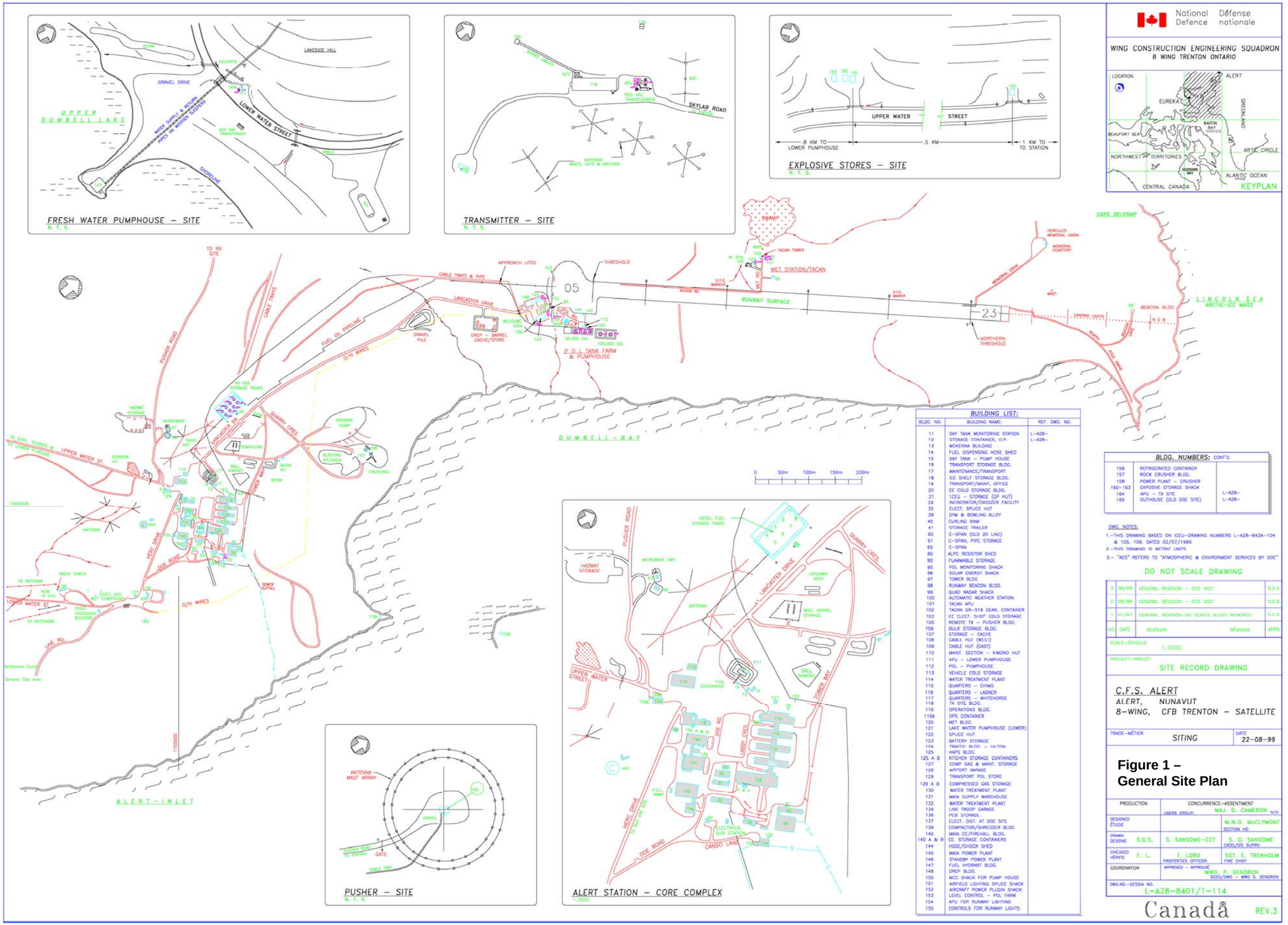
Government Nunavut Department of Environment, Iqaluit (867) 979-7800

Environment Canada (867) 975-4644

Kitikmeot Inuit Association (KIA) (867) 983-2458

For more information see the 1Cdn Air Div Uniform Spill Protocol @ http://winnipeg.mil.ca/a4env/subjects/spills/Uniform%20Spill%20Reporting%20Protocol_Revised_Jan_07.pdf

Appendix A: Figures



BUILDING LIST:

BLDG. NO:	BUILDING NAME:	REF. DWG. NO:
11	DAY TANK MONITORING STATION	L-A28-
12	STORAGE CONTAINER, O.P.	L-A28-
13	MCKENNA BUILDING	
14	FUEL DISPENSING HOSE SHED	
15	DAY TANK – PUMP HOUSE	
16	TRANSPORT STORAGE BLDG.	
17	MAINTENANCE/TRANSPORT	
18	ICE SHELF STORAGE BLDG.	
19	TRANSPORT/MAINT. OFFICE	
20	CE COLD STORAGE BLDG.	
21	1CEU – STORAGE (GP HUT)	
29	INCINERATOR/OXIDIZER FACILITY	
35	ELECT. SPLICE HUT	
39	GYM & BOWLING ALLEY	
40	CURLING RINK	
41	STORAGE TRAILER	
60	C-SPAN (OLD 20 LINE)	
61	C-SPAN, PIPE STORAGE	
65	C-SPAN	
80	ALPC RESISTOR SHED	
90	FLAMMABLE STORAGE	
95	POL MONITORING SHACK	
96	SOLAR ENERGY SHACK	
97	TOWER BLDG	
98	RUNWAY BEACON BLDG.	
99	QUAD RADAR SHACK	
100	AUTOMATIC WEATHER STATION	
101	TACAN APU	
102	TACAN GR-518 GEAR, CONTAINER	
103	CE ELECT. SHOP COLD STORAGE	
105	REMOTE TX – PUSHER BLDG.	
106	BULK STORAGE BLDG.	
107	STORAGE – CACHE	
108	CABLE HUT (WEST)	
109	CABLE HUT (EAST)	
110	MAINT. SECTION – KIMONO HUT	
111	APU – LOWER PUMPHOUSE	
112	POL – PUMPHOUSE	
113	VEHICLE COLD STORAGE	
114	WATER TREATMENT PLANT	
115	QUARTERS – CHIMO	
116	QUARTERS – LADNER	
117	QUARTERS – WHITEHORSE	
118	TX SITE BLDG.	
119	OPERATIONS BLDG.	
119A	OPS CONTAINER	
120	MET BLDG.	
121	LAKE WATER PUMPHOUSE (LOWER)	
122	SPLICE HUT	
123	BATTERY STORAGE	
124	TRAFFIC BLDG. – MILTON	
125	HAPS BLDG.	
125 A B	KITCHEN STORAGE CONTAINERS	
127	COMP GAS & MAINT. STORAGE	
128	AIRPORT GARAGE	
129	TRANSPORT POL STORE	
129 A B	COMPRESSED GAS STORAGE	
130	WATER TREATMENT PLANT	
131	MAIN SUPPLY WAREHOUSE	
132	WATER TREATMENT PLANT	
134	LINE TROOP GARAGE	
136	PCB STORAGE	
137	ELECT. DIST. AT DOE SITE	
139	COMPACTOR/SHREDDER BLDG	
140	MAIN CE/FIREHALL BLDG.	
140 A & B	CE. STORAGE CONTAINERS	
144	HOSE/CHOCK SHED	
145	MAIN POWER PLANT	
146	STANDBY POWER PLANT	
147	FUEL HYDRANT BLDG.	
148	DREP BLDG.	
150	MCC SHACK FOR PUMP HOUSE	
151	AIRFIELD LIGHTING SPLICE SHACK	
152	AIRCRAFT POWER PLUGIN SHACK	
153	LEVEL CONTROL – POL FARM	
154	APU FOR RUNWAY LIGHTING	
155	CONTROLS FOR RUNWAY LIGHTS	

BLDG. NUMBERS: CONT'D.

156	REFRIGERATED CONTAINER	
157	ROCK CRUSHER BLDG.	
158	POWER PLANT – CRUSHER	
160–163	EXPOSIVE STORAGE SHACK	
164	APU – TX SITE	L-A28-
165	OUTHOUSE (OLD DOE SITE)	L-A28-

DWG. NOTES:

1.–THIS DRAWING BASED ON ICEU–DRAWING NUMBERS L–A28–842A–104 & 105, 106. DATED 02/07/1986

2.–THIS DRAWING IS METRIC UNITS.

3.– "AES" REFERS TO "ATMOSPHERIC & ENVIRONMENT SERVICES BY DOE"

DO NOT SCALE DRAWING

NO.	DATE	REVISION	RÉVISION	APPR.
3	08/99	GENERAL REVISION – SITE VISIT		S.G.S.
2	08/98	GENERAL REVISION – SITE VISIT		S.G.S.
1	01/97	GENERAL REVISION–50 SERIES BLDGS REMOVED		S.G.S.

SCALE–ÉCHELLE: 1:5000

PROJECT–PROJET: SITE RECORD DRAWING

C.F.S. ALERT
ALERT, NUNAVUT
8–WING, CFB TRENTON – SATELLITE

TRADE–MÉTIER	DATE
SITING	22–08–99

Figure 1 – General Site Plan

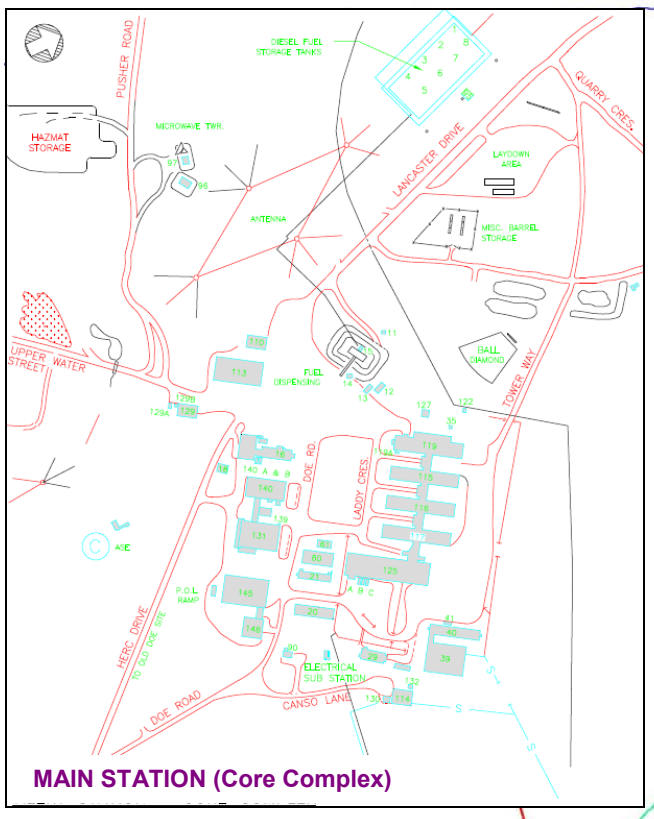
PRODUCTION	CONCURRENCE–ASSENTIMENT	
	USERS GROUP: MAJ. D. CAMERON SCO.	
DESIGNED ÉTUDIE		M.W.O. McCLYMONT SECTION HD.
DRAWN DESSINE S.G.S.	S. SANSOME–CET	S. G. SANSOME CADD/GIS SUPRV.
CHECKED VÉRIFIÉ F. L.	F. LORD PROPERTIES OFFICER:	SGT. E. TRENHOLM FIRE CHIEF
COORDINATION	APPROVED – APPROUVÉ: MWO. P. GENDRON SCEO/SWO – MWO G. GENDRON	

DWG.NO.–DESSIN NO. L–A28–8401/1–114

Canada REV.3

Source: DND, 1999.

Defence Construction Canada
Construction de Défense Canada



MAIN STATION (Core Complex)

N
W
E
S

Lincoln Sea

ALT-8

ALT-11

Dumbell Bay

ALT-4

ALT-9

MAIN STATION
(Core Complex)

ALT-10

ALT-2

ALT-3

Parr Inlet

ALT-5

ALT-6

ALT-7

ALT-1

Upper
Dumbell
Lake

Title:	CFS Alert Site Overview
Project:	Spill Contingency Plan, CFS Alert
Client:	Department of National Defence
Date:	November 2010
Figure:	Figure 2

LEGEND

ALT-1	Water Supply at Raw Water Intake (i.e., Pumphouse)
ALT-2	Sewage Outfall
ALT-3	Final Discharge Point of the Sewage Terrace System
ALT-4	Leachate from the Main Station Landfill
ALT-5	Leachate from the Battery Dump
ALT-6	Leachate from the Millionaire's Dump
ALT-7	Leachate from Dump 3
ALT-8	Lower (i.e., Airfield) Fuel Tank Farm (secondary containment)
ALT-9	Upper Fuel Tank Farm (secondary containment)
ALT-10	Day Fuel Tank Farm (secondary containment)
ALT-11	Landfarm
◘	Spill Kits

Appendix B: MSDS Sheets

MATERIAL SAFETY DATA SHEET

Product Name: Arctic Diesel Fuel (3090)

SECTION 1 – PRODUCT IDENTIFICATION AND USE

Product name	Arctic Diesel Fuel	**PIN #, UN #**	1202
Chemical name	None	**TDG, DOT class**	Class 3
Common names and	Diesel fuel No. 1, Fuel oil #1-D	**Packing group**	III
Product use	Fuel	**Shipping name**	Diesel Fuel

WHMIS classification: Combustible liquid Class B Division 3; Toxic material Class D Division 2 Subdivision B

Hazard codes

NFPA	Health	2	**HMIS**	Health	2
	Flammability	2		Flammability	2
	Reactivity	0		Reactivity	0

NFPA & HMIS Ratings:0=Insignificant/No Hazard. 1=Slight Hazard. 2=Moderate Hazard. 3=High/Serious Hazard. 4=Extreme/Severe

Supplier: Irving Oil Limited, Refining Division, Box 1260, Saint John, New Brunswick Canada E2L 4H6

Phone (506) 202-2000
Emergency 1-800-424-9300
Refinery (506) 202-3000

SECTION 2 – HAZARDOUS INGREDIENTS

Ingredients	CAS#	Wt (%)	ACGIH-TLVs (2004)	OSHA PELs (general industry) (2004)	NIOSH RELs (2004)	LD_{50} (rat, oral)	LC_{50} (rat, 4 hours)
Diesel fuel no. 1	68334-30-5	100	200 mg/m^3 TWA (total hydrocarbon vapour)	NAv for this product name or	100 mg/m^3 TWA	>5 g/kg	~5g/m^3
May contain: Benzene	71-43-2	Trace	0.5 ppm TWA 2.5 ppm STEL	1 ppm TWA 5 ppm STEL	0.1 ppm TWA 1.0 ppm STEL	930 mg/kg	13,200 ppm
May also contain: Sulphur	7704-34-9	Trace	NAv	NAv	NAv	>8.4 mg/kg	NAv
Which, under certain circumstances, may result in the evolution of: Hydrogen sulphide (H_2S)	7783-04-6	NAp	10 ppm TWA 15 ppm STEL	20 ppm CEILING	10 ppm CEILING	NAp	444 ppm

Arctic diesel is a complex mixture of hydrocarbons. Its exact composition depends on the source of the crude oil from which it was produced and the refining methods used. Arctic diesel contains hundreds of individual organic chemicals. This section identifies only some of the well-known chemical constituents.

SECTION 3 – PHYSICAL DATA

Form	Liquid	**Vapour**	10.5 mm Hg @ 38°C
Colour	Colourless to pale yellow	**Evaporation rate**	NAv
Odour	Kerosene-like	**Boiling point**	157 to 261°C (315 to 501°F)
Odour	Not available	**Freezing point**	- 47°C (- 53°F)
Specific gravity	0.81 @ 15°C	**pH**	NAp
Vapour density	4.5	**Coefficient of water/oil**	3.3 to >6(Log P_{oct})

SECTION 4 – FIRE AND EXPLOSION HAZARDS

Flammability ☒ Yes ☐ No **Conditions** Easily ignited by heat, sparks or flames.

Flash point 40°C (104°F) (cc) **Auto ignition** 210°C (410°F)
Lower flammable limit 0.7% **Upper flammable limit** 5%

Explosion data: Sensitivity **Mechanical impact** Not expected to be sensitive **Static discharge** Yes

Means of extinction: In general, do not extinguish fire unless flow can be stopped. Use carbon dioxide, dry chemical, or foam. Cool containers with flooding quantities of water until well after the fire is out.

Special precautions: Vapour is heavier than air. It will spread along the ground and collect in low or confined areas (sewers, basements, tanks). Vapour may travel to source of ignition and flash back. Containers may explode when heated.

Hazardous combustion products: Carbon monoxide. Nitrogen oxides. Aromatic hydrocarbons.

SECTION 5 – REACTIVITY INFORMATION

Stability	Stable
Conditions to avoid	Sources of ignition. Static discharges. High temperatures.
Incompatible substances	Oxidizers such as peroxides, nitric acid, and perchlorates.
Hazardous decomposition products	Carbon monoxide. Nitrogen oxides. Aromatic hydrocarbons. H_2S and sulphur dioxide (SO_2) may be produced from minor amounts of sulphur in the product.

SECTION 6 – HEALTH HAZARD INFORMATION

Route of Entry

- ☐ **Eye**
- ☒ **Skin absorption** Diesel fuel itself, as well as some components
- ☒ **Inhalation**
- ☒ **Ingestion**

Hazardous Contact

- ☐ **Eye**
- ☒ **Skin contact**

Acute exposure Headache and other symptoms of central nervous system (CNS) depression, such as nausea and dizziness, as well as burning sensation in chest following inhalation. Aspiration into the lungs can cause severe pneumonitis (serious lung irritation), chest pain, and/or pulmonary edema (swelling). Ingestion may produce nausea, vomiting, and cramping.

Note: H_2S may offgas from the product in confined spaces such as the headspace in tanks, even though the concentration of sulphur in the product is minimal. H_2S is very toxic. At concentrations as low as 1 to 5 ppm, nausea and severe eye irritation may occur. Sense of smell may be impaired at about 20 ppm, with headache and respiratory tract lung irritation. At 250 to 500 ppm, potentially fatal pulmonary edema (fluid in the lungs) may occur. Dizziness, sudden (often fatal) collapse, unconsciousness, and death occur at higher concentrations. Pulmonary edema may be delayed as long as 48 hours.

Chronic exposure Dermatitis. Possibly blood and nervous system disorders. Fatigue, and severe nervous and respiratory system symptoms may follow survival of H_2S poisoning.

Carcinogenicity Benzene is known to be carcinogenic.
Exposure to fuel oils during refining is considered "probably carcinogenic to humans".
IARC and NTP classify untreated and mildly treated mineral oils as known human carcinogens. ACGIH, EPA, NIOSH, and OSHA have not classified them.

Mutagenicity Not known to be mutagenic
Sensitization No
Irritancy Skin, respiratory
Teratogenicity NAv
Reproductive toxicity NAv

Toxicologically synergistic Other CNS depressants can be expected to produce additive or synergistic effects. May increase photosensitizing ability of certain chemicals, such as dinitrochlorobenzene (DNCB).

SECTION 7 – FIRST AID

Inhalation Move victim to fresh air Give artificial respiration if breathing has stopped and if a qualified AR administrator is available. Apply CPR if both pulse and breathing have stopped. Obtain medical attention immediately.

Ingestion Never give anything by mouth if the person is unconscious, rapidly losing consciousness, or convulsing. If the person is conscious, have them drink 8 to 10 ounces of water or milk to dilute the material in the stomach. **Do not** induce vomiting. If vomiting occurs spontaneously, have the person lean forward to avoid aspiration. Obtain medical attention immediately.

