Addendum to Operations and Maintenance Plan for the Water Supply Facility, Char River, Rankin Inlet, Nunavut

Final

Prepared for:
Department of Community and Government Services,
Government of Nunavut

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Abbreviations

GN-CGS	Government of Nunavut Community and Government Services
HDPE	High Density Polyethylene
km	kilometre
m	metre
mm	millimetre
O&M	Operations and Maintenance
PPE	Personal Protective Equipment
USGPM	US Gallons per Minute
WHMIS	Workplace Hazardous Materials and Information System
%	percent

1.0 Introduction

On behalf of the Government of Nunavut Department of Community and Government Services (GN-CGS), Stantec Consulting Ltd. (Stantec) has prepared the following addendum to the Operations and Maintenance (O&M) Plan for the Water Treatment Facilities located in the community of Rankin Inlet. The original O&M Plan for the Water Treatment Facilities was submitted in response to a condition of its Water License 3AM-GRA1015 and was approved by the Nunavut Water Board (NWB). The Water Treatment Facilities included in the original O&M Plan comprise of:

1. A water intake plant (including the collection of water from Nipissar Lake); and,

2. A waste water treatment plant.

This addendum was prepared in response to additional infrastructure constructed, namely a 4.05 kilometre (km) water intake pipeline extending from the Char River to Nipissar Lake. The following sections provide an overview of the O&M amendments associated with the installation of the 4.05 km water intake pipeline.

2.0 System Overview

The water supply for the community is collected from Nipissar Lake, located approximately 2 km northwest of Rankin Inlet. Water is withdrawn using two submersible pumps and pumped year-round through an insulated watermain extending from Nipissar Lake pump house to the Williamson Lake pump house. Further information on the O&M requirements for the existing water treatment facilities are provided in the main O&M Plan in Appendix A.

2.1 WATER INTAKE PIPELINE

Due to water level decreases in Nipissar Lake, the GN-CGS retained Stantec in 2010 to design a 4.05 km water intake pipeline extending from the Char River approximately to Nipissar Lake (Figure 1-1). The purpose of this pipeline is to transport water during the summer months (June to September) to replenish Nipissar Lake. In 2012, the pipeline was constructed. The pipeline will begin operation in June 2014.

The water intake pipeline has three distinct areas:

1. Intake Area (including the pump, intake hose, floating base, intake screen and sea canister)

2. Pipeline (the 4.05 km pipeline, one low point drain, two high point air releases)

3. Discharge Area (including a concrete slab and riprap area at the end of the pipeline)

Sources: Imagery - Microsoft BING. Thematic Data - FSC Architects and Engineers

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

Nipissar Lake Resupply Line - Site Plan

A brief summary of each of the areas are provided in the sections below.

2.2 INTAKE AREA

The intake area includes a pump, sea canister, 50 m intake hose, and a floating base which anchors the intake hose in place during seasonal operation (June to September). The intake line extends from the Char River to the pump and consists of a 150 mm reinforced suction hose connected to an end-of-pipe screen (mesh size 2.54 mm) to prevent fish entrapment. During operation, the screen and a portion of the intake hose are inserted into the river, immediately down gradient from the intake pump. The pump consists of a trailer mounted four cylinder 75 horsepower diesel powered generator.

The sea canister provides equipment storage for the intake line, floating base and intake screen when not in use. The sea canister will not house any hazardous materials, such as antifreeze, fuel, etc. or materials that have the potential to freeze over the winter months. As per the Spill Contingency Plan, fire extinguishers will located in the sea canister during pumping activities; however, they will be removed from the sea canister at the end of the pumping season.

2.3 PIPELINE ALIGNMENT

The pipeline is constructed of 250 mm high density polyethylene (HDPE) piping. The pipeline is secured to the ground using galvanized steel rods. To facilitate pipeline drainage at the end of the season, two high point releases and one low point drain were installed. The low point drain consists of a 75 mm HDPE drain line leading from the pipeline, protected by a circular galvanized steel case.

2.4 DISCHARGE AREA

The discharge area is located at Nipissar Lake. A prefabricated concrete pad (approximately 3.0 m by 1.5 m in size) is used as a splash pad at the pipeline outlet location at Nipissar Lake. The pad should be periodically inspected for any deficiencies. Nipissar Lake will be replenished until the water level returns to the ordinary high water mark. When this water level is reached, the pump at the Char River will be turned off.

3.0 Personnel Training

All personnel working at the water intake pipeline will require training to follow this O&M Plan. In addition, personnel should have site-specific instruction including, but not limited to, operating procedures, basic first aid and Workplace Hazardous Materials and Information System (WHMIS) training.

4.0 Health and Safety

Health and safety must be taken into consideration when working at the water intake pipeline. All staff will be required to wear appropriate personal protective equipment (PPE) including hard hats, steel-toe boots, reflective vests and appropriate clothing.

5.0 Operational Procedures

The following sections provide an overview of the procedures required for the operation of the water intake pipeline.

5.1 PLACEMENT OF INTAKE LINE

The floating base with the screened intake line will be placed in the Char River, immediately down gradient from the pump. The floating base will be anchored in place.

5.2 OPERATION OF THE PUMP

During the summer of 2014, daily flow measurements will be collected to develop a Withdrawal Plan for the river; this Plan will be used during subsequent years to direct pumping activities. Once the measurements have been collected, the pump start-up and/or operation will be in accordance with the manufacturer's operational procedures. The pumping rate will not exceed 10% of the flow rate of the river. If insufficient flow to operate the pump is present, pumping activities will cease until sufficient water is present.

The diesel generator for the pump will be refueled with a hand pump or electric pump (e.g. tidy tanks). Because the pump is located within 30 m of the high water mark of the Char River, extra precautions are necessary. The pump will be placed in a drip pan when operational and during fueling. The drip pan will be large enough to contain 110% of the total volume of fuel in the generator. The spill kit dedicated to the sea canister will be readily available when refueling the generator. No refueling will take place in water or on ice. There will be no fuel stored at the sea canister at any time and all fuel will be transported via the existing access road.

In the event of a spill, the Spill Contingency Plan will be implemented. As per the Spill Contingency Plan, any spills of waste are to be reported to the 24-hour Spill Report Line. A copy of the Spill Contingency Plan is provided in Appendix B.

The site representative will record the time that the pumping began to the time the pumping was completed and the rate at which the water was pumped on a daily basis. These recordings will then be used to determine the water usage volumes.

5.3 ANNUAL PIPELINE SHUT DOWN

Upon completion of the water extraction (i.e. September), the intake will be removed from the water, dismantled and stored in the sea canister along with the intake pump. Other maintenance activities will include re-grading of the pump area as necessary. Also, the bank of the River where the intake line comes back out of the water will be monitored for erosion. If erosion is suspected, then erosion control measures will be implemented.

6.0 Monitoring

The following sections outline the monitoring requirements for the water intake pipeline.

6.1.1 Pre-operation Annual Monitoring

Prior to the commencement of pumping each year, a pre-operation inspection of the water intake pump will be completed by a qualified mechanic. During the operation of the pump, personnel will monitor equipment to ensure that the equipment is properly maintained and is in good working condition to reduce the potential for leaks.

In addition to checking the pump, an annual monitoring of the pipeline alignment will be undertaken to determine the presence of potential issues including surface water ponding, slumping, etc., of granular material. If issues are identified, corrective measures are to be completed as soon as possible.

6.1.2 Culvert Monitoring

Three culverts located along the alignment of the pipeline will be monitored daily during freshet; and, if required, cleared of any flow impediments. Cleared debris will be placed adjacent to the culvert location and/or removed from the area if required. Debris will not be placed into adjacent water bodies.

6.1.3 Flow Monitoring

Prior to the operation of the pump each day, measurements of the river will be collected by personnel. These measurements include:

1. River width (from bank to bank at the intake location)

2. A profile of river depth across the width of the river(from water level to river bottom at the intake location, every 0.25 m)

3. Flow measurement (at the intake location)

Once these measurements have been collected, the pumping rate will be adjusted on the pump to ensure that the 10% maximum withdrawal rate is not exceeded at any time.

The monitoring equipment (i.e. flow meter) will be maintained and operated by the GN-CGS facility representative. Any equipment malfunctions will be remedied as soon as possible, prior to commencement of pumping activities.

6.1.4 End of Season Discharge Monitoring

To prevent freezing of the line, any residual water remaining in the pipeline at the end of the season will be discharged from the low point drain. Discharge rates from the drain will be monitored daily by personnel, with alterations made to the flow rate depending on the presence of ponding and/or erosion.

7.0 Emergency Response and Contingencies

An overview of the emergency contacts is provided in Table 7-1 below.

Table 7-1 Emergency Contacts

Contact	Location	Telephone number
24-Hour Emergency Spill Report Line	Yellowknife, Northwest Territories	867-920-8130
Aboriginal Affairs and Northern Development Canada – Manager of Field Operations	Rankin Inlet, Nunavut	867-645-2831
Hamlet of Rankin Inlet – Senior Administrative Officer	Rankin Inlet, Nunavut	867-645-2895
Government of Nunavut – Regional Engineer	Rankin Inlet, Nunavut	867-645-4074
Environment Canada – Inspector	Edmonton, Alberta	780-951-8600
Fire Department	Rankin Inlet, Nunavut	867-645-2598
Royal Canadian Mounted Police Detachment	Rankin Inlet, Nunavut	867-645-0123
Community Health Center	Rankin Inlet, Nunavut	867-645-4532

In the event of fuel or contaminant spill, the Spill Contingency Plan will be activated. A copy of the Spill Contingency Plan is provided in Appendix B.

8.0 Reporting

As part of the Nunavut Water Board License General Conditions (Part B of the License), an annual report must be completed. In relation to this Site, the report will include:

- The monthly and annual quantities in cubic meters of freshwater obtained from the Char River.
- A summary of alterations and/or major maintenance work carried out at the Char River Station and associated pump and pipeline components.
- A summary of any abandonment and restoration work carried out during the year and any scheduled maintenance or restoration to be completed the following year.
- A summary of any studies, reports and plans requested by the Board that relate to waste disposal, water use or reclamation, and a brief description of any future studies planned; and
- Any other details on water use or waste disposal requested by the board by November 1st of the year being reported.

In addition to the annual report, a quarterly report will also be submitted to the board for review which will include monthly quantities of fresh water obtained from the Char River.

9.0 References

Statistics Canada (StatsCan). 2012. Rankin Inlet, Nunavut (Code 1320) (table). Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWE. Ottawa. Released October 24, 2012. http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E (accessed April 27, 2014).

Nuna Burnside Engineering and Environmental Ltd. 2010. Water Supply Facility Operation and Maintenance (O&M) Plan, Hamlet of Rankin Inlet. Department of Community and Government Services.

Appendix A Current Operations and Maintenance Plan – Water License 3AM-GRA1015

Water Supply Facility
Operation and Maintenance (O&M) Plan
Hamlet of Rankin Inlet
Department of Community and Government Services, Government of Nunavut

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December 2008
Revised April 2010

File No: N-O 14850

Water Supply Facility
Operation and Maintenance (O&M) Plan
Hamlet of Rankin Inlet

December 2008
Revised April 2010

Executive Summary

Community and Government Services (CGS) of the Government of Nunavut (GN), provides water supply services for the Hamlet of Rankin Inlet.

Nunavut Water Board (NWB) license Number NWB3GRA0207 expired November 30, 2008 and a new water license application is in progress.

A Water Supply Facility Operation and Maintenance (O&M) Plan dated December 2008, was prepared by Nuna Burnside Engineering and Environmental Ltd. (Nuna Burnside), as required by the original license and in support of the application for a new license.

As noted in the December 2008 O&M Plan as per the NWB license, the Plan is to be reviewed and updated annually. This April 2010 update of the Plan also addresses comment provide by review agencies during the license renewal application process.

During the new license application review, various agencies provided comments and concerns regarding:

- The impact of water withdrawals from Nipissar Lake
- Sustainability of the Lake as a long term supply
- Compliance with the DFO end of pipe fish screen guidelines.

This O&M Plan includes the current studies and effects underway to address these issues.

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1.0 Introduction

1.1 Hamlet Description

The Hamlet of Rankin Inlet is located on Rankin Inlet, on the west coast of Hudson Bay. It is 96-air km southwest of Chesterfield Inlet and 1088 air km east of Yellowknife, at 62° 49'N latitude and 92° 05' W longitude, as shown on Figure 1. The Hamlet has been growing substantially in the past 10 years. Economic activities now include government, commercial fishing, transportation/communications, carvings/handicrafts, trapping, hunting, and tourism. The community has a population of approximately 2,358 residents.

Community and Government Services (CGS) of the Government of Nunavut (GN), provides water supply and sewage disposal services for the Hamlet of Rankin Inlet.

The Hamlet provides solid waste collection for the residents, businesses and institutions. The water, wastewater, and solid waste systems include the following facilities and services:

- A water intake plant, which draws water from Nipissar Lake and provides treatment by chlorination
- A waste water treatment plant that provides primary treatment of sewage with use of a mechanical screen
- A current (old) solid waste disposal facility, which includes a bulky metals disposal area and a waste oil and liquid waste storage area
- A new solid waste management facility that has not been commissioned yet.

Key features of the community are shown on Figure 2.

1.2 Nunavut Water Board License

The Water Supply Facility currently operates under Nunavut Water Board License Number NWB3GRA0207 issued December 01, 2002 to the Government of Nunavut. The license expired November 30, 2008 (Appendix A). An application for a renewal/amendment of the licence was submitted in December 2008.

This O&M Plan includes items outlined in the requirements of the current license such as:

- Operation and Maintenance Plans
- Environmental Emergency Contingency Plan (Spill Contingency Plans) – separate document

- Monitoring Program and Quality Assurance/Quality Control Plan – separate document.

The O&M Plan is focussed on environmental impacts and compliance, which are the mandate of the NWB. It does not address the treatment and supply of drinking water for human consumption. It does not address human health and safety, these are the mandate of other agencies.

This O&M Plan should be updated annually, as required by the license and when the new NWB license is issued.

1.3 Climate

Rankin Inlet is affected by arctic air masses, and experiences a maritime Arctic climate characterized by short cool summers, and long cold winters. The Rankin Inlet area receives an average of 18.1 cm of rainfall and 107 cm of snowfall per annum. Mean annual precipitation totals 29.7 cm per annum. July mean high and low temperatures are 14.9°C and 5.9°C, respectively. January mean high and low temperatures are -28.3°C and -35.5°C, respectively. Winds are generally north-west, and average 23 km/h (Rankin Inlet Weather Station, Climate Normals 1991-2000, Environment Canada, 2008). A summary of climate conditions in Rankin Inlet is included in Appendix B.

1.4 Water Supply

The community of Rankin Inlet obtains its potable water from Nipissar Lake, located approximately two kilometres northwest of the community (Figure 2). Nipissar Lake covers an area of 1,090,565 m^2. Using an average depth of 4 metres the estimated volume is 4,362260 m^3. The total drainage area of Nipissar Lake is 323 hectares. Using an annual precipitation rate of 297.2 mm and an annual evapotranspiration rate of 200 mm, the total recharge to the lake is approximately 314 000 m^3 per year. Hydrology calculations are included in Appendix C.

1.5 Health and Safety

Health and safety of workers and the public is the first priority while operating the Water Supply Facility. The requirements of the Nunavut Safety Act must be followed at all times. All actions and operations must be undertaken with safety as the first priority.

It should be noted, that this document was prepared to meet the requirements of the NWB and is not to be considered a Health and Safety Plan.

1.6 Training

Staff training is an important aspect of the operation of a Water Supply Facility. Staff must be adequately trained to follow this O&M Plan and operate the facility. This O&M Plan is dependent on sufficient site specific training to ensure staff are appropriately trained to operate the facility.