Eye If irritation occurs, flush eye with lukewarm, gently flowing fresh water for at least 10 minutes.

Skin Quickly and gently blot away excess chemical. Gently remove contaminated clothing and shoes under running water. Wash gently and thoroughly with water and non-abrasive soap. Obtain medical assistance.

SECTION 8 – PRECAUTIONARY MEASURES

Do not attempt rescue of an H_2S knockdown victim without the use of proper respiratory protective equipment.

Personal protective equipment	**Gloves**	Nitrile, Viton™, polyethylene preferred.
	Eye	Chemical safety goggle or face shield, as a good general safety practice.
	Respiratory	NIOSH-approved. SCBA or air line respirator with escape cylinder for confined spaces or work with sulphur-containing product. A qualified occupational health and safety professional should advise on respirator selection. If an air-purifying respirator is appropriate, use organic vapour
	Clothing & footwear	Coveralls to prevent skin contact with product. If clothing or footwear becomes contaminated with product, completely decontaminate it before re-use, or discard it.

Engineering controls	Enclose processes. Use local exhaust ventilation to remove vapour at its site of generation. Handle laboratory samples in a fume hood. Use mechanical ventilation in confined spaces.
Handling procedures & equipment	Avoid heating open containers of product so as to minimize vapour production and accumulation. Use non-sparking equipment, explosion-proof ventilation, and intrinsically safe electrical equipment. Ground handling equipment. Have clean emergency eyewash and shower readily available in the work area.
Leak & spill procedure	Keep unauthorized persons away Eliminate all sources of ignition. Ventilate area. Stop leak if it can be done safely. Prevent entry into sewers, waterways, or confined spaces. Absorb or cover with dry earth, sand or other non-combustible material and use clean, non-sparking tools to transfer to container.
Waste disposal	Consult local authorities for advice.
Storage	Cool, dry, well-ventilated area. No ignition sources. Containers should be vented and have flame
Shipping	Stable during transport. May be transported hot.

SECTION 9 – PREPARATION DATE OF MSDS

Prepared by	Irving Oil Limited, Refining Division	**Phone**	(506) 202-3000
Revision date	July 26, 2005	**To re-order MSDS,**	(506) 202-2000

Material Safety Data Sheet

SECTION 1 PRODUCT IDENTIFICATION

JP-8

Product Use: Fuel
Product Number(s): CPS243791
Synonyms: AVTUR

SECTION 2 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	AMOUNT
Kerosene	8008-20-6	> 99 %weight
Diethylene glycol monomethyl ether	111-77-3	< 1 %weight

SECTION 3 HAZARDS IDENTIFICATION

****

EMERGENCY OVERVIEW

Clear to light yellow liquid with petroleum odor.

- COMBUSTIBLE LIQUID AND VAPOR
- HARMFUL OR FATAL IF SWALLOWED - CAN ENTER LUNGS AND CAUSE DAMAGE
- MAY CAUSE RESPIRATORY TRACT IRRITATION IF INHALED
- CAUSES SKIN IRRITATION
- TOXIC TO AQUATIC ORGANISMS

****

IMMEDIATE HEALTH EFFECTS

Eye: Not expected to cause prolonged or significant eye irritation.

Skin: Contact with the skin causes irritation. Symptoms may include pain, itching, discoloration, swelling, and blistering. Contact with the skin is not expected to cause an allergic skin response. Not expected to be harmful to internal organs if absorbed through the skin.

Ingestion: Because of its low viscosity, this material can directly enter the lungs, if swallowed, or if subsequently vomited. Once in the lungs it is very difficult to remove and can cause severe injury or death. May be irritating to mouth, throat, and stomach. Symptoms may include nausea, vomiting, and diarrhea.

Inhalation: Breathing this material at concentrations above the recommended exposure limits may cause central nervous system effects. Central nervous system effects may include headache, dizziness, nausea, vomiting, weakness, loss of coordination, blurred vision, drowsiness, confusion, or disorientation. At extreme exposures, central nervous system effects may include respiratory depression, tremors or convulsions, loss of consciousness, coma or death. Mists of this material may cause respiratory irritation. Symptoms of respiratory irritation may include coughing and difficulty breathing.

SECTION 4 FIRST AID MEASURES

Eye: No specific first aid measures are required because this material is not expected to cause eye irritation. As a precaution, remove contact lenses, if worn, and flush eyes with water.
Skin: Wash skin with water immediately and remove contaminated clothing and shoes. Get medical attention if any symptoms develop. To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.
Ingestion: If swallowed, do not induce vomiting. Give the person a glass of water or milk to drink and get immediate medical attention. Never give anything by mouth to an unconscious person.
Inhalation: Move the exposed person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if breathing difficulties continue.
Note to Physicians: Ingestion of this product or subsequent vomiting may result in aspiration of light hydrocarbon liquid, which may cause pneumonitis.

SECTION 5 FIRE FIGHTING MEASURES

See Section 7 for proper handling and storage.

FIRE CLASSIFICATION:
OSHA Classification (29 CFR 1910.1200): Combustible liquid.

NFPA RATINGS: Health: 0 Flammability: 2 Reactivity: 0

FLAMMABLE PROPERTIES:
Flashpoint: (Tagliabue Closed Cup) 100 °F (38 C) (Min)
Auto ignition: 410°F (210°C)
Flammability (Explosive) Limits (% by volume in air): Lower: 0.7 Upper: 5

EXTINGUISHING MEDIA: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

PROTECTION OF FIRE FIGHTERS:
Fire Fighting Instructions: For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.
Combustion Products: Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds will be evolved when this material undergoes combustion.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in the vicinity of the spill or released vapor. If this material is released into the work area, evacuate the area immediately. Monitor area with combustible gas indicator.
Spill Management: Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible, observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible absorbent materials or pumping. All equipment used when handling the product must be grounded. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to collect absorbed material. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.
Reporting: Report spills to local authorities and/or the U.S. Coast Guard's National Response Center at (800) 424-8802 as appropriate or required.

SECTION 7 HANDLING AND STORAGE

Precautionary Measures: Liquid evaporates and forms vapor (fumes) which can catch fire and burn with

explosive force. Invisible vapor spreads easily and can be set on fire by many sources such as pilot lights, welding equipment, and electrical motors and switches. Fire hazard is greater as liquid temperature rises above 85F. Do not get in eyes, on skin, or on clothing. Do not breathe vapor or fumes. Do not breathe mist. Do not taste or swallow. Wash thoroughly after handling.

Do not use as a portable heater or appliance fuel. Toxic fumes may accumulate and cause death.

General Handling Information: Avoid contaminating soil or releasing this material into sewage and drainage systems and bodies of water.
Static Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating an accumulation of electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures. For more information, refer to OSHA Standard 29 CFR 1910.106, 'Flammable and Combustible Liquids', National Fire Protection Association (NFPA 77, 'Recommended Practice on Static Electricity', and/or the American Petroleum Institute (API) Recommended Practice 2003, 'Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents'.
General Storage Information: DO NOT USE OR STORE near heat, sparks or open flames. USE AND STORE ONLY IN WELL VENTILATED AREA. Keep container closed when not in use.
Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:
Consider the potential hazards of this material (see Section 3), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:
Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below the recommended exposure limits.

PERSONAL PROTECTIVE EQUIPMENT
Eye/Face Protection: No special eye protection is normally required. Where splashing is possible, wear safety glasses with side shields as a good safety practice.
Skin Protection: Wear protective clothing to prevent skin contact. Selection of protective clothing may include gloves, apron, boots, and complete facial protection depending on operations conducted. Suggested materials for protective gloves include: 4H (PE/EVAL), Nitrile Rubber, Polyvinyl Alcohol (PVA) (Note: Avoid contact with water. PVA deteriorates in water.), Viton
Respiratory Protection: Determine if airborne concentrations are below the recommended exposure limits. If not, wear a NIOSH approved respirator that provides adequate protection from measured concentrations of this material, such as: Air-Purifying Respirator for Organic Vapors
Use a positive pressure, air-supplying respirator if there is potential for uncontrolled release, exposure levels are not known, or other circumstances where air-purifying respirators may not provide adequate protection.

Occupational Exposure Limits:

Component	Limit	TWA	STEL	Ceiling	Notation
Kerosene	CHEVRON	350 mg/m3	1000 mg/m3		

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor: Clear to light yellow liquid with petroleum odor.
pH: NA
Vapor Pressure: 1 kPa (0.14 psi) @ 100 °F
Vapor Density (Air = 1): 5.7
Boiling Point: 160 - 300 °C (320 - 572 F)
Solubility: Low PPM range in water.
Freezing Point: -47 °C (-53 F) (Max)
Density: 0.755 - 0.84 g/ml @ 15 °C
Viscosity: 8 cSt @ -20 °C (Max)

SECTION 10 STABILITY AND REACTIVITY

Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.
Incompatibility With Other Materials: May react with strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.
Hazardous Decomposition Products: None known (None expected)
Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

IMMEDIATE HEALTH EFFECTS
Eye Irritation: The eye irritation hazard is based on evaluation of data for similar materials or product components.
Skin Irritation: The skin irritation hazard is based on evaluation of data for similar materials or product components.
Skin Sensitization: The skin sensitization hazard is based on evaluation of data for similar materials or product components.
Acute Dermal Toxicity: The acute dermal toxicity hazard is based on evaluation of data for similar materials or product components.
Acute Oral Toxicity: The acute oral toxicity hazard is based on evaluation of data for similar materials or product components.
Acute Inhalation Toxicity: The acute inhalation toxicity hazard is based on evaluation of data for similar materials or product components.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY
This material is expected to be toxic to aquatic organisms.

ENVIRONMENTAL FATE
Ready Biodegradability:

This material is not expected to be readily biodegradable.

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. This material, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA under RCRA (40 CFR 261) or other State and local regulations. Measurement of certain physical properties and analysis for regulated components may be necessary to make a correct determination. If this material is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

DOT Shipping Name: FUEL, AVIATION, TURBINE ENGINE
DOT Hazard Class: 3 (Flammable Liquid)
DOT Identification Number: UN1863
DOT Packing Group: III

SECTION 15 REGULATORY INFORMATION

SARA 311/312 CATEGORIES:

1.	Immediate (Acute) Health Effects:	YES
2.	Delayed (Chronic) Health Effects:	NO
3.	Fire Hazard:	YES
4.	Sudden Release of Pressure Hazard:	NO
5.	Reactivity Hazard:	NO

REGULATORY LISTS SEARCHED:

4A=IARC Group 1	12=TSCA Section 8(a) PAIR	21=TSCA Section 5(a)
4B=IARC Group 2A	13=TSCA Section 8(d)	25=CAA Section 112 HAPs
4C=IARC Group 2B	15=SARA Section 313	26=CWA Section 311
05=NTP Carcinogen	16=CA Proposition 65	28=CWA Section 307
06=OSHA Carcinogen	17=MA RTK	30=RCRA Waste P-List
09=TSCA 12(b)	18=NJ RTK	31=RCRA Waste U-List
10=TSCA Section 4	19=DOT Marine Pollutant	32=RCRA Appendix VIII
11=TSCA Section 8(a) CAIR	20=PA RTK	

The following components of this material are found on the regulatory lists indicated.

Kerosene	17, 18, 20
Diethylene glycol monomethyl ether	17, 20, 25

CHEMICAL INVENTORIES:
UNITED STATES: All of the components of this material are on the Toxic Substances Control Act (TSCA) Chemical Inventory.
CANADA: All the components of this material are on the Canadian Domestic Substances List (DSL).
WHMIS CLASSIFICATION:
Class B, Division 3: Combustible Liquids
Class D, Division 2, Subdivision B: Toxic Material -
Skin or Eye Irritation

SECTION 16 OTHER INFORMATION

NFPA RATINGS: Health: 0 Flammability: 2 Reactivity: 0

(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *- Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA) or the National Paint and Coating Association (for HMIS ratings).

REVISION STATEMENT: REVISION STATEMENT: This document has been prepared using a new MSDS format and all 16 sections have been revised. Please read the entire document.

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV	-	Threshold Limit Value	TWA	-	Time Weighted Average
STEL	-	Short-term Exposure Limit	PEL	-	Permissible Exposure Limit
			CAS	-	Chemical Abstract Service Number
NDA	-	No Data Available	NA	-	Not Applicable
<=	-	Less Than or Equal To	>=	-	Greater Than or Equal To

Prepared according to the OSHA Hazard Communication Standard (29 CFR 1910.1200) and the ANSI MSDS Standard (Z400.1).

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

Appendix C: Manifest Tracking System Form-CARF

National Défense
Defence nationale

CONSIGNMENT AUTHORIZATION AND RECEIPT FORM (CARF)
FORMULE D'AUTORISATION ET REÇU D'EXPÉDITION (FARE)

1. TCN - NCT

SECTION 1: CONSIGNOR / DELIVERY - L'EXPÉDITEUR / LIVRAISON

2. PACKED BY - EMBALLÉ PAR — SIGNATURE — DATE

3. MPC - CPM

4. RDD - DLD — (JULIAN - JULIEN)

5. CARF CONTINUATION SHEETS ATTACHED / FEUILLES DE FARE PROLONGATION ATTACHÉES — TOTAL NUMBER - NOMBRE TOTAL

6A. UIC / SAC / PRI /SN - CIU / SAC / CIDP /NM

6B. SHIP/POSTAL - LIVRAISON/POSTE (S/P) ☐

7A. UIC / SAC / PRI / SN - CIU /SAC / CIDP / NM

7B. SHIP/POSTAL - LIVRAISON/POSTE (S/P) ☐

6C. FROM / CONSIGNOR - DE / L'EXPÉDITEUR

7C. TO / CONSIGNEE - À / DESTINATAIRE

8. DTA - ATD

9. ASSOCIATED TA NAME - NOM D'AT ASSOCIÉ

10. ☐ CFSS ISSUE DISTRIBUTION DU SAFC ☒ NEW PROCUREMENT NOUVEAU MATÉRIEL ☐ REPAIR & OVERHAUL RÉPARATION E RÉVISION ☐ MISC. DIVERS

☐ CUSTOMS ACTION DOUANES ☐ CGR - MCR ☐ IEM - EIM ☐ SL - PS

☐ SPECIAL HANDLING MANIPULATION SPÉCIAL ☐ OUTSIZE DIM. SUPÉR ☐ UAB - BNA

17. SPECIAL INSTRUCTIONS - INSTRUCTIONS SPÉCIALES

18. DANGEROUS GOODS / MARCHANDISES DANGEREUSES
☐ AMMUNITION MUNITION ☐ OTHERS AUTRES ☐ NO NON

11. PIECES ARTICLES (PID) (IDA)	12. TYPE GENRE (CODE)	13. DESCRIPTION	14A. WEIGHT IN LB POIDS EN LB	14B. CUBE IN F3 PIED CUBIQUE	14C. WEIGHT IN KG POIDS EN KG	14D. CUBE IN M3 MÈTRE CUBIQUE	15. DOCUMENT COUNT NOMBRE DE DOCUMENTS
			IMPERIAL / IMPÉRIAL		METRIC / MÉTRIQUE		
TOTAL			TOTAL	TOTAL	TOTAL	TOTAL	TOTAL

SECTION 2: ORIGIN TRANSPORTATION AGENT - AGENT DE TRANSPORT AU LIEU D'ORIGINE

CODING BLOCK - BLOC DE CODAGE

FUNDS RES RÉS DE FONDS	FUNDS RESERVATION LINE Ligne réservation de fonds	WBS ELEMENT - ELEMENT WBS	FUNDS CENTRE CENTRE DE FONDS	COST CENTRE CENTRE DE COÛT	FUND FONDS	GENERAL LEDGER GRAND LIVRE GÉNÉRAL	INTERNAL ORDER ORDRE INTERNE

21. ACCEPTED FOR SHIPMENT - ACCEPTÉ POUR EXPÉDITION — DATE

23. WSBL NO. - Nº FEUILLE DE FECS

SECTION 3: DESTINATION TRANSPORTATION AGENT - AGENT DE TRANSPORT A DESTINATION

24. DATE REC'D - DATE REÇU

25. CARRIER / CARRIER SERVICE - TRANSPORTEUR / SERVICE DU TRANSPORTEUR

26. DESCRIPTION OF LOSS / DAMAGE / DESCRIPTION DE LA PERTE / DOMMAGE

27. INCOMING OFF CONTRACT - RÉCEPTION DU CONTRAT
CONTRACTOR CONTRACTEUR ▶
NAME - NOM ▶
ADDRESS ADRESSE ▶

28. FOB POINT - FRANCO POINT

29. ISN # (DEPOT ONLY) ISN # (DÉPÔT SEULEMENT)

SECTION 4: DELIVERY / CONSIGNEE - LIVRAISON / DESTINATAIRE

30. DELIVERY SERVICE - LIVRAISON — SIGNATURE — DATE

31. CONSIGNEE - DESTINATAIRE — SIGNATURE — DATE

32. COMMENTS - COMMENTAIRES

DND 690 (5-94)
7530-21-903-1515

CODING BLOCK FOR 12 - BLOC DE CODAGE 12

TYPE GENRE	BALE BALLE	BUNDLE BALLOT	CARTON CAISSE	CASE BOITE	CONTAINER RECIPENT	CRATE-CAISSE CLAIRE-VOIE	ENVELOPE ENVELOPPE	PALLET PALETTE	TRI-WALL CAISSE CARTON TRIPLE	OTHER AUTRE
CODE	BAL	BUN	CTN	CSE	CTR	CRT	ENV	PAL	T/W	OTH

Appendix D: Responders Roles and Responsibilities

QUALIFIED RESPONDERS

ROLES	RESPONSIBILITIES
8 Wing Environment Management (WEnv) - 8 Wing Environmental Officer	**Report *spills* and *changes* to Environment Canada and required legislative authorities**
	Keep tank Emergency Response Plan (ERP) up to date
	Submit any changes of ERP to Fire hall
	Establish a schedule for replacing and upgrading tanks as required by regulations
	Respond to Emergencies as required
Fire Chief (Smokey)	**First line response to HAZMAT related issues i.e. spill response**
Deputy Fire Chief (Bandit)	**Augment Fire Chief in providing a HAZMAT Response capability**
HAZMAT Coordinator	**Fill out CFS Alert Spill Report for all spills, regardless of quantity, and forward to Site Manager for review**
	Augment Fire Chief in providing a HAZMAT Response capability
Zippo, B Furn O	**Follows an established preventative maintenance schedule for regular tank inspections**
All qualified personnel, as required	**Spill Containment, Clean-up**
Supervisor (CBO Site Manager)	**CBO to maintain tank inspection and maintenance records; Keep tank inspection records for life of tank.**
	Request changes required to tank, tank system, contents of tank or tank maintenance to Boss Beaver.
	Review CFS Alert Spill Report; Ensure spill reports signed by the CO or delegated authority
	Report any spills to WEnv within 24 hours
Daily Inspector (Zippo, B Furn O)	**Report repair and maintenance issues to supervisor**
	Have any combustible debris cleared away from around tank
	Maintain spill equipment
	Daily inspections every day tank is in use
	In case of spill, implement spill response procedures
	Initiate Emergency Response Plan on discovery of a spill

Appendix E: General Spill Procedures for CFS Alert

General Spill Procedures

Immediately contact Smokey at ext. 3300 or Bandit at ext. 3301, if spill technical assistance is required or the spill has occurred off the hard surface, or the spill has entered a waterway.

1. Ensure personnel safety and that of others by keeping unnecessary personnel away from the spill site;
2. Ensure that there is an appropriate fire extinguisher in the immediate area;
3. Ventilate area if release is indoors and remove all sources of ignition;
4. Stop the source of the release *only if safe to do so.* Stop leak by plugging hole or using, if available, a tank or pipe shut-off valve;
5. Control the further spread of the product to prevent the product from escaping the transfer or secondary containment area if possible, by use of spill kit. Ensure that proper PPE is worn when assessing, containing, and cleaning up a release. Ensure that the product does not enter streams or waterways by using absorbent booms, pads, mats, earth, dykes, trenches, and other available materials;
6. Any spills must be reported immediately to the Fire Chief (Smokey), Site Manager, Zippo, HAZMAT Coordinator; and,
7. 8 Wing Environmental Management staff are to be notified as soon as possible.

For Releases

1. Residues should be soaked up with appropriate absorbent material (do not flush away residues with water);
2. Clean up the spill, *only if safe to do so*;
3. Transfer absorbent material with non-sparking tools into a labelled, sealable container;
4. Excavate any impacted soil or snow to be stored in a sealed container for analysis and disposal;
5. Return all clean-up material and hazardous waste to the HAZMAT Coordinator for disposal;

Do not **mix contaminated soil with existing soil in the BIOPILE**

6. Return the completed *Hazardous Material Incident Report* to the 8 WEnv O by fax or E-Mail within 24 hours; and,
7. Replenish spill kit items.

Appendix F: Spill Report Forms

1 CAD - Hazardous Materials Incident Report Spreadsheet

Ref: 1 CAD HQ Uniform Spill Reporting Protocol 1262-1 (A4 Env 3) 6 July 98

1. Spill reported by:	**Name & Initials:**	**Phone #:**	**Unit:**
2. Spill Occurrence - Date:		**Time:**	
3. Source of Spill:		**Location of Spill -**	
4. a. Hazardous Material Spilled:		**b. Quantity Spilled (Litres):**	
c. Quantity Recovered (Litres):			
5. **Aircraft Fuel Jettisons** **a. Tail # and Call Sign:**			
b. Type of fuel		c. Quantity jettisoned (lbs):	
d. Altitude of jettisoning (m):		e. Ground temperature during jettisoning (°C):	
f. Duration of fuel jettison (min):		g. Aircraft velocity during jettisoning (Kt/hr):	
h. average wind speed between ground level and jettisoning altitude (kt/hr):		i. Wind orientation (relative to aircraft) during jettisoning (parallel/not parallel):	
6. Cause of Spill (be brief):			
7. Effect(s) of Spill (be brief):			
8. Distance (in metres) from point of release to nearest:			
a. Water Well:		**c. Catch Basin or Drain:**	
b. Property Boundary:		**d. Surface water course (ie creek, Bay, etc):**	
9. Details of action, taken or proposed, to mitigate effects of spill:			
10. Off -Base agencies that responded to spill:			

NOTE: FORWARD THIS REPORT TO WENVO (FAX 3368) WITHIN 24 HOURS OF SPILL

For use by Wing Environmental Staff only

11. Off-Base agencies informed of spill - Env Can/MOEE (time/date):
MOE: 1 (800) 268-6060 When required: Env Can N.W.T. Phone: (867) 920-8130 Fax: (867) 873-6924
Env Can Ont: (416) 518-3221 Env Can Qc Phone: (514) 283-2333

12. **ACTION**	**FAX**	**HALOCARBON**	**POL/OTHER**
NDHQ/CFFM	182-846-1753	X	
NDHQ/DGAEPM	182-840-5236	X	
1 CAD HQ/AOC	182-257-2576	X	X
1 CAD HQ//A4 AE//A4 Env//	182-257-2566	X	X
INFO			
NDHQ//DGE//	182-842-9422	X	X
WCOMD	3944	X	X
W LOG O	3448	X	X
WCEO	2788	X	X
UNIT/SQN CO		X	X

FROM: 8 Wg Env Office Phone (613) 965-3930
FAX (613) 965-3368

Sent by: (Name)
(Time/Date)

Instructions for Completing the NT-NU Spill Report Form

This form can be filled out electronically and e-mailed as an attachment to spills@gov.nt.ca. Until further notice, please verify receipt of e-mail transmissions with a follow-up telephone call to the spill line. Forms can also be printed and faxed to the spill line at 867-873-6924. Spills can still be phoned in by calling collect at 867-920-8130.

A. Report Date/Time	The actual date and time that the spill was reported to the spill line. If the spill is phoned in, the Spill Line will fill this out. **Please do not fill in the Report Number**: the spill line will assign a number after the spill is reported.
B. Occurrence Date/Time	Indicate, to the best of your knowledge, the exact date and time that the spill occurred. Not to be confused with the report date and time (see above).
C. Land Use Permit Number /Water Licence Number	This only needs to be filled in if the activity has been licenced by the Nunavut Water Board and/or if a Land Use Permit has been issued. Applies primarily to mines and mineral exploration sites.
D. Geographic Place Name	In most cases, this will be the name of the city or town in which the spill occurred. For remote locations – outside of human habitations – identify the most prominent geographic feature, such as a lake or mountain and/or the distance and direction from the nearest population center. **You must include the geographic coordinates** (Refer to Section E).
E. Geographic Coordinates	This only needs to be filled out if the spill occurred outside of an established community such as a mine site. Please note that the location should be stated in degrees, minutes and seconds of Latitude and Longitude.
F. Responsible Party Or Vessel Name	This is the person who was in management/control/ownership of the substance at the time that it was spilled. In the case of a spill from a ship/vessel, include the name of the ship/vessel. Please include full address, telephone number and e-mail. Use box K if there is insufficient space. **Please note that, the owner of the spilled substance is ultimately responsible for any spills of that substance, regardless of who may have actually caused the spill.**
G. Contractor involved?	Were there any other parties/contractors involved? An example would be a construction company who is undertaking work on behalf of the owner of the spilled substance and who may have contributed to, or directly caused the spill and/or is responding to the spill.
H. Product Spilled	Identify the product spilled; most commonly, it is gasoline, diesel fuel or sewage. For other substances, avoid trade names. Wherever possible, use the chemical name of the substance and further, identify the product using the four digit UN number (eg: UN1203 for gasoline; UN1202 for diesel fuel; UN1863 for Jet A & B)
I. Spill Source	Identify the source of the spill: truck, ship, home heating fuel tank and, if known, the cause (eg: fuel tank overfill, leaking tank; ship ran aground; traffic accident, vandalism, storm, etc.). Provide an estimate of the extent of the contaminated/impacted area (eg: 10 m^2)
J. Factors Affecting Spill	Any factors which might make it difficult to clean up the spill: rough terrain, bad weather, remote location, lack of equipment. Do you require advice and/or assistance with the cleanup operation? Identify any hazards to persons, property or equipment: for example, a gasoline spill beside a daycare centre would pose a safety hazard to children. Use box K if there is insufficient space.
K. Additional Information	Provide any additional, pertinent details about the spill, such as any peculiar/unique hazards associated with the spilled material. State what action is being taken towards cleaning up the spill; disposal of spilled material; notification of affected parties. If necessary, append additional sheets to the spill report. Number the pages in the same format found in the lower right hand corner of the spill form: eg. “Page 1 of 2", “Page 2 of 2" etc. **Please number the pages to ensure that recipients can be certain that they received all pertinent documents.** If only the spill report form was filled out, number the form as “Page 1 of 1".
L. Reported to Spill Line by	Include your full name, employer, contact number and the location from which you are reporting the spill. Use box K if there is insufficient space.
M. Alternate Contact	Identify any alternate contacts. This information assists regulatory agencies to obtain additional information if they cannot reach the individual who reported the spill.
N. Report Line Use Only	**Leave Blank**. This box is for the **Spill Line’s use only**.

NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND OTHER HAZARDOUS MATERIALS

NT-NU 24-HOUR SPILL REPORT LINE
TEL: (867) 920-8130
FAX: (867) 873-6924
EMAIL: spills@gov.nt.ca

REPORT LINE USE ONLY

A	REPORT DATE: MONTH – DAY – YEAR	REPORT TIME	☐ ORIGINAL SPILL REPORT, OR ☐ UPDATE # _____ TO THE ORIGINAL SPILL REPORT	REPORT NUMBER _____-_____
B	OCCURRENCE DATE: MONTH – DAY – YEAR	OCCURRENCE TIME		

C	LAND USE PERMIT NUMBER (IF APPLICABLE)	WATER LICENCE NUMBER (IF APPLICABLE)
D	GEOGRAPHIC PLACE NAME OR DISTANCE AND DIRECTION FROM NAMED LOCATION	REGION ☐ NWT ☐ NUNAVUT ☐ ADJACENT JURISDICTION OR OCEAN
E	LATITUDE DEGREES MINUTES SECONDS	LONGITUDE DEGREES MINUTES SECONDS

F	RESPONSIBLE PARTY OR VESSEL NAME	RESPONSIBLE PARTY ADDRESS OR OFFICE LOCATION	
G	ANY CONTRACTOR INVOLVED	CONTRACTOR ADDRESS OR OFFICE LOCATION	
H	PRODUCT SPILLED	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER
	SECOND PRODUCT SPILLED (IF APPLICABLE)	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER
I	SPILL SOURCE	SPILL CAUSE	AREA OF CONTAMINATION IN SQUARE METRES
J	FACTORS AFFECTING SPILL OR RECOVERY	DESCRIBE ANY ASSISTANCE REQUIRED	HAZARDS TO PERSONS, PROPERTY OR EQUIPMENT
K	ADDITIONAL INFORMATION, COMMENTS, ACTIONS PROPOSED OR TAKEN TO CONTAIN, RECOVER OR DISPOSE OF SPILLED PRODUCT AND CONTAMINATED MATERIALS		

L	REPORTED TO SPILL LINE BY	POSITION	EMPLOYER	LOCATION CALLING FROM	TELEPHONE
M	ANY ALTERNATE CONTACT	POSITION	EMPLOYER	ALTERNATE CONTACT LOCATION	ALTERNATE TELEPHONE

REPORT LINE USE ONLY

N	RECEIVED AT SPILL LINE BY	POSITION STATION OPERATOR	EMPLOYER	LOCATION CALLED YELLOWKNIFE, NT	REPORT LINE NUMBER (867) 920-8130

LEAD AGENCY ☐ EC ☐ CCG ☐ GNWT ☐ GN ☐ ILA ☐ INAC ☐ NEB ☐ TC

SIGNIFICANCE ☐ MINOR ☐ MAJOR ☐ UNKNOWN

FILE STATUS ☐ OPEN ☐ CLOSED

AGENCY	CONTACT NAME	CONTACT TIME	REMARKS
LEAD AGENCY			
FIRST SUPPORT AGENCY			
SECOND SUPPORT AGENCY			
THIRD SUPPORT AGENCY			

Appendix E: Quality Assurance and Quality Control Plan, CFS Alert, Nunavut

Defence Construction Canada
Construction de Défense Canada

Quality Assurance (QA) and Quality Control (QC) Plan
CFS Alert (ALT), Nunavut

In support of the
Nunavut Water Board Licence
No. 3BC-ALT1015

November 2010

Prepared for:
1 Canadian Air Division,
Department of National Defence

Prepared by:
Environmental Services
Defence Construction Canada

Canada

Table of Contents

LIST OF APPENDICES

ACRONYMS

AGAT	AGAT Laboratories Ltd.
ALT	CFS Alert
BOD	Biological Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
cBOD	Carbonaceous Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
CFS	Canadian Forces Station
NWB	Nunavut Water Board
PAH	Polycyclic Aromatic Hydrocarbons
pH	Measure of acidity and alkalinity
QA	Quality Assurance
QC	Quality Control
SNP	Surveillance Network Program
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids

1. INTRODUCTION

This document has been prepared in response to the requirements of the Nunavut Water Board (NWB) for the submission of a Quality Assurance (QA) and Quality Control (QC) Plan, under Licence number 3BC-ALT1015, issued to the Department of National Defence (DND) on August 4, 2010. This new Class B Water Licence issued allows for the use of water and the disposal of waste during operation and maintenance of Canadian Forces Station (CFS) Alert ("Alert"). Alert is located on the north-eastern tip of Ellesmere Island within the Qikiqtani Region of Nunavut (latitude 82°30'1"N / longitude 62°20'37"W).

Alert was originally established as a High Arctic Weather Station in 1950, and is currently a remote camp maintained by DND that has been continually operational since 1958. The nearest communities to Alert are Grise Fiord and Resolute Bay, and are located approximately 780 km and 1080 km from the station. This station is active year round. During the summer months the population onsite can expand to 200 people; however, on average the population ranges between 50 to 100 people.

This document has been prepared in accordance with the *Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories*, published in 1996. As outlined in the Licence, 11 monitoring stations shall be maintained at Alert at the following locations: Water Supply Intake, Sewage Outfall Discharge Point, Sewage Treatment Facility Discharge Point, Main Station Landfill, Battery Dump, Millionaire's Dump, Dump 3, secondary containment discharge from the Airfield Fuel Tank Farm, Upper Fuel Tank Farm and Day Fuel Tank Farm, and the Landfarm, primarily for the purpose of assessing water quality. Implementation of this QA/QC Plan at Alert is scheduled to commence within one month of NWB approval.

2. SAMPLE COLLECTION

2.1 Sampling Locations

As part of the NWB Licence, the Surveillance Network Program (SNP) consists of 11 water monitoring stations at Alert, which include:

Station No.	Monitoring Station
ALT-1	Water Supply at Raw Water Intake (or Pumphouse)
ALT-2	Discharge Point at the Sewage Outfall
ALT-3	Final Discharge Point of the Sewage Treatment Facility (at weir box or similar structure, prior to entry into Parr Inlet)
ALT-4	Runoff and Leachate from the Main Station Landfill
ALT-5	Runoff and Leachate from the Battery Dump
ALT-6	Runoff and Leachate from the Millionaire's Dump
ALT-7	Runoff and Leachate from Dump 3
ALT-8	Discharge from Airfield Fuel Tank Farm (secondary containment)
ALT-9	Discharge from Upper Fuel Tank Farm (secondary containment)

Station No.	Monitoring Station
ALT-10	Discharge from Day Fuel Tank Farm (secondary containment)
ALT-11	Discharge from the Landfarm

Sampling locations listed above were established by the NWB and are identified on Figures 1 through 3 (Appendix A). The exact sampling locations as per the NWB licence will be identified at the commencement of the sampling program, and if feasible with assistance from an Inspector. GPS coordinates and photographic records of the sampling locations will be documented, and locations will be identified using markers for consistency and repeatability in subsequent months and years.

Timing of Sampling
Timing of the collection of the water samples at Alert is outlined in the requirements of the NWB Licence, which specify:

Monitoring Station	Timing of Sampling
ALT-1	• Shall be measured and recorded *daily* and *annually* in cubic metres to document the quantity of water utilized. • Presently the quantity of water utilized daily is recorded and reported monthly.
ALT-2	• Shall correspond to timing of sampling of ALT-3.
ALT-3	• Inspections will be conducted weekly (at a minimum) during June to September inclusively, to determine periods of flow. • Shall be sampled and analysed *monthly* during periods of flow.
ALT-4-5-6-7	• Inspections will be conducted weekly (at a minimum) during June to September inclusively, to determine periods of runoff and/or seepage. • Shall be sampled and analysed *annually* during periods of runoff or seepage.
ALT-8-9-10-11	• Shall be sampled and analysed prior to the release of effluent.

Documenting Non-Sampling Events
In the event that water samples are not successfully collected and submitted for analysis, the following will be documented:

- Location(s) of the sampling attempts will be recorded (i.e., GPS coordinates, photographic records and the sampling locations will be identified on a map); and,
- Justification outlining why a sample was not successfully collected.

Attempted unsuccessful sampling event(s) and justification will be reported to the NWB in the Annual Report for Alert.

2.2 Sampling Equipment

No specialized equipment will be required for the collection of water samples at Alert. New sample bottles will be supplied by AGAT Laboratories Ltd. (AGAT) and used for the collection of all water samples. Samples are not to be filtered.

The table below identifies the sample bottles necessary for each sampling round. Extra bottles will be requested for duplicate samples, field blanks and/or in case of breakage.

Sewage Outfall & Discharge Point (ALT-2-3)	**Runoff/Leachate from Landfill & Dumps (ALT-4-5-6-7)**
6 Bottles/Monitoring Station: 1 x 500 ml plastic (BOD) 1 x 250 ml plastic (TSS, pH) 1 x 100 ml plastic H_2SO_4 (COD) 2 x 1L glass amber bottles HCl (oil and grease) 1 x 500 ml plastic (cBOD)*	16 Bottles/Monitoring Station: 1 x 500 ml glass amber bottle (TPH, F2-F4) 2 x 1L glass amber bottles (PAHs) 3 x 40 ml vials $NaHSO_4$ (BTEX, F1) 1 x 500 ml plastic (BOD) 1 x 250 ml plastic (pH, nitrate-nitrite, conductivity, alkalinity, hardness, Mg, Na, Ca, K, SO_2) 1 x 500 ml plastic (TSS) 1 x 120 ml glass amber bottle H_2SO_4 (phenols) 1 X 120 ml plastic bottle H_2SO_4 (ammonia nitrogen) 1 X 120 ml plastic HNO_3 (total As,Cu,Fe,Cd,Cr, Pb,Ni) 1 X 120 ml glass $HNO_3/K_2Cr_2O_7$ (total Hg) 1 x 250 ml plastic $Na_2S_2O_3$ (fecal coliform) 2 x 1L glass amber bottle HCl (oil and grease)
Tank Farms & Landfarms (ALT-8-9-10-11)	
7 Bottles/Monitoring Station: 3 x 40 ml vials $NaHSO_4$ (benzene, toluene,ethylbenzene) 1 x 100 ml metals bottle HNO_3 (lead) 2 x 1L glass amber bottles HCl (oil and grease) 1 x 100 ml glass amber bottle H_2SO_4 (phenols)	

NOTES: * Laboratory analysis optional. Decision to analyse is to be determined by DND as per page 3 of the NWB Licence No. 3BC-ALT1015.

2.3 Sampling Methods

Sample collection instructions provided by AGAT are provided in Appendix B. Refer to Table 1 (Appendix C) for additional laboratory considerations including minimum sample size, rinsing, filtering, and preservation and storage requirements for the parameters. Additionally, samples for ALT-3-8-9-10-11 will be collected prior to the release of any effluent to demonstrate compliance with the criteria set out by the NWB (refer to Section 4.4).

Duplicates and Blanks

Duplicate samples and blanks shall be submitted to and analysed by the accredited laboratory to provide an internal (i.e., laboratory) and external (i.e., at time of sampling, shipping) QA/QC check to verify the reliability of the sample results. Duplicates samples shall be collected for approximately 10 percent of the samples. A duplicate sample is a repeat sample collected and handled using the same methods and submitted blindly for analysis. Based on the analytical results the laboratory will match the blind duplicate to the corresponding sample.

Field blanks and travel blanks will also be analysed to ensure reliability of the sampling method and to ensure that the integrity of the samples was maintained during transport. Blanks will be provided by the laboratory to accompany the shipment of sample bottles roundtrip and will contain reverse osmosis de-ionized (RODI) water.

3. SAMPLE HANDLING

3.1 Preservation

Samples will be preserved in accordance with requirements identified by AGAT for the parameters to be analysed (refer to Appendix C). The following six preservatives will be used, nitric acid (HNO_3), sulphuric acid (H_2SO_4) hydrochloric acid (HCl), sodium thiosulfate (Na_2S2O_3), sodium hydrogen sulphate ($NaHSO_4$), and potassium chromate (K_2CrO_4), and transported in the sampling bottling corresponding to the analysis to be conducted. The sample bottles provided by the laboratory identify the preservative contained in the sample bottle.