1.7 Waste Disposal

The facility does not generate wastes other than small amounts of municipal type wastes, that are collected and disposed of through an agreement with the Hamlet of Rankin Inlet.

2.0 Operation and Maintenance of the Water Supply Facility

2.1 Overview

The community draws its water from the Nipissar Lake, located 2 km northwest of the Hamlet. The Water Supply Facility consists of a pump house and water intake located on the south-east side of the lake. A fuel storage tank is located in a fenced off area on the north side of the pumphouse. Photographs of the facility taken by Nuna Burnside in September 2008 are included in Appendix D.

2.2 Water Supply Facility Design

The Nipissar Lake pump house contains vertical turbine submersible pumps installed inside the twin intake lines. Each of the 10 Hp pumps has a 1020 L/min. capacity. Only one pump operates at a time. Operation of the pump is controlled by the water level in the water storage tank adjacent to the Williamson Lake pump house. An air compressor aerates water around the intake to prevent taste and odour problems.

2.3 Water Intake System Operational Procedures

The following operational procedures shall be carried out by the Government of Nunavut on behalf Hamlet of Rankin Inlet:

- Monitoring and inspections will occur as outlined in the NWB license and described in this O&M Plan

- In the event of an accident, a spill of petroleum products or a fire during water distribution operations, *the Hamlet of Rankin Inlet Environmental Emergency Contingency Plan* (separate document) shall be implemented

- No motorized vehicles should be operated in the lake or on the ice of the lake due to risk of fuel spills

- If the lake is used for fishing, no motorized augers shall be used and there should be no materials that could contaminate the water brought onto the ice of the lake.

2.4 Periodic and Seasonal Maintenance Procedures

The following procedures shall be undertaken by the staff of the Government of Nunavut on behalf of Hamlet of Rankin Inlet during periodic and seasonal maintenance operations at the Water Supply Facility:

- The roadway and truck pad shall be maintained by snow clearing in the winter and surface grading in the summer, with any defects repaired as necessary

- Site warning signage, which identifies the boundaries of the Water Supply Facility shall be inspected weekly, and repaired or replaced as necessary

- The berms at the Water Supply Facility reservoir shall be inspected during the summer for erosion and settlement weekly, and repaired as necessary

- Any airborne litter shall be removed from the area of the pump house and taken to the Hamlet landfill in the spring and fall, or as required.

Forms to assist site staff in conducting the inspections and data recording are included in Appendix E.

The activities described above shall be completed by the staff of the Government of Nunavut on behalf of the Hamlet and details of any repairs shall be reported in the Annual Report submitted to the Nunavut Water Board, in compliance with the Water License.

2.5 Water Intake System Monitoring Program

All water sampling completed by the Government of Nunavut on behalf of the Hamlet of Rankin Inlet shall be in accordance with the *Hamlet of Rankin Inlet Environmental Monitoring Program and Quality Assurance/Quality Control (QA/QC) Plan* (separate document).

The sampling program is focussed on meeting the requirements of the Water License, which is environmental protection not water quality for drinking.

Daily monitoring of residual chlorine levels shall be undertaken, to facilitate and confirm the maintenance of free chlorine residual in treated water in accordance with the *Public Health Act* (1992) and associated *Regulations*. Drinking water quality control is not the mandate of the NWB. Refer to other documents and agencies with jurisdiction for operational procedures and requirements regarding drinking water quality.

2.5.1 Water License Requirements

As outlined in the NWB water license, regular monitoring of the quantities of water obtained from the natural environment and processed through the Water Treatment Facility is required.

As part of the General Conditions, the licence requires that monthly and annual quantities in cubic metres of fresh water obtained be recorded and reported in the Annual Reports. It also requires that metres, recorders, or other such methods to record the volume of water used be installed, operated and maintained by the Licensee. The Licensee must maintain the Water Supply Facilities to the satisfaction of the Inspector.

A Surveillance Station will be established at the intake of the raw water supply before treatment (GRA-1). Monthly and annual quantities of raw water pumped will be measured and recorded in the official operations logbook on a form similar to that presented in Appendix E.

3.0 Operation and Maintenance of Water Storage and Distribution System (Utilidor)

3.1 Water Storage Design

The Hamlet has a storage tank that is used to provide water during emergencies such as fires. The tank has a useable storage capacity of 3,364,000 L and can provide water for up to two days. In case of an emergency lasting longer than two days, Williamson Lake can be accessed by means of a portable pump, flexible hose, and ice auger.

Water Storage Tank Data	
Height	12.8 m
Diameter	18.3 m
Useable Storage	
2 hour fire demand	545,000 L
2 day emergency storage	2,030,000 L
Peak balance	473,000 L
Total	3,364,000 L

3.2 Water Distribution System

3.2.1 Overview

There are two systems of water distribution in Rankin Inlet. Approximately 99% of the population receives piped water while the remainder is on trucked service. The Hamlet of Rankin Inlet delivers water to the community utilizing an 8172 L capacity water truck. The truck is filled from the truck fill arm, located on the northwest side of the Williamson Lake pump house and delivers three to five days per week. All water deliveries are metered.

3.2.2 Water Distribution System Design

Water from the Nipissar Lake pump house is pumped to the community through a shallow buried insulated main, which operates year-round.

Piping System Data	
Length	2000 m
Supply Line	200 mm diameter insulated HDPE
Return Line	150 mm diameter insulated HDPE
Access Vaults	7 vaults, each 1600 mm diam HDPE. Inside the vaults, each line is fitted with a butterfly valve and two 75 mm diam thaw ports.

The lines slope continuously upward from Nipissar Lake to Williamson Lake; there are no intermediate drain points.

The supply line passes through the Williamson Lake pumphouse where most of the water is chlorinated in the bottom of the water storage tank adjacent to the pumphouse. A small portion of the water is heated in the Nipissar Lake heat exchanger in the Williamson Lake pumphouse and then pumped back through the return line. Most of the heated water arriving in the Nipissar Lake pumphouse is injected back in to the supply line. Some of the heated water is bled into the Nipissar Lake intake casings to prevent freezing of the intake lines.

The Williamson Lake pumphouse is located on the north berm of the Williamson Lake, in the centre of the community. The pumphouse contains two wet-wells; four distribution pumps, two hot water boilers, three heat exchangers (one for the Nipissar Lake supply line, one for the Hamlet and one spare), chlorination equipment, a diesel standby generator, valves, alarms, and controls.

Water flows by gravity from the water storage tank through a valve into the two wet-wells; the valve is regulated by the water level in the wet-wells. The four 22.4 kW distribution pumps, each rated at 25 L/s, pump water from the wet-wells into the distribution system through a common header. The pump system is sized for maximum daily demand and the fire flow needs. One pump operates continuously, circulating heated water through the distribution loops with a portion returning to the pump house. As demand in the distribution system increases, additional pumps activate according to pressure drop in the system.

The heat for the distribution water is produced by two fuel oil fired boilers. The heated water circulates through the Hamlet heat exchanger, which in turn heats water for injection into the distribution header. Modulating valves, located on each loop where the loop returns to the pumphouse, control water temperatures in the loops by varying their flow rates. If a loop's return temperature falls below a set point, the modulating valve for that loop opens to increase the return flow rate. If the temperature rises above the set point, the valve closes to reduce the loop's return flow rate.

The boilers also provide heat for the building heating system through the Hamlet heat exchanger and for the Nipissar Lake supply line through the Nipissar heat exchanger.

The piped water distribution system consists of shallow-buried and insulated mains, usually installed in the same trenches as the sewer mains to save installation costs. Since the mains both originate and terminate at the Williamson Lake pumphouse, they are known as loops. As part of the freeze protection system, the water is constantly circulating in the loops. Water not consumed is returned to the wet-wells at the pumphouse.

Access vaults are placed throughout the distribution system at about 100 m intervals, or at bends or intersections. Vault type depends on the year of construction. Vaults constructed prior to 1976 are insulated corrugated metal pipe. Vaults constructed from 1977 to 1979 are rectangular concrete structures. Vaults from 1979 onward are prefabricated insulated double-walled steel structures.