Samples requiring analysis within 48 hours or less will be collected immediately prior to shipping. All samples will be stored on ice and kept cool at approximately 4°C prior to and during shipping.

3.2 Sample Identification

Samples collected will be labelled using consistent terminology, identifying the water monitoring station (corresponding to the facility), followed by the year, month and sample number. For example, ALT-2-2011-06-1 denotes a water sample collected at the discharge point of the Sewage Outfall, in June 2011, and is the first sample collected for the month.

Similarly, blind duplicate samples collected will be labelled using consistent terminology, identifying the station, followed by the year, month and duplicate sample number. For example, ALT-2011-06-DUP1 denotes a blind duplicate water sample collected at Alert, in June 2011, and is the first duplicated collected for the month. Trip and field blanks will be labelled as such.

At the time of collection, sample identification will be recorded in a field notebook for consistency in terminology, and to ensure the sample identifiers are unique. Sample labels will also include the following information: name of organization, time and date. Information provided on the sample labels will be clearly printed in permanent (i.e., waterproof) non-smear ink (marker or pen).

A Chain-of-Custody shall be completed for each sampling round and will accompany the samples to the laboratory.

3.3 Transportation

Samples will be packed appropriately (i.e., packed upright, immobile) in coolers, sealed and shipped to 8 Wing Trenton via a scheduled flight. When possible, extreme coolers will be used for transporting the samples. Scheduled round trip commercial charter flights (direct) or military flights (overnight stopover in Greenland) depart weekly from Trenton for Alert. Direct flights will be preferred and sought when possible; however, the required timing of the sampling may ultimately determine flight(s) as some sampling is dependent on environmental factors leading to periods of flow, runoff, and/or seepage. DND will notify the designated courier company of the

scheduled flight arrival time in Trenton for immediate pick-up at the time of arrival. The samples will be transported by courier to AGAT in a timely manner.

In addition, AGAT will be immediately notified when the samples are in transit, in order to start analysis as quickly as possible on samples with a maximum storage of 24-48 hours. A Chain-of-Custody will accompany the sample shipment and will clearly identify the location of samples requiring immediate analysis.

4. LAB ANALYSIS

4.1 Lab Accreditation

AGAT Laboratories Ltd. (Mississauga, ON) will analyse all samples collected in support of this licence. AGAT is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA). AGAT is accredited to conduct analyses on each of the required sampling parameters, with the exception of total hardness. Refer to Appendix D for proof of valid laboratory accreditation in accordance with ISO/IEC17025:2005.

4.2 Detection Limits

Laboratory detection limits for all parameters required by the NWB are identified in Table 1 (Appendix C). In addition, the laboratory shall report the detection limits of the methods used for the analysis of the samples.

4.3 Methodology

The laboratory will conduct the analysis of the samples in accordance with the *Standard Methods (SM) for the Examination of Water and Wastewater* (2005), US Environmental Protection Agency (EPA), or the Ontario Ministry of Environment (MOE) methodologies. AGAT identified the following methods to be implemented for the parameters to be analysed:

Parameter	Method	Parameter	Method
TPH	MOE E3421	Total Iron	EPA SW846 6020/EPA 200.8
PAH	EPA SW846 3510C/8270C	Total Mercury	SM 3112 B
BTEX/F1	EPA 5030B/8260C	Fecal Coliforms	SM 9222D
BOD	SM 5210 B	Conductivity	SM 2510 B
COD	SM 5220 D	Oil and Grease	SM 5520 A,B,E,F
cBOD	SM 5210 B	Ammonia Nitrogen	SM 4500 NH3
pH	SM 4500-H B	Total Alkalinity	SM2320 B
TSS	SM 4110 B	Calcium	EPA SW846 6010/EPA 200.7
Nitrate-Nitrite	SM 4110 B	Potassium	EPA SW846 6010/EPA 200.7
Total Phenols	SM 5310 B	Sulphate	SM 4110 B
Total Hardness	Calculation	Total Cadmium	EPA SW846 6020/EPA 200.8
Magnesium	EPA SW846 6020/EPA 200.8	Total Chromium	EPA SW846 6020/EPA 200.8
Sodium	EPA SW846 6020/EPA 200.8	Total Lead	EPA SW846 6020/EPA 200.8
Total Arsenic	EPA SW846 6020/EPA 200.8	Total Nickel	EPA SW846 6020/EPA 200.8
Total Copper	EPA SW846 6020/EPA 200.8		

4.4 Reporting Requirements

As previously stated in Section 2.3, duplicates samples shall be collected for approximately 10 percent of the samples to verify the reliability of the sample results.

NWB Effluent Standards
Analytical results of effluent discharged from the Sewage Treatment Facility, Tank Farms and the Landfarm Facility will be reported against the following effluent quality standards provided by the NWB:

Parameter	Maximum Concentration of any Grab Sample
Sewage Treatment Facility Final Discharge Point (ALT-3)	
BOD_5	80 mg/L
Total Suspended Solids	70 mg/L
Oil and Grease	5 mg/L and no visible sheen
pH	between 6 and 9
Tank Farms and Landfarm (ALT-8-9-10-11)	
Benzene	370 µg/L
Toluene	2 µg/L
Ethylbenzene	90 µg/L
Lead	1 µg/L
Oil and Grease	15 mg/L and no visible sheen
Phenols	20 µg/L

Effluent standards provided by the NWB are consistent with the *Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories* (1992), or are consistent with other municipal licences.

5. QA/QC PLAN REVIEW

AGAT has reviewed this document, *QA/QC Plan for CFS Alert,* and has provided a confirmation letter of acceptance of this plan in Appendix E.

In addition, this document shall be reviewed annually by DND to ensure that this plan remains current and consistently reflects the operations, activities and technology at Alert. Revisions required to this document shall be made as necessary. Revised plans will include an updated confirmation letter of acceptance from the accredited laboratory and shall subsequently be submitted to the NWB. Changes to this plan will also be reflected in the Annual Report.

6. REFERENCES

Department of Indian and Northern Affairs Canada Water Resources Division and the Northwest Territories Water Board. *Quality Assurance (QA) and Quality Control (QC) Guidelines for Use by Class "B" Licensees in Collecting Representative Water Samples in the Field and for Submission of a QA/QC Plan.* July 1996.

Eaton, A., Clesceri, L., Rice, E., and A. Greenberg. *Standard Methods for the Examination of Water and Wastewater – 21st Edition.* 2005.

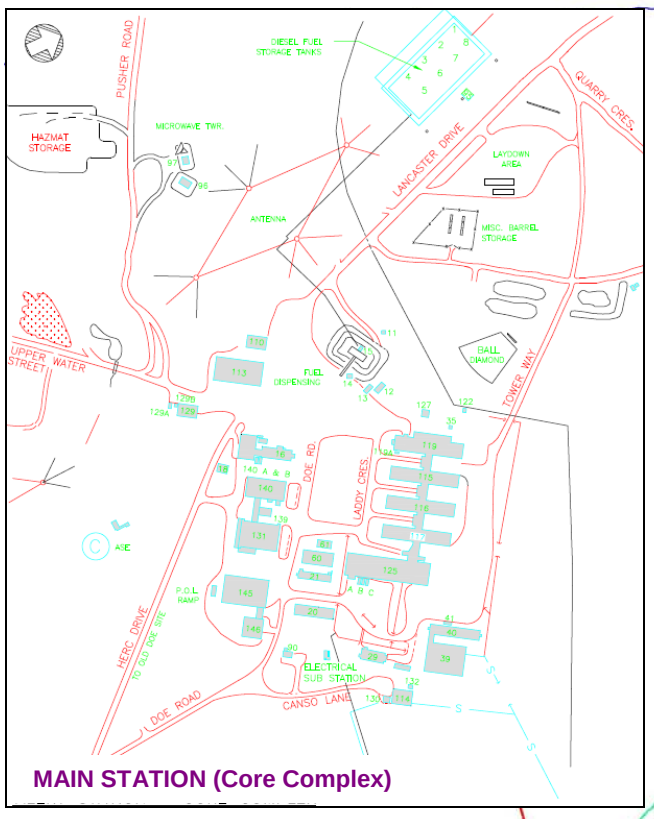
Nunavut Water Board. *Letter, RE:NWB Licence No. 3BC-ALT1015.* August 5, 2010.

Nunavut Water Board. *NWB Licence No. 3BC-ALT1015.* August 4, 2010.

Taiga Environmental Laboratory (Taiga). *Water Sampling Instructions – Collecting the Sample.* January 18, 2010.

Appendix A: CFS Alert Site Overview and Sampling Locations

Defence Construction Canada
Construction de Défense Canada



MAIN STATION (Core Complex)

N
W
E
S

Lincoln Sea

ALT-8

ALT-11

Dumbell Bay

ALT-4

ALT-9

MAIN STATION
(Core Complex)

ALT-10

ALT-2

ALT-3

Parr Inlet

ALT-5

ALT-6

ALT-7

ALT-1

Upper
Dumbell
Lake

Title:
CFS Alert Site Overview and Sampling Locations

Project:
QA/QC Plan for CFS Alert

Client:
Department of National Defence

Date:
November 2010

Figure:
Figure 1

LEGEND

○ Monitoring Station Locations

ALT-1	Water Supply at Raw Water Intake (or Pumphouse)
ALT-2	Discharge Point at the Sewage Outfall
ALT-3	Final Discharge Point of the Sewage Treatment Facility
ALT-4	Runoff and Leachate from the Main Station Landfill
ALT-5	Runoff and Leachate from the Battery Dump
ALT-6	Runoff and Leachate from the Millionaire's Dump
ALT-7	Runoff and Leachate from Dump 3
ALT-8	Discharge from Airfield Fuel Tank Farm (secondary containment)
ALT-9	Discharge from Upper Fuel Tank Farm (secondary containment)
ALT-10	Discharge from Day Fuel Tank Farm (secondary containment)
ALT-11	Discharge from the Landfarm

Appendix B: AGAT Laboratories
Instructions for Collecting and Submitting Samples

AGAT Laboratories

Instructions for Collection and Submitting Samples to AGAT Laboratories Ltd. for Testing

Ontario Branch Locations

AGAT Laboratories has an extensive network of branches and depots located throughout Canada and internationally.

Following is a list of Ontario branches.

Branch	Address	Phone/Fax #'s	Reception - Hours of Operation
GeoChem Div. (lab)	5623 McAdam Road Mississauga, ON L4Z 1N9	Tel: 905-501-9998 Fax: 905-501-0589 Toll Free: 800-856-6261	8:00am - 7:00pm M-F 9:00am - 2:00pm Sat
Environmental lab	5835 Coopers Ave Mississauga, Ontario L4Z 1Y2	Tel: 905-712-5100 Fax: 905-712-5120	8:00am - 7:00pm M-F 9:00am - 2:00pm Sat
Kitchener Branch	975 Bleams Road Unit # 4 Kitchner, Ontario N2E 3Z5	Phone: (519) 894-3883	8:00am - 5:00pm M-F
London Branch	300 Exeter Road Units 10-12 London, Ontario N6L 1A3	Tel: 519-652-6826 Fax: 519-652-9733 Toll Free: 800-856-6261	8:00am - 5:00pm M-F
Stoney Creek Branch	903 Barton Street East Unit 19 Stoney Creek, Ontario L8E 5P3	Tel: 905-643-8163 Fax: 905-643-3391 Toll Free: 800-856-6261	8:00am - 5:00pm M-F
Sudbury Branch	2054, Kingsway Road Sudbury, Ontario P3B 4J8	Phone: (705) 560-5001 Fax: (705) 560-5035	8:00am - 5:00pm M-F

Representative Samples

A *representative* sample is one that reflects the same characteristics as, and can be considered an accurate subset of the material being measured. Representative samples taken in a similar manner at the same time and location have an equal probability of yielding the same result. Sample collection techniques are outside of the scope of the laboratory however, the sampler must be cognisant of the conditions that the material sampled represents. Sampling points must be selected to address the intent of monitoring outlined in the Regulations. The choice of sample type (i.e., grab samples, composite samples or continuous in-line sampling) will depend on certain characteristics such as average, maximum or minimum concentrations of a contaminant.

As well, the sample type selected must be fit for purpose so that the data gathered meets the monitoring objectives. For more information the reader is recommended to review documents such as MOE's *Practices for the Collection and Handling of Drinking Water Samples, Ver.2, April 2009,* and other practices recommended by EPA, MOE, the Ontario Clean Water Agency and other leading jurisdictions.

Sample Containers

Certain tests have specific volume and container-cleaning requirements. Microbiology tests require sterile containers and many organic tests require 1-litre sample volumes. Sampling containers are provided by AGAT Laboratories and are listed by parameter type on the back of AGAT's Chain of Custody form. Minimum volumes are specified as well.

Sample Collection

The collection and handling of samples is crucial to obtaining valid data. Disposable gloves may be worn and care must be taken that the inside of the container and cap do not come into contact with anything other than the atmosphere. If the inside of the sampling container is touched, it must be considered contaminated and should not be used. While the sample is being taken, the exterior of the cap should be held in the sampler's fingertips.

The collection of drinking water grab samples is generally done from taps located at the sampling points. Sampling taps should be free of aerators, hose attachments, strainers and mixing type faucets. The best method for collecting a grab sample is to collect the sample directly into the container provided by the laboratory. This eliminates the potential for sample contamination through the use of an intermediate container.

In the case of sampling for microbiological testing, phenols, sulphide, volatile organic compounds, hydrocarbons, and oil and grease (not regulated), the sample must always be collected directly into the laboratory sample container.

Some sample containers are pre-charged with preservative; field personnel must not rinse these containers prior to sample collection. Also, sample containers for organic compound analysis should never be rinsed with the sample, as the organic compounds from the rinse may accumulate on the container walls and compromise the accuracy of the analytical results. Sample containers should be filled slowly to prevent overflowing when containers have been pre-charged with preservative, and to eliminate bubble formation.

Sample Filtering

Drinking water samples shall not be filtered in the field prior to analysis. As it is not expected that the consumer filters their water prior to drinking it, unfiltered samples will provide a more representative sample of what the consumer is drinking. Unfiltered samples for the measurement of organic compounds and microbiological parameters are very important because many organic

compounds adsorb to the particulate present in a water sample and membrane filtering will remove bacteria from the sample.

Sample Preservation

Preservation may be required to stabilize the analyte of interest in the sample prior to its transportation to the laboratory. The main types of preservation for drinking water samples are refrigeration and pH control. Containers that have been pre-charged with preservative should not be rinsed or allowed to overflow or the preservative will be diluted.

Sample Holding Times

For certain tests, the sample must be received at the laboratory and analyzed within a short period of time. Examples of perishable parameters include turbidity, microbiological contaminants, volatile organic compounds and N-nitrosodimethylamine (NDMA). Laboratory method holding times for parameters are listed on the back page of the AGAT Laboratories Drinking Water Chain of Custody. Holding time is defined as the time between the collection of the sample and the start of analysis.

Sample Labelling

Accurate and complete labelling of samples ensures that the sample's identity is maintained. This is very important for sample tracking and data interpretation and is mandatory for sample data reporting and adverse water quality notification requirements under the Regulations. It is advisable to pre-label all sample containers prior to taking the sample or to label each container **immediately** after the sample is taken to prevent confusion. An indelible (permanent) marker or pen should be used and the material from which the label is comprised should be able to withstand water. AGAT Laboratories Ltd. will supply the sampling container. Sample containers will have labels affixed to the container itself and it will list information regarding which test(s) is analysed from the container and the preservative, if any, pre-charged into the bottle.

The sample ID generated should be simple and unique to the sampling set/batch collected.

Sample Storage and Transportation

It is recommended that all samples be delivered to the laboratory as soon as possible after sampling. Samples should be kept cool (refrigerated) if immediate shipping is not possible. Samples should be packaged using the packing materials provided by AGAT Laboratories to avoid breakage during shipping. Samples **must** be shipped to arrive at the branch/laboratory before the holding time for the samples has expired.

Samples for microbiological testing should be packed with ice packs or a suitable leak-proof container of ice and shipped in insulated boxes/coolers. Loose ice must be encased in waterproof packaging or a sealed container to avoid possible contamination of the sample. If possible, the

sample should be chilled to below 10°C, but not frozen, prior to packing. Optimal temperatures conditions during transport are less than 10°C.

The chain-of-custody record must be included in the shipping cooler. A written record of how the samples are shipped, the time, date, carrier and tracking numbers for the shipments should be kept by the sampler.

Chain-of-Custody (COC)

As previously mentioned, proper sample labelling is crucial to maintaining the identity of a sample. However, additional measures are then required to ensure a sample is traceable from the time of collection through to its analysis. These steps are referred to as a *chain-of-custody* and are used to ensure the integrity of the sample and resulting data. A chain-of-custody form provides an accurate written record that can be used to trace the possession, transfer and custody of a sample from the time of its collection through to its introduction into the analytical data set. As illustrated in the attached example of a completed Drinking Water Chain of Custody (COC) all information must be documented to ensure that samples can be processed immediately for lab testing. An incomplete COC can result in delays while the missing information is ascertained from the sender.

Each person involved in the chain of possession must sign the custody form when a sample or set of samples is received or relinquished. In the case of drinking water samples, an AGAT Drinking Water chain-of-custody form must accompany samples to the point of receipt by the laboratory. The intent of this form is to document the transfer of custody of the samples from the sample custodian (sampler) to any other person and to the laboratory. If common carriers are used, receipts should be kept and, if packages are mailed, they should be registered and return receipts requested. These should be kept as part of the chain-of-custody documentation.

Once the samples have arrived at the laboratory, the chain-of-custody form will be signed off by an authorized person at the laboratory receiving the samples. Any samples that arrive in a condition unsuitable for analysis (e.g., broken, improperly preserved) will be documented and the client contacted for further directions on how to wish to proceed. This includes checking sampling dates recorded on containers or on COC to make certain that holding times for the tests requested have not been exceeded. Clients will be notified immediately of samples that cannot be analyzed so that a second sample can be taken

Sample Delivery to Branches

Samples can be submitted to any AGAT Branch/Depot through common couriers or by direct drop-off in person between the hours of operation indicated in the table above. Samples must be received by an AGAT staff on duty during normal office hours.

Relative to sample holding times it is essential that samples are received as quickly as possible after collection to ensure that samples can be delivered to the analytical lab in time to meet specified parameter hold times. If delivery of samples will occur late in the day on Fridays the

Branch should be contacted in advance to enable staff to be able to make arrangements with common couriers or AGAT drivers to have samples picked up before closing time and rerouted to our main lab.

Appendix C: Parameter Considerations

Table 1: AGAT Laboratories Ltd. parameter considerations.