In current designs, the water main passing through the vault is constructed of steel and is typically fitted with a butterfly valve, two 50 mm thaw access ports and two 25 mm drain ports. Many vaults are fitted with electrical outlets but the present design is limited to an access conduit to allow electrical cables and hoses into the vault without keeping the hatch open. The vaults also house cleanouts on the sewer mains to allow access to the sanitary sewer system in the event of a frozen or plugged sewer line.

Water service connections to single-family residential buildings consist of un-insulated 25 mm HDPE supply and return lines taped together, wrapped in a self-limiting heat tape and inserted into a 100 mm diameter insulated HDPE carrier pipe. Water flows from the main through the supply line to circulation pump and flow switch, located inside the building. Water required for consumption then flows through a water meter into the building's water fixtures. Water required for consumption flows into the return line and then back into the main.

By maintaining a constant flow, the circulation pump keeps the water in the service lines from freezing. The heat trace cable, controlled by the floor switch on the supply line, keeps the water from freezing when flow is reduced or stops due to circulation pump failure or other causes. This dual-line circulating system has been found to be the most economical and reliable method of providing water service to the buildings.

Installed service connections are valve at the main and can be shut off by means of valve extensions that expend to above ground level. Older service connections cannot be shut off from above the ground. For multi-family residential, commercial or industrial buildings, the water service connections are individually designated but use basically the same system as described above.

3.2.3 Water Storage and Distribution System Operational Procedures

The following operational procedures shall be carried out by the Government of Nunavut on behalf of the Hamlet of Rankin Inlet:

- Monthly water usage volumes obtained from the Hamlet Water Storage and Treatment Facility shall be recorded on the recording form attached in Appendix E

- Monitoring and inspections will occur as outlined in the NWB license and described in this O&M Plan

- Sampling will be conducted as per the Environmental Monitoring Program and Quality Assurance/Quality Control Plan, Hamlet of Rankin Inlet (separate document).

3.3 Periodic and Seasonal Maintenance Procedures

- Facility generators and associated fuel storage shall be monitored daily

- Chlorine residuals shall be monitored daily, or as directed by a Public Health Inspector (as defined by the Public Health Act (1992), not part of the NWB mandate

- The chlorine feed system shall be inspected daily (to prevent spills and environmental impacts).

4.0 Emergency Response and Contingencies

In the event of an emergency, guidance regarding containment and site emergency response can be obtained from the following sources (Table 1):

Table 1: Emergency Contacts

Contact	Location	Telephone Number	Fax Number
INAC – Water/Wastewater Resources Manager	Iqaluit	(867) 975-4550	(867) 979-6445
Hamlet of Rankin Inlet – SAO	Rankin Inlet	(867) 645-2895	(867) 645-2146
Government of Nunavut (Regional Engineer)	Rankin Inlet	(867) 645-8159	(867) 645-8196
Environment Canada – Inspector	Iqaluit	(867) 975-4644	(867) 975-4594
Fire Department	Rankin Inlet	(867) 645-2525	-
RCMP Detachment	Rankin Inlet	(867) 645-1111	(867) 645-2568
Community Health Center	Rankin Inlet	(867) 645-8300	(867) 645-8324

Contingency plans are designed to provide site staff with direction and options when there is an unexpected event or accident.

The Environmental Emergency Contingency Plan, Hamlet of Rankin Inlet (prepared as a separate document) provides procedures and direction in the case of a spill or accident.

As outlined in the Contingency Plan, the health and safety of workers and the public are the first priority.

5.0 Reporting

The Nunavut Water Board License on Part B: General Conditions include the requirement to file an Annual Report with the NWB no later than March 31st of the next calendar year. The report shall include:

- Tabular summaries of all data generated under the "Monitoring Program"
- The monthly and annual quantities in cubic metres of freshwater obtained from all sources
- The monthly and annual quantities in cubic metres of each and all waste discharged
- A summary of modifications and/or major maintenance work carried out on the Water Supply and Waste Disposal Facilities, including all associated structures
- A list of unauthorized discharges and summary of follow-up action taken
- A summary of any abandonment and restoration work completed during the year and an outline of any work anticipated for the next year
- A summary of any studies, reports and plans (i.e. Operation and Maintenance, Abandonment and Restoration, QA/QC) requested by the Board that relate to waste disposal, water use or reclamation, and a brief description of any future studies planned
- Any other details on water use or waste disposal requested by the Board by November 1st of the reporting year.

The format of the NWB Annual Report is included in Appendix F.

The creation of the report can be greatly simplified by staff regularly filling in and filing the Site Forms included in Appendix E. The forms include:

- Form 1 – Annual Water Intake Log – a monthly record of flow measurements
- Form 2 – Monthly Water Supply Facility Inspection Form – a monthly record of conditions and issues at the water supply facility
- Form 3 – Water Supply Facility Planning Form – which provides a list of items to be discussed by the site foreman, Hamlet, and GN Project Manager related to short term and long term water supply and treatment decision making.

In addition to these forms, there would be sampling information and analytical data collected. The Monitoring Plan and QA/QC Plan (prepared as a separate document) outlines sample collection and analytical data handling protocols. Using the forms and following the procedures provided herein should make submitting the annual monitoring report relatively straight forward.

6.0 Summary

6.1 Overview

This Operation and Maintenance Plan (O&M) has been prepared for the Hamlet of Rankin Inlet Water Supply Facility. The facility is operated by the Government of Nunavut on behalf of the Hamlet.

Appropriate training for site staff is necessary as part of the implementation of this O&M Plan. This document should be reviewed and updated annually, and whenever the NWB Water License is amended or new relevant legislation is issued.

Nipissar Lake drainage basin should be recognized in community land use plans and zoning. The drainage basin should be classified as a sensitive area where land uses must be restricted to prevent impacts to the lake water supply.

This O&M Plan pertains to those aspects of operating the water supply facility within the NWB mandate for environmental protection. This O&M Plan does not address issues of water quality for human consumption, which is the mandate of other agencies.

6.2 Outstanding Issues

6.2.1 DFO Issues

Comments from Fisheries and Oceans Canada (DFO), regarding the impacts of water withdrawals from Nipissar Lake, were addressed in a letter dated March 25, 2010 and included in Appendix G.

6.2.2 Water Usage and Nipissar Lake Drawdown

As outlined in the license application there are some discrepancies in the volumes reported related to water usage and distribution. There is also significant evidence to indicate Nipissar Lake is not large enough to be a sustainable water supply as the Hamlet grows. To address these issues in August 2009 the GN issued a Request for Proposal (RFP) for a Water Supply Capacity, Consumption and Conservation Study. The Scope of Work included:

a. Is Nipissar Lake an adequate source of water for the community of Rankin Inlet, currently, and in the future?
b. When will Nipissar Lake fail to be adequate?
c. What is the water usage on a per capita basis, in Rankin Inlet?
d. Why is the water usage, per capita, what is it?
   - How much water is lost through bleeders?
   - How much water is lost through distribution system leaks?

e. How can the GN/Municipality of Rankin Inlet undertake to reduce the amount of water usage?
   - How does currently metering and billing practises affect water use?
   - How can the number of bleeders be reduced?
   - How can system leaks be managed?

The Scope outlined the following methodology:

1. Assess

- The capacity of the water supply servicing the Hamlet of Rankin Inlet
  - Complete a survey of the existing shore line of Nipissar Lake
  - Determine Nipissar Lake volume loss compared to Bathymetry and Topographical Survey that was completed in 1995
  - An assessment of climate variables affecting the Nipissar Lake watershed capacity
  - A review of historical precipitation and evapo-transpiration rates to establish if the current volume reduction of Nipissar Lake is a result of climatic variables or municipal consumption/wastage

- The consumption of water in Rankin Inlet, taking into consideration the specific demographic dynamic of the community and the unique climate in which Rankin Inlet is situated
  - Compile existing pumphouse metering data and general consumption data, and graphically present trends
  - Identify abnormalities in residential and commercial meter readings
  - Review historical and current consumption data to determine if Nipissar Lake is an adequate water source for the community
  - Current and future development being undertaken in Rankin Inlet and its anticipated effect on consumption

- Recommend means by which water can be conserved.