Parameter	Container	Minimum Amount	Rinse	Filter	Preservation	Maximum Storage Recommendation	Detection Limit	Method	Accredited
Sewage Outfall and Discharge Points (ALT-2-3)									
BOD_5	500 ml plastic	500 ml	no	no	None, cool	4 days	5 mg/L	SM 5210 B	Yes
COD*	100 ml plastic	100 ml	no	no	H_2SO_4, cool	30 days	5 mg/L	SM 5220 D	Yes
cBOD*	500 ml plastic	500 ml	no	no	None, cool	4 days	5 mg/L	SM 5210 B	Yes
TSS	250 ml plastic	250 ml	no	no	None, cool	7 days	10 mg/L	SM 4110 B	Yes
Oil and Grease	1L amber glass	2X1 L	no	no	HCl, cool	28 days	0.5 mg/L	SM 5520 A,B,E,F	Yes
pH	250 ml plastic	250 ml	no	no	None, cool	4 days	0.1 units	SM 4500-H B	Yes
Runoff/Leachate from Landfill and Dumps (ALT-4-5-6-7)									
TPH	500 ml amber glass	500 ml	no	no	Cool	14 days	F2 – F4: 100 ug/L	MOE E3421	Yes
PAH	1L amber glass	2X1 L	no	no	None, cool	14 days	Refer to Table 2	EPA SW846 3510C/8270C	Yes
BTEX/F1	40 ml amber glass vial	3X40 ml	no	no	$NaHSO_4$	7 days	BTX - 0.2 ug/L, E 0.1ug/L	EPA 5030B/8260C	Yes
BOD	500 ml plastic	500 ml	no	no	None, cool	4 days	5 mg/L	SM 5210 B	Yes
pH	250 ml plastic	250 ml	no	no	None, cool	4 days	0.1 units	SM 4500-H B	Yes
TSS	500 ml plastic	250 ml	no	no	None, cool	7 days	10 mg/L	SM 4110 B	Yes
Nitrate-Nitrite	250 ml plastic	250 ml	no	no	None, cool	28 days	0.05 mg/L	SM 4110 B	Yes
Total Phenols	120 ml amber glass	100 ml	no	no	H_2SO_4, cool	30 days	0.001 mg/L	SM 5310 B	Yes
Total Hardness	250 ml plastic	100 ml	no	no	None, cool	6 months		Calculation	No
Magnesium	250 ml plastic	100 ml	no	no	None, cool	6 months	0.05 mg/L	EPA SW846 6020/EPA 200.8	Yes
Sodium	250 ml plastic	100 ml	no	no	None, cool	6 months	0.05 mg/L	EPA SW846 6020/EPA 200.8	Yes
Total Arsenic	120 ml plastic	100 ml	no	no	HNO_3	30 days	0.57 ug/L	EPA SW846 6020/EPA 200.8	Yes
Total Copper	120 ml plastic	100 ml	no	no	HNO_3	30 days	0.80 ug/L	EPA SW846 6020/EPA 200.8	Yes
Total Iron	120 ml plastic	100 ml	no	no	HNO_3	30 days	10.0 ug/L	EPA SW846 6020/EPA 200.8	Yes
Total Mercury	120 ml glass	120 ml	no	no	HNO_3/K_2CrO_4	7 days	0.0002 mg/L	SM 3112 B	Yes
Fecal Coliforms	250 ml plastic	250 ml	no	no	$Na_2S_2O_3$, sterile	48 hrs	1CFU/	SM 9222D	Yes

Parameter	Container	Minimum Amount	Rinse	Filter	Preservation	Maximum Storage Recommendation	Detection Limit	Method	Accredited
Continued: Runoff/Leachate from Landfill and Dumps (ALT-4-5-6-7)									
Conductivity	250 ml plastic	250 ml	no	no	None, cool	28 days	2 uS/cm	SM 2510 B	Yes
Oil and Grease	1L amber glass	2X1 L	no	no	HCl, cool	28 days	0.5 mg/L	SM 5520 A,B,E,F	Yes
Ammonia Nitrogen	120 ml plastic	100 ml	no	no	H_2SO_4, cool	28 days	0.02 mg/L	SM 4500 NH3	Yes
Total Alkalinity	250 ml plastic	250 ml	no	no	None, cool	4 days	5 mg/L	SM2320 B	Yes
Calcium	250 ml plastic	100 ml	no	no	None, cool	6 months	0.05 mg/L	EPA SW846 6010/EPA 200.7	Yes
Potassium	250 ml plastic	100 ml	no	no	None, cool	6 months	0.05 mg/L	EPA SW846 6010/EPA 200.7	Yes
Sulphate	250 ml plastic	250 ml	no	no	None, cool	28 days	0.1 mg/L	SM 4110 B	Yes
Total Cadmium	120 ml plastic	100 ml	no	no	HNO_3	30 days	0.20 ug/L	EPA SW846 6020/EPA 200.8	Yes
Total Chromium	120 ml plastic	100 ml	no	no	HNO_3	30 days	1.0 ug/L	EPA SW846 6020/EPA 200.8	Yes
Total Lead	120 ml plastic	100 ml	no	no	HNO_3	30 days	0.50 ug/L	EPA SW846 6020/EPA 200.8	Yes
Total Nickel	120 ml plastic	100 ml	no	no	HNO_3	30 days	1.0 ug/L	EPA SW846 6020/EPA 200.8	Yes
Discharge from Fuel Tank Farms and Landfarm (ALT-8-9-10-11)									
Benzene	40 ml amber glass vial	3X40ml	no	no	$NaHSO_4$	7 days	0.2 ug/L	EPA 5030B/8260C	Yes
Toluene	40 ml amber glass vial	3X40ml	no	no	$NaHSO_4$	7 days	0.2 ug/L	EPA 5030B/8260C	Yes
Ethylbenzene	40 ml amber glass vial	3X40ml	no	no	$NaHSO_4$	7 days	0.1ug/L	EPA 5030B/8260C	Yes
Lead	100 ml plastic	100 ml	no	no	HNO_3	30 days	0.50 ug/L	EPA SW846 6020/EPA 200.8	Yes
Oil and Grease	1L amber glass	2X1L	no	no	HCl, cool	28 days	0.5 mg/L	SM 5520 A,B,E,F	Yes
Phenols	100 ml amber glass	100 ml	no	no	H_2SO_4, cool	30 days	0.001 mg/L	SM 5310 B	Yes

NOTES: * Laboratory analysis optional. Decision to analyse is to be determined by DND as per page 3 of the NWB Licence No. 3BC-ALT1015.

Table 2. AGAT PAH detection limits.

Parameter	RDL (ug/L)	Parameter	RDL (ug/L)
Naphthalene	0.12	Benz(a)anthracene	0.08
Acenaphthylene	0.11	Chrysene	0.05
Acenaphthene	0.10	Benzo(b)Fluoranthene	0.05
Fluorene	0.09	Benzo(k)Fluoranthene	0.05
Phenanthrene	0.10	Benzo(a)Pyrene	0.01
Anthracene	0.05	Indeno(1,2,3-c,d)Pyrene	0.03
Fluoranthene	0.12	Dibenz(a,h)Anthracene	0.09
Pyrene	0.05	Benzo(g,h,i)Perylene	0.06
2-Methyl Naphthalene	0.20	1-Methyl Naphthalene	0.02

Appendix D: Proof of Laboratory Accreditation - AGAT Laboratories Ltd.

Canadian Association for Laboratory Accreditation Inc.

CALA

Certificate of Accreditation

AGAT Laboratories (Mississauga)
AGAT Laboratories (Calgary)
5835 Coopers Ave.
Mississauga, Ontario

This laboratory is accredited in accordance with the recognised International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated 18 June 2005).

Accreditation No.:	A 3200
Issued on:	March 27, 2008
Accreditation Date:	February 2, 2005
Expiry Date:	March 27, 2011

Chief Executive Officer

ilac-MRA CALA

Appendix E: Confirmation of Laboratory Acceptance of QA/QC Plan

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL 905-712-5100
FAX 905-712-5122
www.agatlabs.com

November 11, 2010

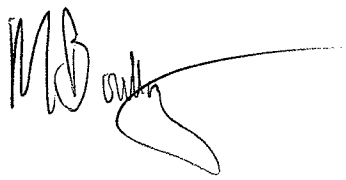
Defence Construction Canada
161 Laurier Avenue, Suite 300
Ottawa, ON, K1P 5J2

Subject: Acceptance of QA/QC Plan – CFS Alert (ALT), Nunavut

Dear Ms. Johnson,

This letter serves to confirm AGAT Laboratories Ltd acceptance of the QA/QC Plan for CFS Alert (ALT) for the analysis to be performed under Licence (No. 3BC-ALT1015).

Regards,



Nick Boulton

QA Officer

AGAT Laboratories Ltd

Appendix F: Characterization of Emissions from the Eco Waste Solutions Thermal Waste Oxidizer Burlington, Ontario – Report 2003

Characterization of Emissions From the Eco Waste Solutions Thermal Waste Oxidizer Burlington, Ontario

Dominic Cianciarelli
Christopher House

Report ERMD 2002-03
February 2003
Emissions Research and Measurement Division
Environmental Technology Advancement Directorate

Environment Canada Environnement Canada
Environmental Technology Centre Centre de Technologie Environnementale

DISCLAIMER

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Any comments concerning its content should be directed to:

Environment Canada
Emissions Research and Measurement Division
Environmental Technology Advancement Directorate
Environmental Technology Centre
Ottawa, Ontario
K1A 0H3

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

The Emissions Research and Measurement Division would like to express their appreciation to Jean Lucas and the operating staff of Eco Waste Solutions for their cooperation and assistance during the test program at the thermal waste oxidizer. Special thanks are extended to the Analysis and Ambient Air Quality Division at the Environmental Technology Centre for performing the dioxin, furan, PAH, chlorobenzenes, octachlorostyrene and volatile organic compounds analyses. Philip Analytical Services Inc. of Burlington, Ontario performed the metals analysis.

1. INTRODUCTION

In cooperation with the National Office of Pollution Prevention, the Emissions Research and Measurement Division (ERMD) conducted characterization of the Eco Waste Oxidizer manufactured by Eco Waste Solutions of Burlington, Ontario. The Eco Waste Oxidizer uses a two-step thermal oxidation process. In the first step, municipal solid waste is burned in the dual primary chambers under starved oxygen conditions and relatively low temperatures (500 to 650ºC) in order to preserve metal and glass for later recycling. Each of the two primary chambers in this oxidizer has a capacity of two tonnes of waste. Once the waste starts burning, the process becomes self-fuelling until the volume is reduced by over 90 percent. In the second step, smoke and gases from the two parallel primary chambers are treated in the afterburner or secondary chamber at an operating temperature of 1000ºC and a minimum of 2 seconds residence time to ensure complete oxidation of the combustion products.

The Eco Waste Oxidizer is configured to treat the flue gases from the afterburner in a water quench system followed by a packed tower scrubber to remove acid gases and metals. However, the scrubber system was bypassed in this study. The main purpose of this study was to characterize the emissions from a well-operated incinerator without control technology.

The Emissions Research and Measurement Division (ERMD) conducted source testing at this facility for various target compounds. These pollutants included particulate, metals, acid gases, dioxins and furans (PCDDs/PCDFs), polycyclic aromatic hydrocarbons (PAHs), selected chlorobenzenes (CBs), octachlorostyrene (OCS), volatile organic compounds (VOCs) and flue gases (CO_2, O_2, CO, SO_2 and NO_x). The semi-volatile and volatile organic compounds included Track 1 and CEPA toxic compounds.

2. SAMPLING SITE AND LOCATION

Sampling was conducted on the stack exhaust located above the roof of the Eco Waste facility. Samples were extracted from the two existing ports. The sampling location is illustrated in Figure 1. Sampling was conducted from two 4-inch ports positioned approximately 36 inches above the temporary platform and 15 feet above the roof. The stack sampling location met the "eight and two" criteria.

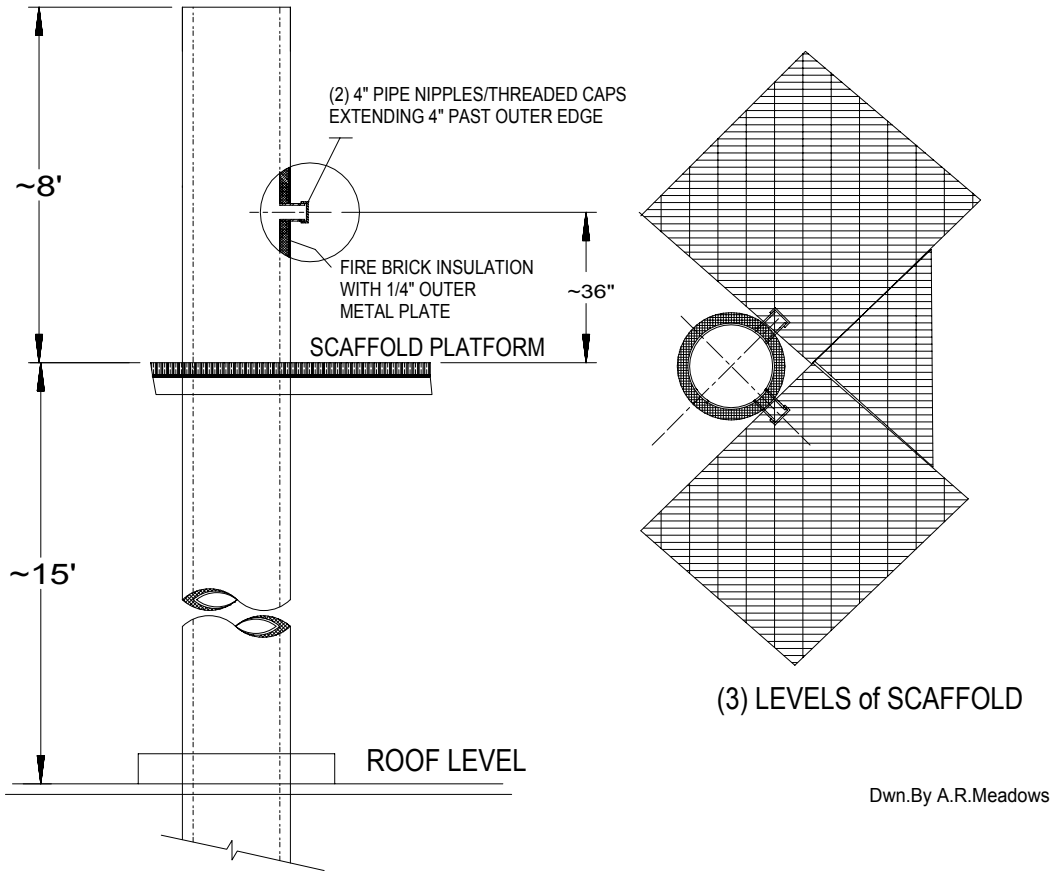


Figure 1 Sampling Location – Eco Waste Solutions Oxidizer

3. SAMPLING METHODS

3.1 General

The Method 5 train formed the basis of the manual methods used to collect particulate, acid gases, metals and semi-volatile organics during the sampling phase. The train consisted of a probe, heated filter enclosure, leak-free vacuum line, vacuum gauge, flow control valves, vacuum pump and a dry gas and orifice meter. Stack gas and orifice pressures were measured with an inclined manometer and micromanometer. Temperatures were measured in the hot box,

impinger train outlet and at the inlet and outlet of the dry gas meter. In the case of the SVOCs, the temperature was also monitored at the Amberlite XAD-2 inlet. All trains were assembled in the ERMD mobile lab.

Leak-checks were conducted at the beginning and at the end of each run or whenever a train joint was opened. Sampling was conducted from two traverses at isokinetic sampling rates with readings recorded every five minutes. Sampling duration for the particulate/metals and organic runs was 2 and 4 hours respectively.

3.2 Particulate/Acid Gases/Metals Train Description

EPA Method 29, "Determination of Metal Emissions from Stationary Sources", was used to determine particulate and metal emissions. Particulate emissions were collected in the probe and on the heated filter. The condensation and collection of the gaseous fraction was accomplished using seven impingers connected in series. The first impinger was filled with 100 mL deionized water to trap acid gases, followed by two impingers containing 100 mL of an acidic solution of hydrogen peroxide (5% HNO_3/10% H_2O_2), followed by an empty impinger, followed by two impingers containing 100 mL each of an acidic solution of potassium permanganate (4% $KMnO_4$/10% H_2SO_4) and finally followed by a silica gel impinger. A schematic of the sampling train is shown in Figure 2.

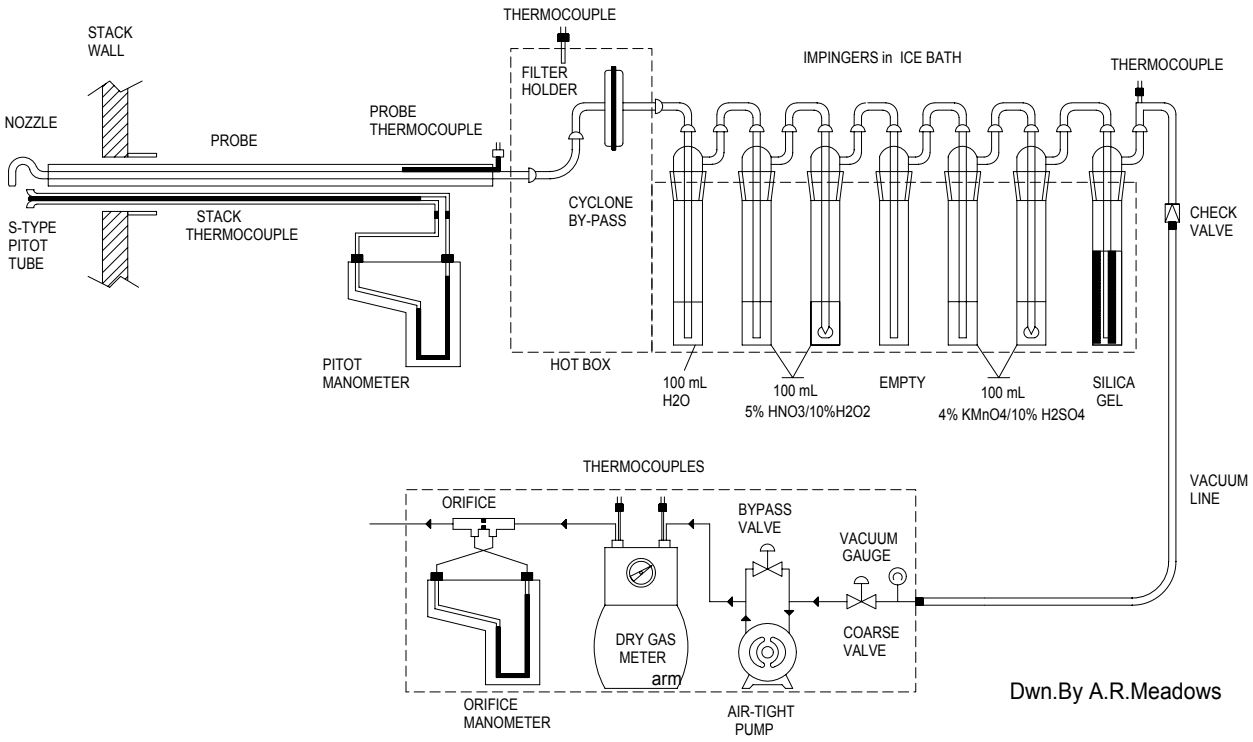


Figure 2 Particulate/Acid Gases/Metals Sampling Train

The glassware was pre-cleaned following the meticulous procedure detailed in the method. Eight samples from each test were obtained from the recovery procedure and submitted for analysis. These samples include the particulate filter, aliquots of the first impinger water, rinses of the front- and back-half glassware with various portions of acetone, nitric acid, acidified potassium permanganate and hydrochloric acid that are detailed in the method. As well, aliquots of the reagents used in the sampling train and in the recovery procedure were submitted for blank analysis.

Glass bottles with Teflon-lined caps were used for storage of acidified $KMnO_4$ containing samples and blanks. No metal components were used in this method. In its place, Teflon probe fittings and filter supports and quartz nozzles and probes were utilized to avoid contamination of the train and samples.

3.3 SVOC Train Description

The Environment Canada Report EPS 1/RM/2 *"Reference Method for Source Testing: Measurement of Releases of Semi-volatile Organic Compounds from Stationary Sources"* was used to determine the emissions of dioxins, furans, polycyclic aromatic hydrocarbons, chlorobenzenes and octachlorostyrene from the stack. A schematic of the sampling train is shown in Figure 3.