2. Report

The final deliverable for the assessment criteria in 1, above, shall be a report (submitted at 50% and 100% complete) which outlines the findings of the assessments undertaken by the consultant. Proponents shall give a detailed proposal on the scope of their report as it relates to their proposed methodology in item 1, above.

3. Leak Detection Equipment Report and Training

The Department of Community and Government Services has an interest in purchasing leak detection equipment and training Operations and Maintenance (O&M) Staff in its use. Services of a consultant are required to:

- Review the water distribution system in Rankin Inlet and prepare a report outlining the type of equipment available and recommending suitable equipment for purchase
- Develop specifications (for use in tendering) for supply of equipment presented in report (after approval by GN).

This project was awarded to FSC Architects and Engineers and is in progress.

Until this work is complete the need for a new or supplemental water supply and related engineering cannot be determined.

It has been suggested that the licence be issued with the following conditions:

- By December 31, 2010, provide an assessment of the water supply capacity of Nipissar Lake and a detailed assessment of Hamlet water supply requirements for the future. Outline a detailed plan for the required engineering and development of a new or supplemental water supply. Following the necessary agency consultation and approvals, conduct the necessary engineering improvements by December 31, 2011.

7.0 References

Department of Municipal and Community Affairs, Government of Northwest Territories, October 1996. *Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories*. Queen's Printer: Yellowknife, Northwest Territories.

Environment Canada, 2008. *Canadian Climate Normals 1971-2000, Rankin Inlet A Weather Station*, Environment Canada. <http://climate.weatheroffice.ec.gc.ca/climate_normals/results_e.html?StnID=1721&autofwd=1>. Accessed Nov 10, 2008.

Nunavut Water Board, December 2002. *Hamlet of Rankin Inlet Water Licence NWB3GRA0207*. Gjoa Haven, Nunavut.

Nuna Burnside Engineering & Environmental Ltd., (2008, revised April 2010). *Environmental Emergency Contingency Plan, Hamlet of Rankin Inlet.*

Nuna Burnside Engineering & Environmental Ltd., (2008, revised April 2010). *Environmental Monitoring Program and Quality Assurance/Quality Control Plan, Hamlet of Rankin Inlet.*

Stanley Associates Engineering Ltd., *Nipissar Lake Watershed Model*, for Department of Public Works and Services, GNWT, February 1996.

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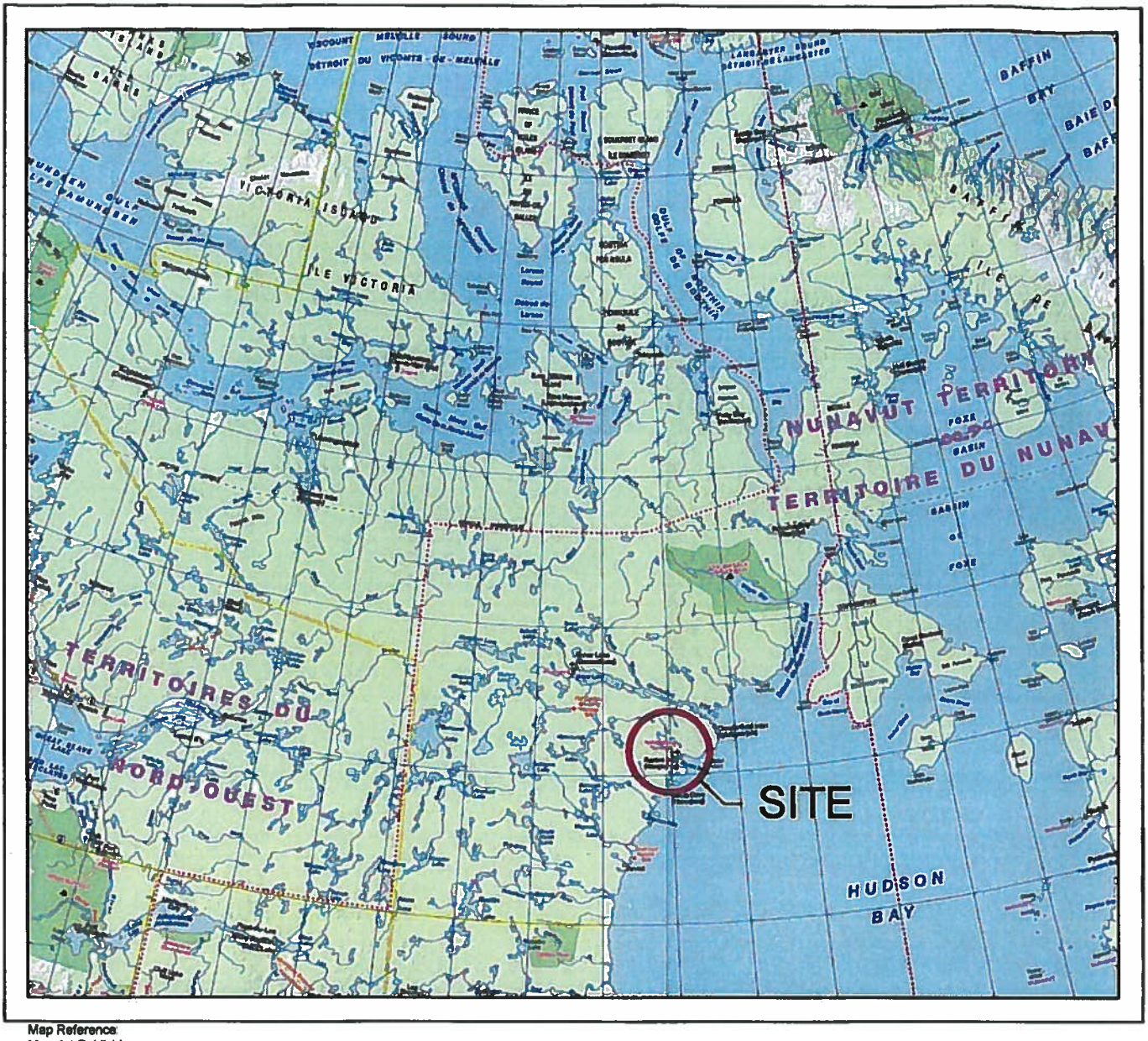
Figures



Map Reference:
Map Art Publishing

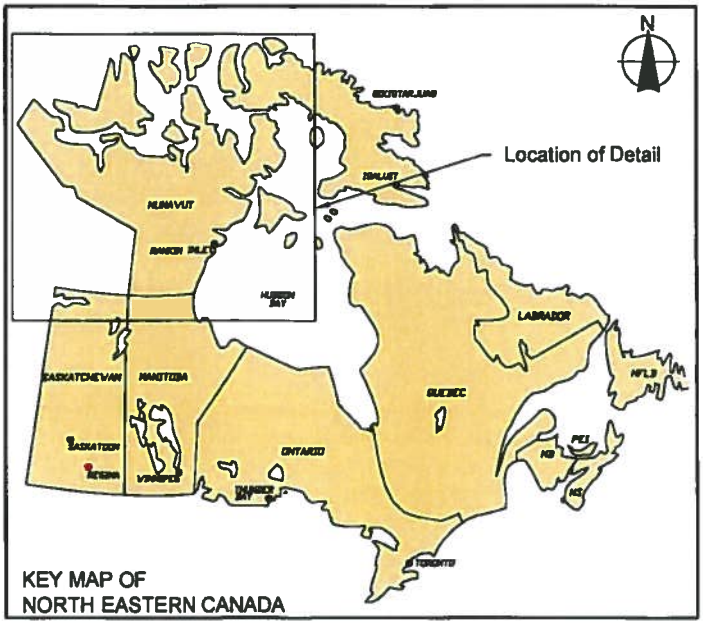


FIGURE 1 - SITE LOCATION MAP

GOVERNMENT OF NUNAVUT
HAMLET OF RANKIN INLET, NUNAVUT

WATER SUPPLY FACILITY OPERATION & MAINTENANCE PLAN

December 2008
Project Number: N-O14850

Prepared by: C. Sheppard

Verified by: J. Walls

BURNSIDE

N-O14850 WATER SUPPLY O&M PLAN - GOVERNMENT SL.dwg

Plot Time Mar 05, 2009 - 11:56am

FIGURE 2

GOVERNMENT OF NUNAVUT
HAMLET OF RANKIN INLET, NUNAVUT
WATER SUPPLY FACILITY O&M PLAN

COMMUNITY PLAN

Satellite Image Source:
Background 2006 satellite image covering the immediate community area obtained from MDA Geospatial Services.
Background colour satellite image covering the area beyond the immediate community obtained from the Google Earth Pro website.