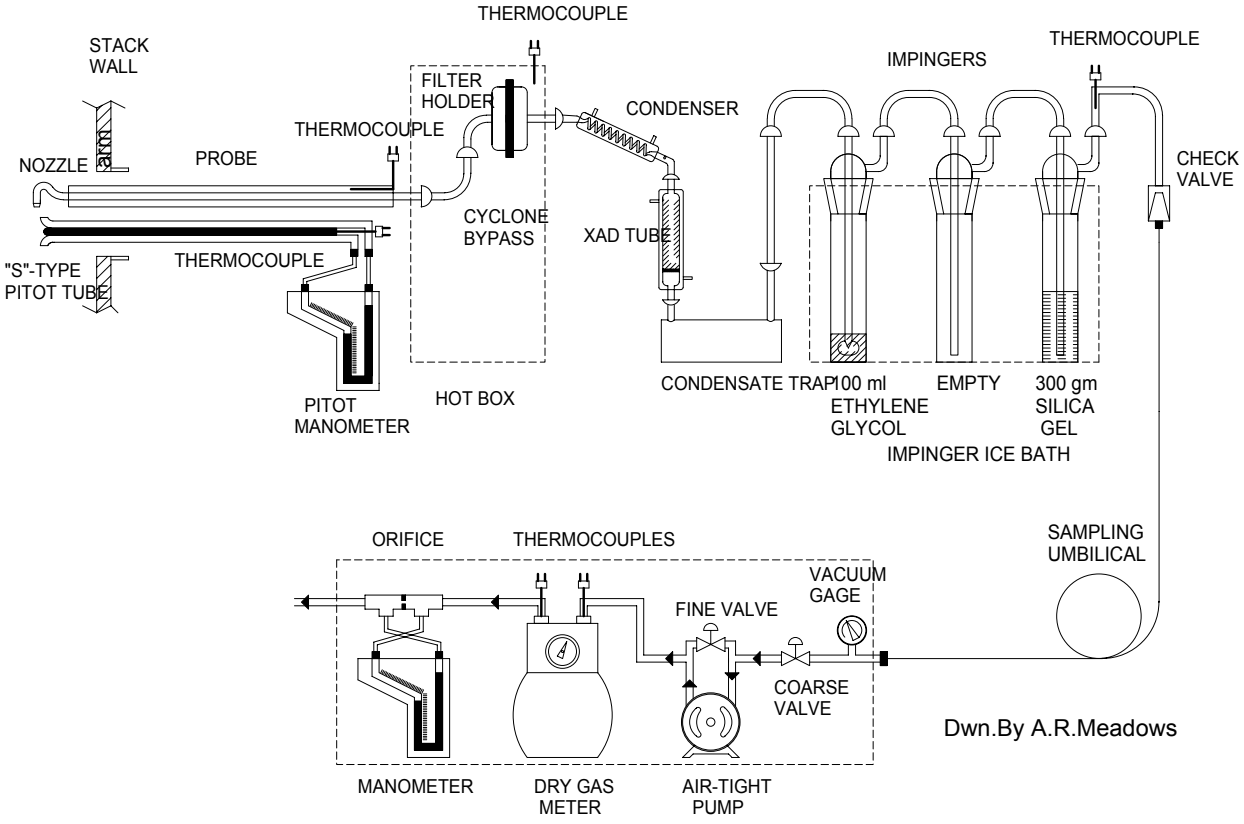


Figure 3 Dioxin, Furan, PAH, CB and OCS Sampling Train

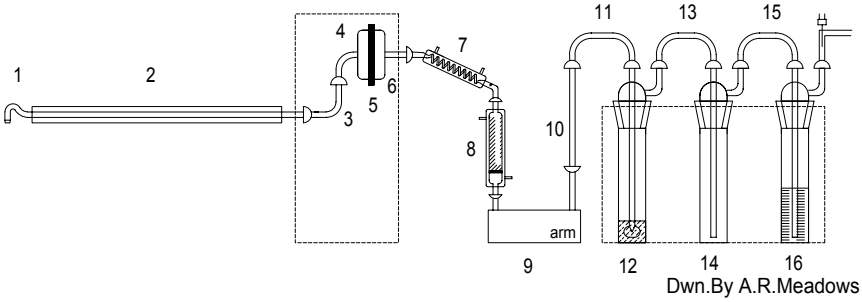
This method is the most widely accepted for the measurement of organic compounds with boiling points above 100°C. Gaseous organics were trapped in a single adsorbent tube containing about 40 grams of Amberlite XAD-2 resin. As the temperature of the resin must be kept below 20°C for optimal collection efficiency, the hot gases leaving the filter enclosure were cooled by passing them through a condenser cooled with ice bath water. The tube containing the XAD-2 resin was also water-cooled. Condensate formed in the cooling coil percolated through the resin bed and was collected in a condensate trap. An impinger containing ethylene glycol inserted downstream of the Amberlite acted as a back-up collection media in the event of breakthrough of organics through the resin. The resin tube was covered with aluminum foil during sampling and storage to prevent photodegradation of the trapped organics. All glassware joints were wrapped with Teflon tape as vacuum greases are not permitted for organic sampling. Sampling duration was four hours. Quartz nozzles and liners were used in the sampling train.

3.3.1 Glassware Cleaning and Proofing

Prior to the test program, all train glassware, probe brushes, glass wool and aluminum foil were cleaned following the rigorous procedure in the Reference Method. The glassware cleaning procedures were verified by analyzing the proofing rinses of the sampling trains. Pre-cleaned and proofed commercial sample storage bottles were used for this test. Four complete sets of train glassware were prepared for this survey. The XAD-2 was pre-cleaned and analyzed for contamination prior to the survey. All reagents were distilled-in-glass grade. Details of the cleaning and proofing procedures are given in Report EPS 1/RM/2.

3.3.2 Sample Recovery

Following the completion of each run, the organic train was recovered in the ERMD mobile laboratory. During the transportation between the sampling site and the lab, all openings were sealed with pre-cleaned glass plugs or caps or aluminum foil. The recovery procedures involved the brushing and rinsing of the train components with acetone and hexane. Only Teflon wash bottles were used during sample recovery. The loaded filter was carefully removed from the holder, sealed in pre-cleaned foil and stored in a pre-cleaned glass petri dish. Amberlite tubes were capped and re-wrapped in aluminum foil. Liquid samples were stored in pre-cleaned amber bottles to prevent photodegradation of the organics. Bottle lids were lined with Teflon. All samples were kept refrigerated following recovery. The sample recovery procedures are detailed in Figure 4. All samples were forwarded to the Analysis and Air Quality Division (AAQD) of Environment Canada for organic analysis.



Sample	Component(s)	Recovery Procedure
1	1,2,3,4	Wash and brush 3 times each with acetone (A) and hexane (H). Rinse 3 times each with A and H.
2	5	Remove filter carefully from filter holder. Place on pre-cleaned foil. Fold in half and crimp the foil edges. Place in pre-cleaned petri dish. Seal petri dish.
3	6,7	Soak 5 minutes each with A and H. Rinse 3 times each with A and H.
4	8	Cap ends and wrap in foil.
5	9,10,11,12	Empty contents into container and rinse 3 times with HPLC water.
6	6 to 15 except 8	Rinse three times each with A and H.

Mark liquid levels on all bottles and wrap all the caps with tape.
All sample containers are pre-cleaned amber glass bottles with pre-cleaned Teflon lid liners.

Figure 4 Recovery Procedure for Dioxins, Furans, PAHs, CBs and OCS

In addition to the regular sampling trains, a blank train was assembled for the tests. The blank train was treated in the same manner as the sampling trains except that no stack gases were sampled. However, a volume of ambient air, equal to that drawn during the leak checks was drawn through the blank train. Essentially, the blank train serves as a check for background levels of organics originating from ambient air, handling of train glassware and rinsing agents.

3.4 Volatile Organic Compounds (VOCs)

VOCs are classified as those organics having saturated vapour pressures at 25°C greater than 10^{-1} mm Hg. The method is based on the collection of a gaseous sample in a previously cleaned, verified and evacuated 6-liter, stainless-steel canister. The canister's interior surface is covered by pure chrome-nickel oxide which is formed during the SUMMA® passivating process. This vessel provides a stable sample collection and storage media for many organic compounds.

A modified method TO-14 *(Compendium Method TO-14 Quality Assurance Division, Environmental Monitoring Systems Laboratory, U.S. EPA, May 1988)* was used as the basis for the VOC sampling train. The train consisted of a stainless-steel probe connected by Teflon tubing to the canister. The gases were drawn by a Teflon-coated pump through a critical orifice (hypodermic needle) into the canister (Figure 5).

Two canisters were collected for each SVOC run corresponding to the first and second halves of the traverses. Sampling duration for the VOC samples was variable, ranging from 50 to 70 minutes. The sample was collected into the evacuated canister to a final pressure of 18 to 19 psig. Following sample collection, the canister valve was closed and the canisters were transported to the AAQD laboratory for analysis.

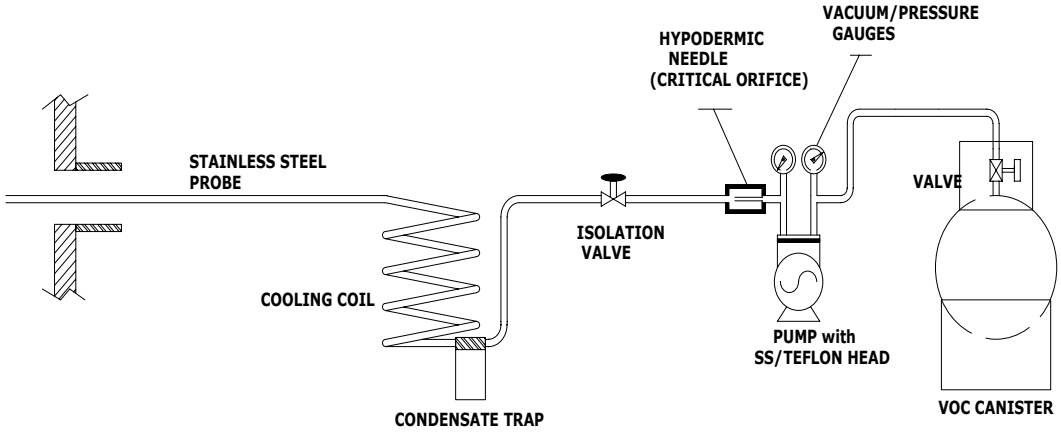


Figure 5 Volatile Organic Compounds Sampling Train

3.5 Flue Gases

An integrated gaseous sample method was employed to collect a representative sample from the stack. This was accomplished by drawing sample gas through a 30-inch Inconel probe located directly in the exhaust stream. Following particulate removal in a heated filter and conditioning (drying and cooling) of the sample gas, the sample gas was drawn through a stainless steel/Teflon head pump into a high volume aluminized Tedlar sample bag. A sampling rate of 1 liter per minute was used over a 30-minute sampling period per sample. A schematic of the system is shown in Figure 6.

Each integrated sample was then analyzed using both an ECOM Model KD (electrochemical analysis of O_2, CO, SO_2 and NO and NO_2) and a Nova Model 306 BD (infrared analysis of CO_2), to determine target species concentration. Each instrument was individually calibrated twice a day using two ranges of certified gas standards. Initial calibration was carried out prior to the commencement of sampling, once all equipment had reached operating conditions, while final calibration was performed at the end of sampling.

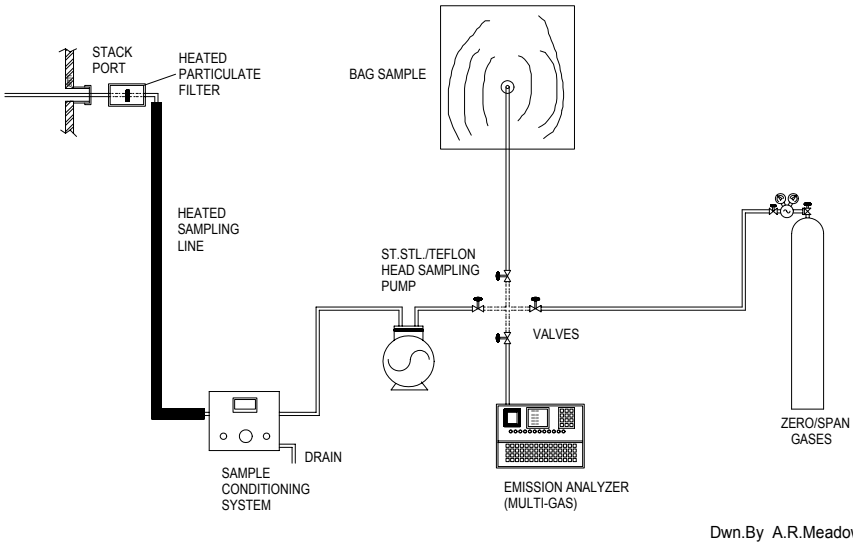


Figure 6 Flue Gas Monitoring System

4. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

All stack sampling equipment was calibrated prior to sampling using accepted techniques. Items that were calibrated included:

- Dry Gas Meter (γ)
- Orifice (K_0)
- Pitot Tubes (C_p)
- Barometers (P_{bar})
- Inclined Gauges (Δp)
- Nozzle Diameters (N_d)
- Temperature Readers (T)

The dry gas and orifice meters were calibrated using a spirometer. Pitot tubes were calibrated at the National Research Council wind tunnel. Barometers and inclined gauges were calibrated against a standard reference mercury barometer and an inclined manometer respectively. Thermocouple readers were calibrated using an ice bath and boiling water. Nozzle openings were measured by averaging three measurements with a vernier caliper. In addition to the above, the sampling consoles and inclined gauges were checked for leaks and the operation of all probe and box heaters was verified.

5. ANALYTICAL METHODS

5.1 Particulate and Metals

Particulate was determined gravimetrically following desiccation of the front-half acetone rinse and loaded filter. Acid gases were determined by ion chromatography analysis of the first impinger contents. Chloride and fluoride were expressed as HCl and HF. The samples were acid digested, and appropriate fractions were analyzed for mercury by cold vapour atomic absorption spectroscopy (CVAAS) and the remainder of the metals was analyzed by inductively coupled argon plasma emission spectroscopy (ICAP). The front- and back-half components were analyzed separately.

5.2 Semi-volatile Organic Compounds

Upon receipt in the laboratory the samples were inspected to ensure integrity and proper labeling. The samples were then entered into the laboratory information management system (LIMS) where they were assigned a laboratory code. The code was then entered onto each of the containers which were then stored in a fridge at 4^oC until sample processing proceeds.

Typically the train samples are divided into the front-half (probe rinse, filter, and front-half filter holder rinse) and back-half sections (back-half filter holder rinse, XAD, condensate trap, glycol impinger and back-half glassware rinses). The solvent fractions were dried by passage through sodium sulphate and reduced in volume by rotary evaporation. The solids (filter and XAD) were air dried prior to a 20-hour soxhlet extraction using cyclohexane/toluene (8:2 v/v). Prior to extraction, each sample was spiked with

a solution containing a known amount of carbon-13 labelled dioxin/furans and chlorobenzenes as well as deuterated PAH. These were used to assess losses incurred during the extraction and sample cleanup procedures. Analytical results for dioxin/furan and chlorobenzenes/octachlorostyrene were corrected for the recovery of these surrogates. PAH results were not corrected for surrogate recovery.

After extraction, the solvent extracts of the solids were reduced in volume and combined with the train rinses prior to cleanup. The samples were split into two equal fractions. One fraction was used for PAH cleanup and analysis while the other was used for dioxin/furan and chlorobenzene/octachlorostyrene cleanup and analysis.

The PAH cleanup involved passing the sample extract through an activated silica column. Co-extracted compounds which may cause interference during analysis were eluted out of the column while the PAHs were retained on the column. A more polar solvent was then applied to the column to elute the PAHs. The cleaned sample extract was concentrated to 500 µL and an internal standard was added to monitor instrumental performance and was used to correct for any variations in injection and sample volume. The sample was analyzed using low resolution mass spectroscopy. Calibration standards containing various known amounts of the analytes were injected into the instrument before, during and after the samples were injected. These standards were used to determine the concentrations of the analytes in the sample. The accuracy of the standards was periodically assessed using standard reference materials.

The dioxin/furan and chlorobenzene/octachlorostyrene cleanup is more rigorous since the concentrations of the dioxin/furans are much lower than other compounds that may be present in the extract. These co-extractants could interfere with the final analysis. Initially the sample extract was passed through a multi-bed silica column containing layers of acid, base and silver nitrate. Some of the co-extractants were retained on the column and others may be reduced or oxidized. Sulphur containing compounds were removed by the silver nitrate. The extract was then passed through an alumina column to separate out the dioxin/furans from other compounds such as PCBs and chlorobenzenes/octachlorostyrene. The fraction containing the chlorobenzenes/octachlorostyrene was reduced to 500 µL and an internal standard was added to monitor instrumental performance and to correct for any variations in injection and sample volume. The sample was analyzed using low resolution mass spectroscopy. The fraction containing dioxin/furans was reduced to 20 µL and an internal standard was added to monitor instrumental performance and to correct for any variations in injection and sample volume. The sample was analyzed using high resolution mass spectroscopy.

As a part of quality assurance and quality control, a method blank is usually processed along with the samples to assess cross contamination. A control sample, usually a standard reference material containing a known amount of analytes, may also be processed along with the samples to check extraction, cleanup and analytical efficiency. The division also participates in inter-laboratory studies. The results of these studies are used to compare the results obtained in-house with the results obtained from several different laboratories. These studies involve various analytes from a variety of matrices. The division is accredited by CAEAL for the analysis of PAH and dioxin/furan.

5.3 Volatile Organic Compounds

The stack samples in canisters were analyzed using thermal desorption technique with a high-resolution gas chromatograph and quadrupole mass-selective detector (GC-MSD) as described in EPA Methods TO-15 and TO-17. A Dynatherm Analytical Instruments ACEM Model 900 thermal desorption system was used for sample preconcentration. Sorbent tubes packed with 20/35 mesh Tenax-TA, 60/80 mesh Carboxen 1000 and 60/80 mesh Carbosieve SIII were used for sample concentration. An Agilent 5890 series II gas chromatograph and an Agilent 5972 MSD were used for species identification and quantification. Volatile organic compounds were separated on a 60 meter, 0.32 mm I.D. fused silica capillary column with a 1.0 μm film thickness of J&W DB-1 bonded liquid phase.

Air from the canister was drawn through the LiOH packed tube and concentrated onto a sorbent. Sample volumes were measured with a mass flow controller at a fixed flow rate, 100 mL/min. Normally, 500 mL of stack sample was passed through a LiOH tube to remove acid and CO_2 from stack gas and then concentrated onto the sorbent tube. Ten mL of internal standard was loaded onto the sorbent tube at the same time. The sorbent tube was purged with 500 mL of UHP air to flush out CO_2 from the sorbent tube. The sorbent tube was loaded onto ACEM Model 900 thermal desorption system. An internal flow of helium purges the tube of residual water vapour and air prior to transfer of the collected analytes to a capillary packed trap for refocusing, then into a GC-MS equipped with wide-bore capillary column and mass spectrometer.

Optimum results were obtained by temperature programming the GC column. Column temperature was initially held for 3 min at $-60^{o}C$, then raised to $250^{o}C$ at a rate of $8^{o}C\ min^{-1}$. The GC-MSD was operated in the selected ion monitoring mode (SIM). Identification of target analytes by SIM is based on a combination of chromatographic retention time and relative abundance of selected monitored ions. Two or three characteristic ions were monitored for each of approximately 145 hydrocarbon compounds found in urban air samples. Since the MSD acquires data for only target ions, this detection technique is considered highly specific and sensitive.