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0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4
Kilometres

1:30,000
August 2008
Project Number: N-O14850

Projection: UTM Zone 15
Datum: NAD83

Prepared by: C. Sheppard

Verified by: J. Walls

BURNSIDE

N-O14850 WATER SUPPLY O&M PLAN - GOVERNMENT CP.dwg

Plot Time: Mar 05, 2009 - 11:36am

FIGURE 3

GOVERNMENT OF NUNAVUT
HAMLET OF RANKIN INLET, NUNAVUT
WATER SUPPLY FACILITY O&M PLAN

WATER SUPPLY FACILITY

LEGEND

- - - - INTERPRETED NIPISSAR LAKE DRAINAGE AREA OUTLINE

Satellite Image Source:
Background 2008 satellite image covering the immediate community area obtained from MDA Geospatial Services.
Background colour satellite image covering the area beyond the immediate community obtained from the Google Earth Pro website

N

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Kilometres

1:12,500
December 2008
Project Number: N-O14850

Projection: UTM Zone 15
Datum: NAD83

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Appendix A

Nunavut Water Licence NWB3GRA0207

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

DECISION

LICENCE NUMBER: NWB3GRA0207

This is the decision of the Nunavut Water Board (NWB) with respect to an application for a Licence originally filed by the Hamlet of Rankin Inlet on 20 November 2002:

Department of Public Works & Services, Government of Nunavut

to allow for the use of water and disposal of waste in the Hamlet at Rankin Inlet, Nunavut.

With respect to this application, the NWB gave notice to the public that the Hamlet had filed an application for a water licence.

DECISION

After having been satisfied that the application, which had originally been filed by the Hamlet of Rankin Inlet on November 20, 2002, was exempt from the requirement for screening by the Nunavut Impact Review Board in accordance with S. 12.3.2 of the *Nunavut Land Claim Agreement* (NLCA), the NWB decided that the application could go through the regulatory process.

Based on the review of the comments and concerns , it was noted that the issue of the operation of Water Treatment and Sewage Treatment Facilities in Rankin Inlet by the Department of Public Works and Services (Government of Nunavut) prevented the issuance of water licence to the Hamlet of Rankin Inlet for the operation of these Facilities. It was determined that the most appropriate action was to issue a water licence to the Hamlet of Rankin Inlet for the operation of the Solid Waste Disposal Facility, while the Department of Public Works and Services would be licensed for the operation of the Water Treatment and Sewage Treatment Facilities, on behalf of the Government of Nunavut.

Applications reflective of this division of activities were received from both the Hamlet of Rankin Inlet and the Department of Public Works and Services. Notice of these applications was posted with local organizations in Rankin Inlet. As the technical information previously reviewed remained unchanged, the Nunavut Water Board accepted written concerns and comments on these applications until December 6, 2002.

After reviewing the submission of the Applicant and written comments expressed 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 *Nunavut Land Claims Agreement* and of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (NWNSRTA), decided to waive the requirement to hold a public hearing and furthermore to delegate its authority to approve the application to the Chief Administrative Officer pursuant to S. 49(a) of the NWNSRTA and determined that:

Licence Number NWB3GRA0207 be issued subject to the terms and conditions contained therein. (Motion #: 2002-22)

SIGNED this 1st day of December, 2002 at Gjoa Haven, NU.

Original signed by:

Philippe di Pizzo
Chief Administrative Officer

TABLE OF CONTENTS

I. INTRODUCTION

Following an application filed by Ferguson Simek Clark on behalf of the Hamlet of Rankin Inlet on 6 June 2002 to the Nunavut Water Board, the Board conducted an initial assessment of the Hamlet's request for a municipal water licence for water use and waste disposal activities within the Hamlet. The assessment was conducted so that the Nunavut Water Board could make a fully informed decision on the application. The application was referred for review and comments to Federal, Territorial and local organizations. Based upon the results of this initial assessment and the technical review, including consideration of any potential accidents, malfunctions, or cumulative environmental effects that the overall project might have in the area, the Board concluded that this application was complete and could go through the regulatory process.

In accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S. 55.1 and Article 13 of the *Nunavut Land Claims Agreement*, public notice of the application was posted. No public concerns were expressed, and the NWB waived the requirement to hold a public hearing for the application. Authority to approve the application was delegated to the Chief Administrative Officer pursuant to S. 13.7.5 of the *Agreement*. After considering and reviewing the comments submitted by interested parties, the NWB has issued licence NWB3GRA0207.

II. GENERAL CONSIDERATIONS

Term of the Licence

In accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* S. 45, the NWB may issue a licence for a term not exceeding twenty-five years. The NWB believes that a term of five years is appropriate. Because this is the first licence issued to the Department by the Nunavut Water Board for operations in Rankin Inlet, a 5-year licence will allow enough time for the Department to establish a consistent compliance record. The 5-year licence will allow the Licensee to properly carry out the terms and conditions of the licence and to ensure that sufficient time is given to permit the Licensee to develop, submit, and implement the plans required under the licence to the satisfaction of the NWB.

Annual Report

The requirements imposed on the Licensee in this licence are for the purpose of ensuring that the NWB has an accurate annual update of municipal activities during a calendar year. This information is maintained on the public registry and is available to any interested parties upon request. Refer to attached standard form for completing Annual Report (see Attachment I).

Regulated Parameters

Effluent quality criteria imposed in this Licence are consistent with the *Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories* (Northwest Territories Water Board; 1992), and follow advice received from both the Department of Indian and Northern Affairs and Environment Canada.

Operation and Maintenance Manual (O&M)

The purpose of an Operation and Maintenance Manual is to assist Department staff in the proper operation and maintenance of their waste disposal facilities. The manual should demonstrate to the Nunavut Water Board that the Department is capable of operating and maintaining all waste disposal sites adequately. The Plan should be completed using 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; see Attachment II).

Abandonment and Restoration (A&R)

To ensure that all future abandoned facilities are reclaimed in an appropriate manner, the NWB has imposed the requirement for the submission of Abandonment and Restoration Plans. These plans should be submitted when the Licensee files preliminary design drawings for the construction of new facilities to replace existing ones.

Monitoring Program

The Monitoring Program is a program established to collect data on water quality to assess the effectiveness of treatment for protection of public health and to assess potential impacts to the environment associated with the municipal facilities. As this is the first Municipal Water Licence issued to the Department by the Board, minimum requirements have been imposed, but additional sampling may be required by an Inspector.

Quality Assurance/Quality Control (QA/QC) Plan

The requirements to develop a QA/QC Plan imposed on the Licensee in this licence are for the purpose of ensuring the NWB that samples taken in the field as part of the Monitoring Program will maintain a high quality, so as to accurately represent the physical and chemical nature of the samples being taken.