An instrument calibration standard was made from gas standards prepared in the laboratory of Environment Canada from three multi-component liquid mixtures and gas mixture cylinders purchased from Scott Environmental Technology Inc. Quantification was based on five-point linear regression calibration curves.

6. RESULTS

6.1 General Sampling Data

The general sampling data for the test program is presented in Table 1. This table includes the average velocity, volumetric flow rate (referenced to 25°C and 101.3 kPa), average stack temperature and average moisture. Average oxygen and carbon dioxide levels were determined from the flue gas samples by the procedure described in Section 3.5. The traverse data for each run and summaries are presented in Appendix I. Operating temperatures for the dual primary and single secondary chambers are also included in Appendix I.

The sampling strategy was devised to collect the samples over different segments of the cycle. This approach provides a more realistic profile of the emissions during the incineration cycle. During the first two days, the SVOC sampling was commenced at the start of the cycle. The particulate/metals run followed with the sampling on the second day commencing about 1 hour later than the sample collected on the first day. On the third day, sampling started with the particulate/metals followed by the SVOC run. The sampling for each test day commenced 35, 23 and 15 minutes following ignition of the primary burners. One VOC canister was collected during each SVOC traverse. The sampling schedule is illustrated in Figure 7.

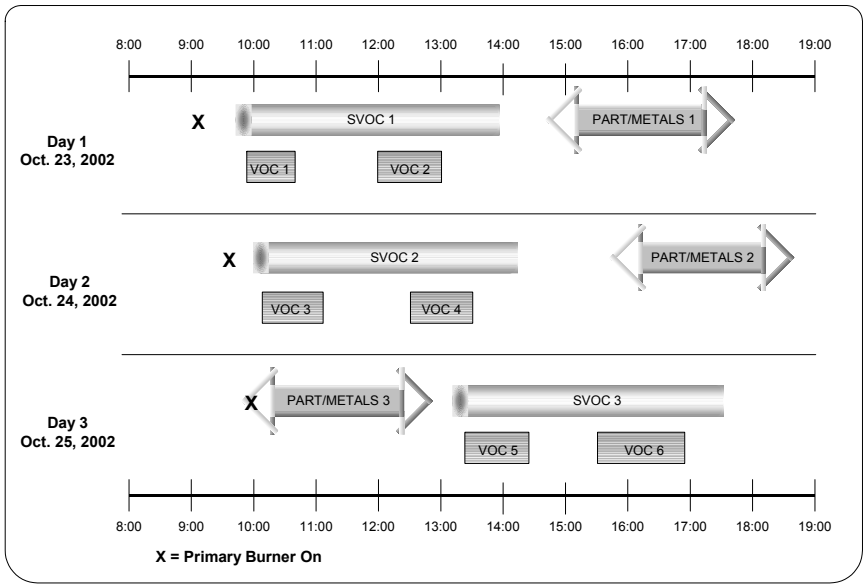


Figure 7 Eco Waste Sampling Schedule

The waste for the three days was delivered and piled outside the facility. Waste loaded to each primary chamber is recorded in Table 1. Two scenarios were used for the purpose of calculating emission rates – 100 and 250 cycles per year. These correspond to 2 and 5 cycles per week.

Table 1 Summary of General Stack Sampling Data

Process Conditions		**Day 1**		**Day 2**		**Day 3**	
Date (Oct 2002)		23		24		25	
Mass loaded (kg)	Primary 1	914		909		912	
	Primary 2	916		917		917	
Time Burners On	Secondary	08:55		09:25		09:30	
	Primary	09:10		09:38		10:03	
Primary Temperature (°C)		See temperature profiles in Appendix I					
Secondary Temperature (°C)		See temperature profiles in Appendix I					
Sampling Conditions		**SVOC 1**	**Part/M-1**	**SVOC 2**	**Part/M-2**	**Part/M-3**	**SVOC 3**
Date (Oct 2002)		23	23	24	24	25	25
Sampling Time (local)		09:45 - 13:53	15:07 – 17:15	10:01 - 14:10	16:07 – 18:11	10:18 – 12:24	13:16 – 17:26
Test Duration (min)		240	120	240	120	120	240
Isokineticity (%)		96.1	96.0	99.4	96.9	100.3	100.3
Sample Volume (m^3)		4.075	1.891	3.894	1.903	1.983	4.043
Stack Gas Characteristics							
Flow Rate (m^3/min)		71.64	66.79	65.73	66.72	67.04	67.74
Actual Velocity (m/s)		6.78	5.90	5.98	5.88	6.25	6.13
Temperature (°C)		705	666	669	671	688	675
Moisture (%)		10.09	7.59	10.10	6.92	10.25	8.13
Oxygen (%)		13.9	15.2	13.9	14.7	14.3	14.8
Carbon Dioxide (%)		4.5	3.2	4.5	3.6	4.5	3.7
Molecular Weight (lb/lb-mole)		29.28	29.12	29.28	29.16	29.29	29.18

All volumes are expressed on a dry basis referenced to 25°C and 101.325 kPa.

6.2 Particulate, Acid Gases and Metals

The concentrations of particulate, acid gases and metals are shown in Table 2. Particulate emissions ranged from 6 to 23 mg/m^3 (average 10.5 mg/m^3) corrected to 11 percent oxygen. The largest particulate level was observed in the third run where the sample was collected at the beginning of the burn cycle. Particulate levels for the two runs collected towards the end of the burn were 6.0 and 2.9 mg/m^3 with the latter value corresponding to the run collected closest to the end of the cycle. HCl levels ranged from 97 to 262 mg/m^3 with the higher value measured during the beginning of the burn. HF concentrations varied between 1.7 and 3.3 but the higher levels were measured towards the latter part of the batch cycle.

The front- and back-half fractions were analysed separately. As expected, all the mercury was associated with the back-half fraction. With the exception of three metals, the majority was consistently found in the front-half of the train. Two of these three metals, manganese and nickel, exhibited partitioning towards the front-half of the train in the run that was collected at the beginning of the cycle (77 and 84% respectively). The partitioning was skewed towards the back-half in the first and second runs for manganese (88/74%) and nickel (59/61%) respectively. In contrast, selenium distribution was skewed toward the back-half when the sample was collected at the start of the burn (70% in the back-half) compared to the two runs (71 and 66% in the front-half) collected towards the end of the cycle. Two metals, beryllium and thallium were not detected in the train samples. Mercury was detected in all runs but was very variable. Levels varied between 4.7 and 72.2 µg/m^3. For most of the metals, the levels in Run 3 (start of burn) were substantially higher than concentrations measured towards the end of the burn. No difference was noted for chromium.

The average (see note in Table 2) metal concentrations for the three runs are illustrated in Figure 8. Values are plotted on a logarithmic y-axis. Lead, copper, zinc and cadmium accounted for the majority of the reported metals (246, 214, 140 and 120 µg/m^3 respectively). Four metals, mercury, antimony, chromium and manganese, showed average concentrations between 10 and 100 µg/m^3. The remainder of the metals were below 10 µg/m^3 of which cobalt was below 1 µg/m^3. As mentioned previously, beryllium and thallium were not detected.

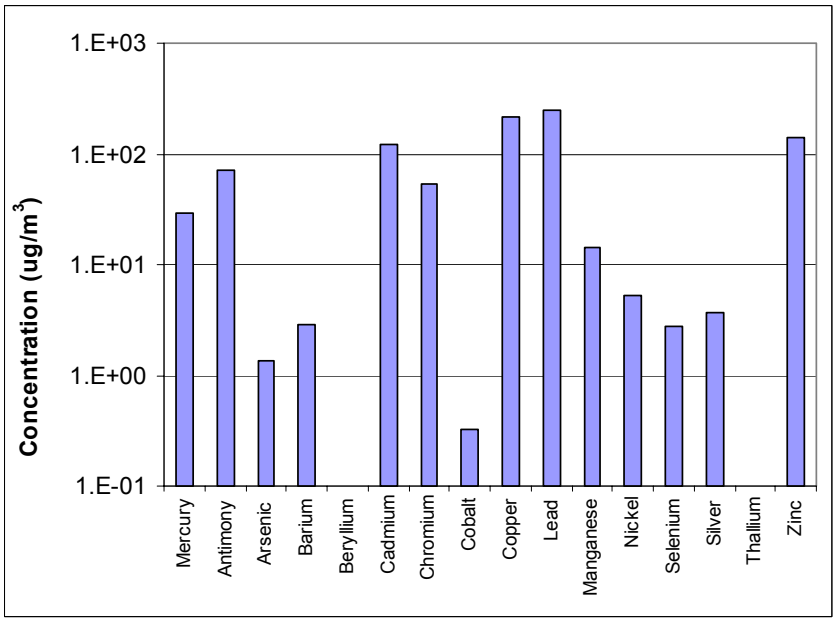


Figure 8 Average Metal Concentrations (corrected to 11% oxygen)

Table 2 Summary of Particulate, Acid Gases and Metals Concentrations
(corrected to 11% oxygen)

Pollutant	**Part/M-1**		**Part/M-2**		**Part/M-3**		**Average***	
Particulate (mg/m^3)	6.0		2.9		22.7		10.5	
HCl / HF (mg/m^3)	97	3.3	113	4.0	262	1.7	157	3.0
HCl / HF (ppm)	65	4.0	76	4.9	175	2.0	105	3.6
Metals ($\mu g/m^3$)								
Mercury	11.2		72.2		4.7		29.4	
Antimony	32.6		92.3		90.8		71.9	
Arsenic	0.9		0.9		2.2		1.3	
Barium	0.2		3.2		5.3		2.9	
Beryllium	0.0		0.0		0.0		0.0	
Cadmium	21.7		35.4		303		120	
Chromium	56.5		49.2		53.4		53.1	
Cobalt	0.3		0.2		0.5		0.3	
Copper	138		161		343		214	
Lead	62.1		160		515		246	
Manganese	11.6		10.4		21.0		14.4	
Nickel	2.9		2.7		10.2		5.3	
Selenium	2.1		2.7		3.6		2.8	
Silver	3.3		3.5		4.3		3.7	
Thallium	0.0		0.0		0.0		0.0	
Zinc	57.7		88.0		274		140	

All volumes are expressed on a dry basis referenced to 25°C and 101.325 kPa.
"0" denotes not detected.
** The average was based on the mean of the three runs.*

6.3 Flue Gases

The concentrations of oxygen, carbon dioxide, carbon monoxide, nitrogen oxides and sulphur dioxide are summarized in Table 3. Carbon monoxide, nitrogen oxides and sulphur dioxide are corrected to 11 percent oxygen. The values summarized in Table 3 represent the arithmetic average of the half-hour integrated bag samples. Detailed data for all the runs is given in Appendix I.

Table 3 Summary of Flue Gas Concentrations

Run	O_2 (%)	CO_2 (%)	CO* (ppm)	NO* (ppm)	NO_2* (ppm)	NO_x* (ppm)	SO_2* (ppm)
Part/M-1	15.2	3.2	9	50	4	54	0
Part/M-2	14.7	3.6	6	47	3	51	0
Part/M-3	14.3	4.5	4	45	4	49	0
SVOC 1	13.9	4.5	0	36	2	38	0
SVOC 2	13.9	4.5	3	40	3	43	2
SVOC 3	14.8	3.7	4	40	3	43	0
Ave**	14.4	4.1	3.6	41.7	3.0	44.7	0.5
Std Dev**	0.5	0.5	2.7	8.0	1.7	9.6	1.9

** Corrected to 11% oxygen. ** All data points*

In general, oxygen levels were 13.5 to 14 % at the start of the burn and increased to 15% by the end of the daily testing. Carbon dioxide followed the reverse trend, starting around 4.6 to 4.9% and decreasing to 3.1 to 3.5%. Sulphur dioxide was detected in only three of the integrated bag samples (SVOC 2). Carbon monoxide levels were below 10 ppm with only one bag sample slightly above 10 ppm. On average, NO represented 93% of the total NO_x. NO_x levels showed a declining trend for the first four to five hours after the start of the daily sampling after which they increased for the remainder of the burn.

6.4 Dioxins and Furans

PCDD/PCDF data is reported on the basis of the seventeen 2,3,7,8-substituted dioxin and furan congeners. This data is further transformed by multiplying each of the 17 congeners by their respective toxicity equivalency factor (International-TEF or I-TEF). The factors range from 1.0 for 2,3,7,8- TCDD to 0.001 for OCDD and OCDF. The sum of all the 17 factored compounds is known as the TEQ. Analytical results of the loaded trains, field blank train, proofing and method blank samples are presented in Appendix II.

The emission summaries for the TEQ dioxins and furans are given in Table 4. The front- and back-half components of the SVOC train which correspond to the particulate and gaseous

fractions respectively in the sample gas were combined for analysis. Train catches were corrected for the blank train. The blank train level was less than 0.35 pg TEQ/m^3.

The levels of the 17 congeners are shown in Figure 9. In all runs, the furan TEQ outweighed the dioxin TEQ. On a train total basis, the 10 furan compounds were very consistent representing 81 to 88% of the total train TEQ. Four furan congeners, 2,3,7,8-T4CDF, 2,3,4,7,8-P5CDF, 1,2,3,4,7,8-H6CDF and 2,3,4,6,7,8-H6CDF accounted for 67 to 71% of the total TEQ. On the TEQ basis, the 2,3,4,7,8-P5CDF congener was the largest component (26 to 30% of total) followed equally by 1,2,3,4,7,8-H6CDF (14 to 17%) and 2,3,4,6,7,8-H6CDF (14 to 18%). The 2,3,7,8-T4CDD congener was detected in all runs and accounted for 2.6 to 5.2% of the total TEQ. The congener profiles among the three runs are essentially identical.

Varying TEQ concentrations were measured during the testing. The highest level (71 pg TEQ/m^3) was measured in SVOC 3 which started about three hours after the ignition of the primary chambers. TEQ concentrations for the two tests conducted shortly after ignition were 10 and 36 pg TEQ/m^3. The simple average concentration was 38.9 pg TEQ/m^3. All concentrations are at 11% oxygen.

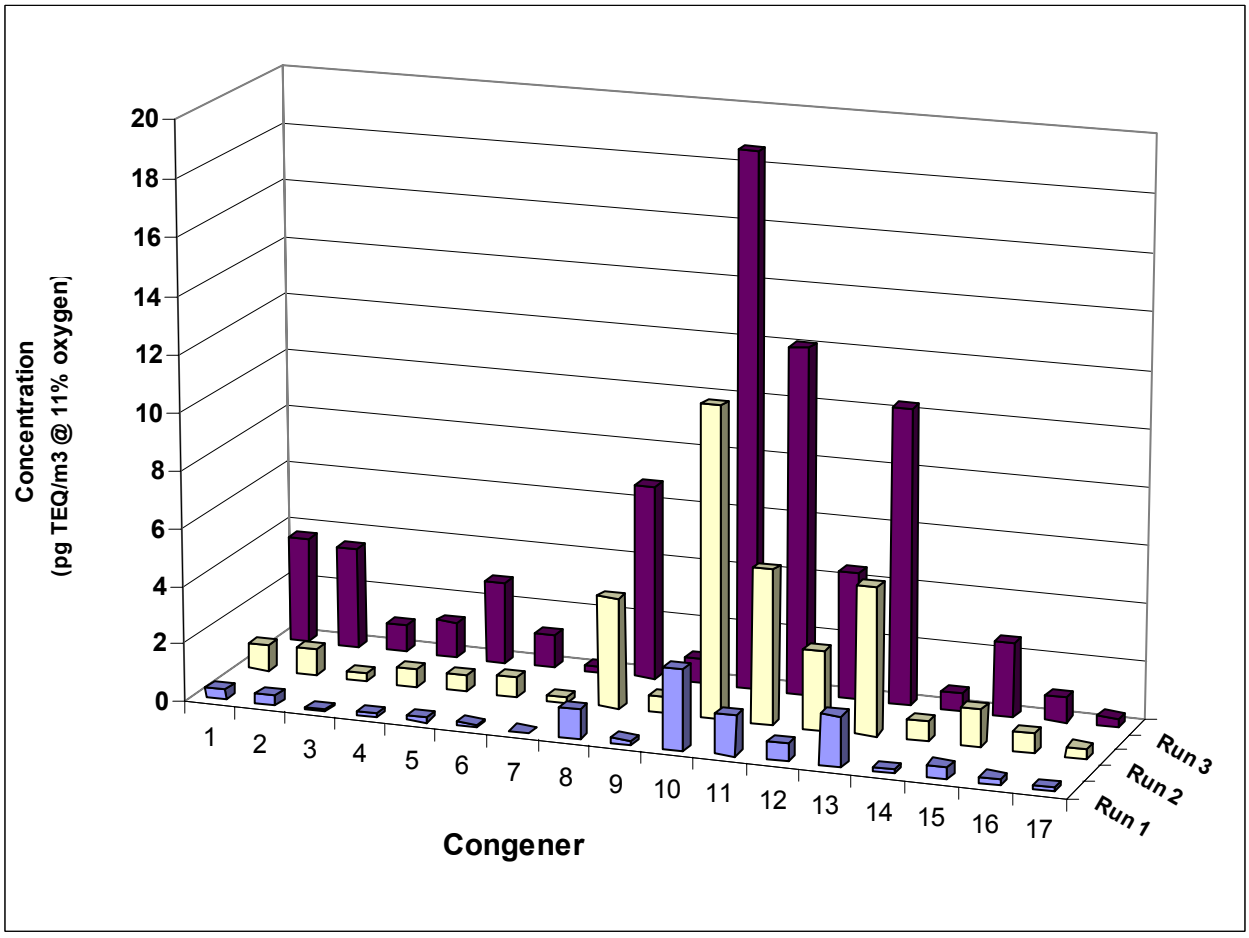


Figure 9 Distribution of TEQ Congeners

Table 4 Concentrations of Dioxins and Furans
(pg TEQ/m^3 @11% oxygen)

Compound	SVOC 1	SVOC 2	SVOC 3
2378-T4CDD	0.41	0.92	3.69
12378-P5CDD	0.35	0.92	3.48
123478-H6CDD	0.05	0.29	0.96
123678-H6CDD	0.11	0.59	1.24
123789-H6CDD	0.14	0.56	2.81
1234678-H7CDD	0.12	0.71	1.17
OCDD	0.03	0.18	0.19
2378-T4CDF	1.03	3.84	6.73
12378-P5CDF	0.15	0.56	0.85
23478-P5CDF	2.81	10.82	18.63
123478-H6CDF	1.42	5.36	12.06
123678-H6CDF	0.65	2.78	4.45
234678-H6CDF	1.77	5.15	10.31
123789-H6CDF	0.13	0.70	0.63
1234678-H7CDF	0.44	1.30	2.56
1234789-H7CDF	0.23	0.69	0.88
OCDF	0.13	0.37	0.33
TOTAL	9.98	35.73	70.98

All values are expressed on a dry basis referenced to 25°C and 101.325 kPa.
Totals may not add due to rounding.

6.5 Chlorobenzenes and Octachlorostyrene

The analysis of the SVOC train samples also included chlorobenzenes (CBs) and octachlorostyrene (OCS). Chlorobenzene compounds included 1,2,3,5-tetrachlorobenzene, 1,2,4,5-tetrachlorobenzene, 1,2,3,4-tetrachlorobenzene, pentachlorobenzene and hexachlorobenzene. Concentrations for the five selected chlorobenzenes and octachlorostyrene are summarized in Table 5 and Figure 10. Both train fractions were combined for the analysis of selected chlorobenzenes and octachlorostyrene. Pentachlorobenzene represented the largest component of the chlorobenzene isomers. Total selected CBs ranged between 3.4 and 44 ng/m^3. Similar to the TEQ dioxins and furans, the highest level for each of the detected compounds was measured in the run collected three hours after ignition. OCS was not detected in any of the three runs. Chlorobenzene concentrations are not corrected to 11 % oxygen.