LICENCE NWB3GRA0207

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 PUBLIC WORKS & SERVICES, GOVERNMENT OF NUNAVUT
(Licensee)

of **RANKIN INLET, NUNAVUT, X0A 0S0**
(Mailing Address)

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

Licence Number **NWB3GRA0207**

Water Management Area **NUNAVUT 05**

Location **RANKIN INLET, NUNAVUT**

Purpose **WATER USE AND WASTE DISPOSAL**

Description **MUNICIPAL UNDERTAKINGS**

Quantity of Water Not to be Exceeded **400,000 CUBIC METRES ANNUALLY**

Date of Licence **DECEMBER 1, 2002**

Expiry Date of Licence **NOVEMBER 30, 2007**

Dated this 1st of December 2002 at Gjoa Haven, NU.

Original signed by:

Philippe di Pizzo
Chief Administrative Officer

PART A: SCOPE AND DEFINITIONS

1. Scope

a. This Licence allows for the use of water and the disposal of waste by the Department of Public Works and Services, Government of Nunavut for municipal undertakings at the Hamlet of Rankin Inlet, Nunavut (64°49'N, 92°05'W);

b. 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

c. 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

In this Licence: **NWB3GRA0207**

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

"**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;

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

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

"**Average Concentration**" means the arithmetic mean of the last four consecutive analytical results for contained in composite or grab samples collected from the Waste Facility's final discharge point;

"**Average Concentration For Faecal Coliforms**" means the geometric mean of the last four consecutive analytical results for faecal coliforms contained in composite or grab samples collected from the Waste Facility's final discharge point;

"**Board**" means the Nunavut Water Board established under the *Nunavut Land Claims Agreement*;

"**Chief Administrative Officer**" means the Executive Director of the Nunavut Water Board;

"**Commercial Waste Water**" means water and associated waste generated by the operation of a commercial enterprise, but does not include toilet wastes or greywater;

"**Effluent**" means treated or untreated liquid waste material that is discharged into the environment from a structure such as a settling pond or a treatment plant;

"**Freeboard**" means the vertical distance between water line and crest on a dam or dyke's upstream slope;

"**Grab Sample**" means a single water or wastewater sample taken at a time and place representative of the total discharge;

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

"**Licensee**" means the holder of this Licence;

"**Modification**" means an alteration to a physical work that introduces new structure or eliminates an existing structure and does not alter the purpose or function of the work, but does not include an expansion, and changes to the operating system that are consistent with the terms of this Licence and do not require amendment;

"**Monitoring Program**" means a program established to collect data on surface water and groundwater quality to assess impacts to the environment of an appurtenant undertaking.

"**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;

"**Sewage**" means all toilet wastes and greywater;

"**Sewage Treatment Facility**" comprises the area and engineered lagoon and decant structures designed to contain sewage as described in the Application for Water Licence;

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

"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;

"Water Supply Facility" means the area and associated intake infrastructure at Nipissar Lake, as described in the Application for Water Licence.

PART B: GENERAL CONDITIONS

1. The Licensee shall file an Annual Report with the Board not later than March 31st of the year following the calendar year reported which shall contain the following information:

   i. tabular summaries of all data generated under the "Monitoring Program";

   ii. the monthly and annual quantities in cubic metres of each and all waste discharged;

   iii. a summary of modifications and/or major maintenance work carried out on the Solid Waste Disposal Facility, including all associated structures and facilities;

   iv. a list of unauthorized discharges and summary of follow-up action taken

   v. a summary of any abandonment and restoration work completed during the year and an outline of any work anticipated for the next year;

   vi. a summary of any studies, reports and plans (e.g., Operation and Maintenance, Abandonment and Restoration, QA/QC) requested by the Board that relate to waste disposal, water use or reclamation, and a brief description of any future studies planned; and

   vii. any other details on water use or waste disposal requested by the Board by November 1st of the year being reported.

2. The Licensee shall comply with the "Monitoring Program" described in this Licence, and any amendments to the "Monitoring Program" as may be made from time to time, pursuant to the conditions of this Licence.

3. The "Monitoring Program" and compliance dates specified in the Licence may be modified at the discretion of the Board.

4. Meters, devices or other such methods used for measuring the volumes of waste discharged shall be installed, operated and maintained by the Licensee to the satisfaction of an Inspector.

5. The Licensee shall, within ninety (90) days after the first visit of the Inspector, post the necessary signs, where possible, to identify the stations of the "Monitoring Program." All signage postings shall be in the Official Languages of Nunavut, and shall be located and maintained to the satisfaction of an Inspector.

6. The Licensee shall immediately report to the 24-Hour Spill Report Line (867-920-8130) any spills of Waste, which are reported to or observed by the Licensee, within the municipal boundaries or in the areas of the Solid Waste Disposal Facility.

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

(i) Chief Administrative Officer:

Executive Director
Nunavut Water Board
P. O. Box 119
Gjoa Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369

(ii) Inspector Contact:

Water Resources Officer
Nunavut District, Nunavut Region
P.O. Box 100
Iqaluit, NU X0A 0H0
Telephone: (867) 975-4298
Fax: (867) 979-6445

(iii) Analyst Contact

Taiga Laboratories
Department of Indian and Northern Affairs
4601 - 52 Avenue, P.O. Box 1500
Yellowknife, NT X1A 2R3
Telephone: (867) 669-2781
Fax: (867) 669-2718

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.**

PART C: CONDITIONS APPLYING TO WATER USE

1. The Licensee shall obtain all fresh water from Nipissar Lake using the Water Supply Facilities or as otherwise approved by the Board.

2. The annual quantity of water used for all purposes shall not exceed 400,000 cubic metres.

3. The Licensee shall maintain the Water Supply Facilities to the satisfaction of the Inspector.

4. The water intake hose used on the water pumps shall be equipped with a screen with a mesh size sufficient to ensure no entrainment of fish.

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

1. The Licensee shall direct all Sewage to the Sewage Treatment Facility or as otherwise approved by the Board.

2. All Effluent discharged from the Sewage Treatment Facility at "Monitoring Program" Station Number GRA-3 shall meet the following effluent quality standards:

Parameter	Maximum Average Concentration
Faecal Coliforms	1 x 10^6CFU/dl
BOD_5	120 mg/L
Total Suspended Solids	180 mg/L
Oil and grease	No visible sheen
pH	between 6 and 9

3. A Freeboard limit of 1.0 metre, or as recommended by a qualified geotechnical engineer and as approved by the Board, shall be maintained at all dykes and earthfill structures associated with a Sewage Treatment Facility.

4. The Sewage Treatment Facility shall be maintained and operated in such a manner as to prevent structural failure.

5. The Licensee shall maintain the Sewage Treatment Facility to the satisfaction of an Inspector.

PART E: CONDITIONS APPLYING TO MODIFICATION AND CONSTRUCTION

1. The Licensee shall submit to the Board for approval design drawings stamped by a qualified engineer registered in the Nunavut prior to the construction of any dams, dykes or structures intended to contain, withhold, divert or retain water or wastes.

2. The Licensee may, without written approval from the Board, carry out modifications to the Water Supply and Sewage Treatment Facility 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;

    ii. said modifications do not place the Licensee in contravention of the Licence or the *Act*;

    iii. 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

    iv. the Board has not rejected the proposed modifications.

3. Modifications for which all of the conditions referred to in Part E, Item 1, have not been met may be carried out only with written approval from the Board.

4. The Licensee shall provide as built plans/drawings of the modifications referred to in this Licence within ninety (90) days of completion of the modifications.

PART F: CONDITIONS APPLYING TO OPERATION AND MAINTENANCE

1. The Licensee shall, before December 1, 2003 submit to the Board for approval, a Plan for the Operation and Maintenance of the Water Treatment Facility and the Sewage Treatment Facility in accordance with *"Guidelines for Preparing an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities"* (October 1996).

2. The Licensee shall implement the Plan specified in Part F, Item 1 as and when approved by the Board.

3. The Licensee shall revise the Plan referred to in Part F, Item 1, if not acceptable to the Board. The revised Plan shall be submitted to the Board for approval within thirty (30) days of notification of the Board decision.