Table 5 Concentrations of Chlorobenzenes and Octachlorostyrene (ng/m^3)

Compound	SVOC 1	SVOC 2	SVOC 3
1,2,3,5-Tetrachlorobenzene	0.7	2.8	10.1
1,2,4,5-Tetrachlorobenzene	0.0	0.8	3.5
1,2,3,4-Tetrachlorobenzene	0.7	3.3	7.2
Pentachlorobenzene	1.2	3.6	17.3
Hexachlorobenzene	0.7	1.8	5.9
Total selected CBs	3.4	12.3	44.0
Octachlorostyrene	0.0	0.0	0.0

Concentrations are expressed on a dry basis referenced to 25°C and 101.325 kPa.
"0" denotes not detectable.

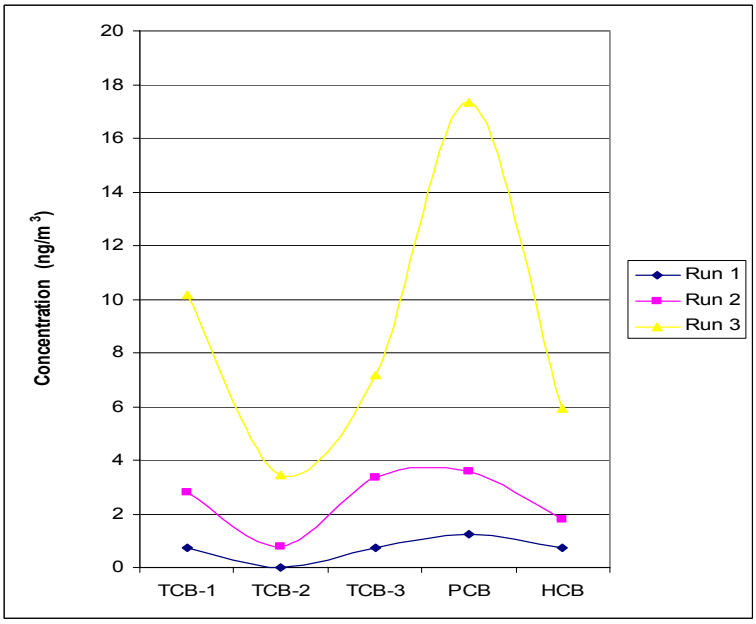


Figure 10 Chlorobenzene Concentrations

6.6 Polycyclic Aromatic Hydrocarbons (PAHs)

PAH concentrations are summarized in Table 6. As mentioned previously, the front- and back-halves of the sampling train were combined for analysis. Train catches were corrected for the PAHs detected in the blank train. Due to the low PAH loadings from this source, the PAH contribution from the blank, was substantial ranging from 44 to 66% of the uncorrected train catch. PAH analytical results of the loaded trains, blank train, proofing and control samples are presented in Appendix II.

Retene, a compound associated with wood combustion was added to the PAH list. The lighter half of the reported PAHs accounted for 82 to 99 % of the total. The heaviest PAH compound detected in at least one of the runs was benzo(g,h,i)perylene. Fluorene, phenanthrene, fluoranthene, pyrene and retene were the most abundant compounds accounting for 70 to 86% of all the reported PAHs for the three runs. Phenanthrene accounted for 33 to 42% of the total.

The totals for each train were low, ranging from 15 to 39 ng/m^3 (simple average 29 ng/m^3). These concentrations are not corrected to 11% oxygen. The highest levels were found in the runs that commenced sampling shortly after ignition of the primary. Little difference was noted between Run 1 and Run 2. A plot of the detected PAHs above 1 ng/m^3 is shown in Figure 11.

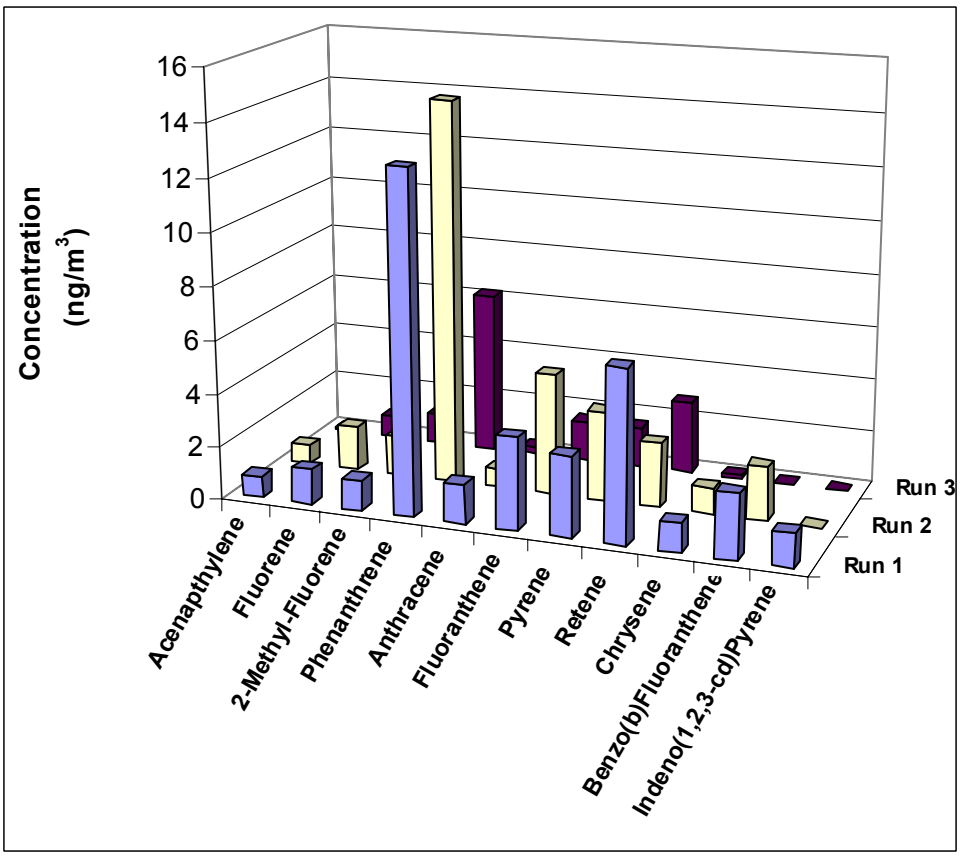


Figure 11 Selected PAH Concentrations

Table 6 Concentrations of PAHs (ng/m^3)
(corrected for blank train)

Compound	SVOC 1	SVOC 2	SVOC 3
Acenapthylene	0.8	0.7	0.1
Acenapthene	0.0	0.0	0.2
Fluorene	1.3	1.7	0.8
2-Methyl-Fluorene	1.2	1.5	1.1
Phenanthrene	12.8	14.5	6.1
Anthracene	1.5	0.7	0.2
Fluoranthene	3.5	4.6	1.5
Pyrene	3.0	3.4	1.5
Retene	6.5	2.4	2.7
Benzo(a)Fluorene	0.0	0.2	0.2
Benzo(b)Fluorene	0.0	0.0	0.0
1-Methyl-Pyrene	0.0	0.2	0.1
Benzo(g,h,i)Fluoranthene	0.0	0.3	0.0
Benzo(a)Anthracene	0.5	0.4	0.0
Triphenylene	0.4	0.3	0.1
Chrysene	1.1	1.0	0.1
7-Methyl-Benzo(a)Anthracene	0.0	0.0	0.0
Benzo(b)Fluoranthene	2.4	2.0	0.0
Benzo(k)Fluoranthene	0.5	0.0	0.0
Benzo(e)Pyrene	0.9	0.7	0.0
Benzo(a)Pyrene	0.0	0.0	0.0
Perylene	0.0	0.0	0.0
3-Methyl-Cholanthrene	0.0	0.0	0.0
Indeno(1,2,3-cd)Pyrene	1.3	0.0	0.0
Dibenzo(a,h)Anthracene	0.0	0.0	0.0
Benzo(b)Chrysene	0.0	0.0	0.0
Benzo(g,h,i)Perylene	0.9	0.0	0.0
Anthanthrene	0.0	0.0	0.0
TOTAL	38.6	34.7	14.9

Values expressed on a dry basis referenced to 25°C and 101.325 kPa.
"0" denotes not detectable.

6.7 Volatile Organic Compounds (VOCs)

The full VOC target list contains 145 compounds, however this list was pared down for reporting purposes as many of the species are of lesser interest. Normally the list is reduced to include BTEX (benzene, ethylbenzene, toluene and xylenes) and halogenated hydrocarbons. Benzene and some halogenated hydrocarbons such as vinyl chloride, 1,3-butadiene, dichloromethane, tri and tetrachloroethene, carbon tetrachloride, 1,1,1-trichloroethane, 1,2-dichloroethane and hexachlorobutadiene are classified as CEPA-toxic substances. Naphthalene, a PAH compound, was also included since it is not reliably determined using the modified Method 5 type train. The full list of VOC concentrations is given in Appendix II.

The emission data for VOCs of interest is summarized in Table 7. Two canister samples were collected during each SVOC run. These are reported separately in Table 7.

Table 7 Concentrations of Selected VOCs (µg/m^3)

Compound	SVOC 1		SVOC 2		SVOC 3		Overall Average
	Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2	
Chloromethane	0.79	4.56	1.34	2.31	1.57	0.85	1.90
Vinyl chloride	0.00	1.72	0.26	1.07	0.36	0.44	0.64
1,3 Butadiene	0.00	11.00	0.00	0.00	0.00	0.00	1.83
Dichloromethane	2.55	2.64	2.24	2.82	1.43	1.03	2.12
Benzene	1.79	99.80	1.60	1.43	1.87	0.95	17.91
Toluene	5831	2072	1258	2660	1170	713	2284
Chlorobenzene	0.10	3.72	0.12	0.26	0.09	0.07	0.73
Ethylbenzene	1.88	17.64	0.79	1.08	0.52	0.28	3.70
Total Above	5838	2213	1265	2668	1176	717	2313
All reported VOCs	5871	3213	1293	2695	1191	731	2499

All values are expressed on a dry basis referenced to 25°C and 101.325 kPa.
Compounds denoted in bold are CEPA-toxic compounds.

With the exception of sample 2 in SVOC 1, the VOCs reported in Table 7 accounted for +98% of the total VOCs. A high level of propene (verified by reanalysis) was measured in second sample of the first SVOC run. Three CEPA-toxic compounds, 1,2-dichloroethane and 1,1,1-trichloroethane and hexachlorobutadiene were analyzed for but not detected. Other toxics such as carbon tetrachloride, tri and tetra chloroethene were detected but at levels below those usually found in ambient air. Two of the naphthalene results showed levels slightly above ambient.

Toluene, normally found in combustion sources, was the most abundant compound accounting for practically all the detected volatile organic compounds. The higher toluene value in the first canister of the first SVOC run was confirmed by reanalyzing the canister. Except for the benzene, toluene and ethylbenzene reported above, other components of BTEX were detected but were found to be around those levels normally found in ambient air.

No agreement was evident among the three pairs of canisters. Using pair averages, the total VOCs for each of the three runs were 4540, 1994 and 960 µg/m^3. The average VOC level is in the order of 600 ppb on a volume/volume basis. The highest levels of VOCs were measured in

the samples collected at the start of the cycle (SVOC1 and SVOC 2). No pattern was evident between the first and second canister of each SVOC run.

6.8 Estimated Emission Rates

The annual emission rates for the particulate/metals and organic runs are given in Table 9. One of the difficulties associated with the calculation of the emission rates is the estimation of the concentration over the oxidizer cycle for each of the pollutants. Pollutant levels are a result of feed material, process operation and the portion of the burn cycle in a batch process. In this program, sampling was staggered as much as possible to provide a more representative variation of the emissions over the cycle.

Normally, the concentration used for calculating emission rates is the arithmetic average of three runs. In this case, this approach may introduce a bias for some of the pollutants as two of the runs were essentially duplicates of the same portion of the cycle. A selective average was also calculated based on the average between the two runs collected during the same part of the cycle and the remaining run. A comparison of these two averaging techniques is illustrated in Table 8.

Table 8 Effect of Averaging Method on Uncorrected Concentrations

Pollutant	Three Run Average		Selective Average	
Particulate/Acid Gases/Metals				
Particulate (mg/m^3)	6.78		8.87	
HCl / HF (mg/m^3)	100.3	1.8	118.9	1.6
Mercury	18.27		14.49	
Antimony	45.70		49.40	
Arsenic	0.86		1.01	
Barium	1.89		2.30	
Cadmium	78.9		109.7	
Chromium	33.00		33.66	
Cobalt	0.20		0.23	
Copper	136.4		159.5	
Lead	159.7		205.6	
Manganese	9.09		10.32	
Nickel	3.39		4.23	
Selenium	1.75		1.90	
Silver	2.33		2.46	
Zinc	90.3		113.3	
Organics				
Dioxins and Furans (pg TEQ/m^3)	25.35		29.95	
PAHs (ng/m^3)	29.40		25.78	
CBs (ng/m^3)	19.93		25.95	
VOCs ($\mu g/m^3$)	2499		2115	

Table 8 shows that the selective approach results in higher average concentrations for particulate, HCl, most metals, dioxins and furans and chlorobenzenes. VOCs and PAHs display the opposite bias. The difference for mercury is irrelevant as the emissions are probably directly related to the feed input. Neither method is invalid but this exercise serves to illustrate that the assumptions have an impact on emission levels. For the purpose of this program, the simple average of three runs will be used to estimate annual emissions. Two scenarios were used for estimating annual emission rates – 100 and 250 cycles per year.

Table 9 Estimated Annual Emission Rates

BASIS: AVERAGE OF THREE RUNS Ten hour cycle 100 and 250 batches per year Stack flow rate - average of all runs			
Pollutant	**Average* Concentration**	**Annual Emission Rate**	
		100 batches	**250 batches**
Particulate, Acid Gases and Metals			
Particulate	6.78 mg/m^3	27.5 kg/year	68.8 kg/year
HCl	100.2 mg/m^3	407 kg/year	1017 kg/year
HF	1.83 mg/m^3	7.4 kg/year	18.5 kg/year
	(µg/m^3)	(g/year)	(g/year)
Metals			
Mercury	18.3	74	185
Antimony	45.7	185	463
Arsenic	0.9	3	9
Barium	1.9	8	19
Beryllium	not detected	-	-
Cadmium	78.9	320	800
Chromium	33.0	134	335
Cobalt	0.2	1	2
Copper	136.4	553	1384
Lead	159.7	648	1619
Manganese	9.1	37	92
Nickel	3.4	14	34
Selenium	1.7	7	18
Silver	2.3	9	24
Thallium	not detected	-	-
Zinc	90.3	366	916
Organics			
Dioxins and Furans (TEQ)	25.35 pg TEQ/m^3	0.103 mg/year	0.257 mg/year
TCB (3 isomers)	9.73 ng/m^3	0.039 g/year	0.099 g/year
PCB	7.38 ng/m^3	0.030 g/year	0.075 g/year
HCB	2.82 ng/m^3	0.011 g/year	0.029 g/year
PAHs	29.4 ng/m^3	0.119 g/year	0.298 g/year
OCS	not detected	-	-
VOCs	2499 µg/m^3	10.1 kg/year	25.3 kg/year

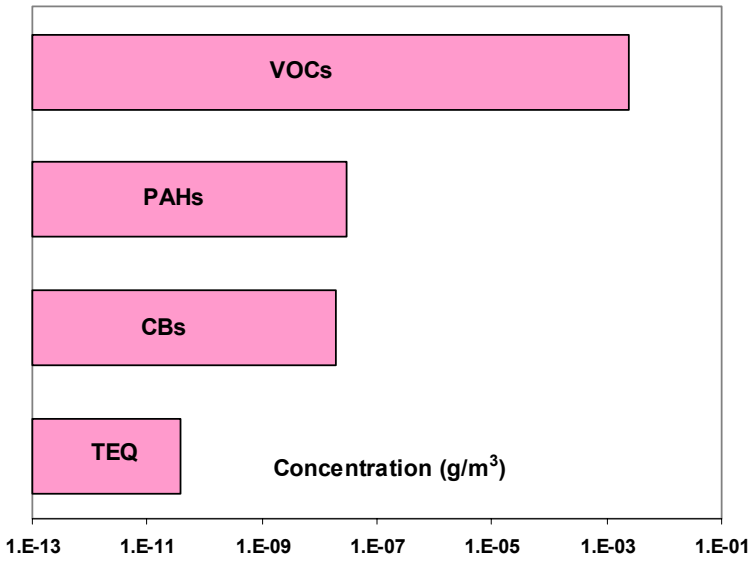
**Uncorrected concentrations at reference conditions used to calculate emission rates.*

7. SUMMARY

Concentration data is summarized below. The relative abundances (on a logarithmic scale) for the organic compounds and metals are illustrated in Figure 12.

Compound	Concentration
PCDDs/PCDFs*	38.9 pg TEQ/m^3
CBs (5 isomers)	19.9 ng/m^3
OCS	0 ng/m^3
PAHs	29.4 ng/m^3
VOCs	2499 µg/m^3
Particulate*	10.5 mg/m^3
HCl*	157 mg/m^3
HF*	3.0 mg/m^3

** at 11% oxygen*
0 denotes not detected.



Metals* (µg/m^3)	
Mercury	29.38
Antimony	71.9
Arsenic	1.3
Barium	2.9
Beryllium	0.0
Cadmium	120.0
Chromium	53.1
Cobalt	0.3
Copper	214.2
Lead	245.5
Manganese	14.4
Nickel	5.3
Selenium	2.8
Silver	3.7
Thallium	0.0
Zinc	139.8

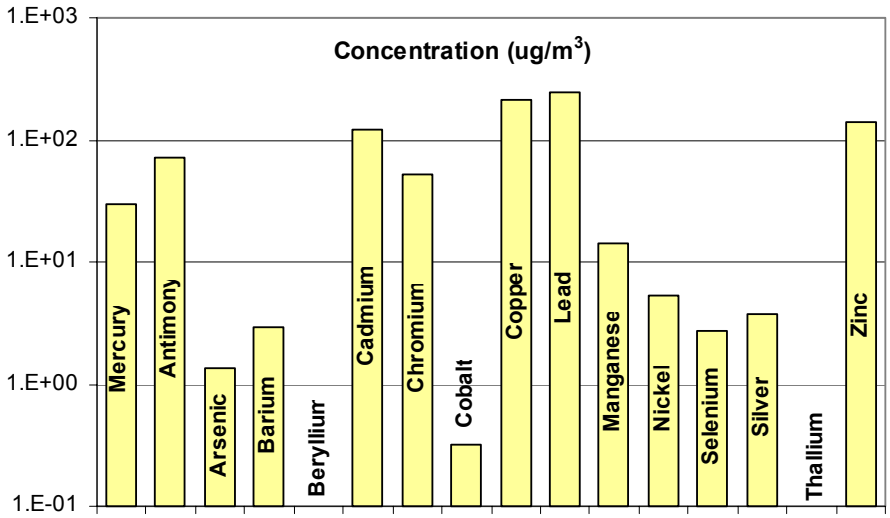


Figure 12 Summary of Emission Results

APPENDIX I

(Only available with hard copy)

Waste Oxidizer Temperature Data

Flue Gas Monitoring Data

SVOC Traverse Data

Particulate /Metals Traverse Data

APPENDIX II

(Only available with hard copy)

Anion, Particulate and Metals Analysis

Dioxin, Furan, CB and OCS Analytical Report

VOC Analytical Data