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

    i. employ the appropriate contingency plan as provided for in the Operation and Maintenance Plan;

    ii. report the incident immediately *via* the 24-Hour Spill Reporting Line at (867) 920-8130 and to an Inspector; and

    iii. submit to an Inspector a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.

PART G: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION

1. The Licensee shall submit to the Board for approval an Abandonment and Restoration Plan at least six (6) months prior to abandoning any facilities and the construction of new facilities to replace existing ones. The Plan shall include, but not be limited to where applicable:

    i. water intake facilities;

    ii. the water treatment and sewage treatment sites and facilities;

    iii. petroleum and chemical storage areas;

    iv. any site affected by waste spills;

v. leachate prevention;

vi. an implementation schedule;

vii. maps delineating all disturbed areas, and site facilities;

viii. consideration of altered drainage patterns;

ix. type and source of cover materials;

x. future area use;

xi. hazardous wastes; and

xii. a proposal identifying measures by which restoration costs will be financed by the Licensee upon abandonment.

2. The Licensee shall implement the plan specified in Part G, Item 1 as and when approved by the Board.

3. The Licensee shall revise the Plan referred to in Part G, Item 1 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.

PART H: CONDITIONS APPLYING TO THE MONITORING PROGRAM

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

Station Number	Description
GRA-1	Raw Water supply prior to treatment
GRA-3	Effluent discharge from the Sewage Treatment Facility

2. The Licensee shall sample monthly at Monitoring Station GRA-3 during the months of May to August, inclusive.

3. The Licensee shall analyze samples collected at Station Number GRA-3 for the following parameters:

BOD	Faecal Coliforms
pH	Conductivity
Total Suspended Solids	Ammonia Nitrogen
Nitrate-Nitrite	Oil and Grease (visual)
Total Phenols	Sulphate
Sodium	Potassium
Magnesium	Calcium
Total Arsenic	Total Cadmium
Total Copper	Total Chromium
Total Iron	Total Lead
Total Mercury	Total Nickel
Total Zinc	

4. Additional sampling and analysis may be requested by an Inspector;

5. The Licensee shall conform to the Quality Assurance/Quality Control (QA/QC) Plan which shall be provided to the Licensee by the NWB within 60 days of the issuance of this licence;

6. 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;

7. All analyses shall be performed in a Canadian Association of Environmental Analytical Laboratories (CAEAL) Certified Laboratory, or as otherwise approved by an Analyst;

8. The Licensee shall measure and record in cubic metres the monthly and annual quantities of water pumped from Monitoring Program Station Number GRA-1 for all purposes;

9. The Licensee shall measure and record the annual quantities of sewage solids removed from the sewage disposal facility ~~shall be measured and recorded~~;

10. The Licensee shall, unless otherwise requested by an Inspector, include all of the data and information required by the "Monitoring Program" in the Licensee's Annual Report, as required *per* Part B, Item 1; and

11. Modifications to the Monitoring Program may be made only upon written approval of the Chief Administrative Officer.

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Appendix B
Climate Data

Rankin Inlet Climate Data

Table 1: Rankin Inlet Climate Normals Data Summary

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Total Precipitation (mm)	6.6	8.9	12.6	14.3	18.4	29.8	39.5	57.6	43.8	34.6	19.8	11.3	297.2
Rain (mm)	0.0	0.1	0.0	1.0	7.4	25.0	39.5	57.3	39.2	11.9	0.1	0.0	181.5
Snow (cm)	6.7	9.3	12.9	13.6	11.5	4.9	0.0	0.3	4.6	23.1	20.9	11.9	107.8
Wind Speeds (km/hour)	23.9	23.9	23.4	22.4	22.1	19.8	19.2	21.1	24.2	26.5	25.3	24.0	
Average Temperatures (°C)	-31.9	-30.1	-25.2	-16.3	-5.9	4.2	10.4	9.5	3.4	-5.3	-17.8	-26.7	

*Canadian Climate Normals 1971-2000, Environment Canada, Rankin Inlet Airport Weather Station

Water Use Projections for the Hamlet of Rankin Inlet, Nunavut

Water Use Projections Table
Key Assumptions

Starting Year:	2006	Starting Population:	2358
Population Growth Rate:	1.4%	Residential Water Usage Rate [L/cd]::	220.0

Planning Year	Calendar Year	Projected Population[1]	Projected Water Consumption[2]	Projected Total Consumption Volume				Based on Recorded Usage Rate in 2008	
			[Lpcd]	[Litres/day]	[Litres/year]	[m3/day]	[m3/year]	[m3/day]	[m3/year]
	2006	2358	331.8	782435	285,588,672	782	285,589		
	2007	2392	332.8	796150	290,594,757	796	290,595		
0	2008	2426	333.8	809900	295,613,377	810	295,613	2108	769420
	2009	2460	334.8	823683	300,644,356	824	300,644		
	2010	2495	335.8	837907	305,836,035	838	305,836		
	2011	2530	336.8	852166	311,040,449	852	311,040		
5	2012	2566	337.8	866868	316,406,662	867	316,407		
	2013	2602	338.8	881605	321,785,974	882	321,786		
	2014	2639	339.8	896790	327,328,173	897	327,328		
	2015	2676	340.8	912010	332,883,827	912	332,884		
	2016	2714	341.8	927681	338,603,444	928	338,603		
	2017	2752	342.8	943389	344,336,861	943	344,337		
10	2018	2791	343.8	959549	350,235,308	960	350,235		
	2019	2831	344.8	976164	356,299,679	976	356,300		
	2020	2871	345.8	992818	362,378,709	993	362,379		
	2021	2912	346.8	1009931	368,624,715	1010	368,625		
	2022	2953	347.8	1027084	374,885,693	1027	374,886		
	2023	2995	348.8	1044698	381,314,687	1045	381,315		
	2024	3037	349.8	1062353	387,758,957	1062	387,759		
	2025	3080	350.8	1080472	394,372,269	1080	394,372		
	2026	3124	351.8	1099056	401,155,495	1099	401,155		
	2027	3168	352.8	1117684	407,954,795	1118	407,955		
20	2028	3213	353.8	1136781	414,925,019	1137	414,925	2466	900000
	2029	3258	354.8	1155922	421,911,589	1156	421,912		
	2030	3304	355.8	1175534	429,070,078	1176	429,070		
	2031	3351	356.8	1195620	436,401,342	1196	436,401		
	2032	3398	357.8	1215753	443,749,704	1216	443,750		
	2033	3446	358.8	1236361	451,271,817	1236	451,272		
	2034	3495	359.8	1257448	458,968,526	1257	458,969		
	2035	3544	360.8	1278584	466,683,053	1279	466,683		
	2036	3594	361.8	1300200	474,573,133	1300	474,573		
	2037	3645	362.8	1322300	482,639,599	1322	482,640		
30	2038	3697	363.8	1344886	490,883,286	1345	490,883		

Note:

1) Population in 2006 taken from Statistics Canada 2006 Census of Population. A population growth of 1.5% was applied to the subsequent years.

2) The projected water consumption is based on the Nunavut water usage formula [RWU L/c/d x (-1 + (0.323 x Ln (population)].

3) The Residential Water Usesage Rate is estimated to be 220 L/c/d for populations greater than 2000 and assumes that the water is distributed by a piping system.

Hydrology Calculations, Hamlet of Rankin Inlet

Annual Rainfall (m/year)	0.2972	*Canadian Climate Normals 1971-2000, Environment Canada, Rankin Inlet Airport Weather Station
Evapotranspiration (m/year)	0.200	* Specific values for Rankin Inlet were not available, estimated using several references, see below.

Nippissar Lake Drainage Basin

Lake Drainage Area (m^2)	3,230,000
Rain and Runoff (m^3/year)	959,956
Evapotranspiration (m^3/year)	646,000
Net Recharge of Lake (m^3/year)	313,956

Nippissar Lake Volume

Lake Area (m^2)	1,090,565
Estimated Average Depth (m)	4
Estimated Lake Volume (m^3)	4,362,260

Evapotranspiration Rates

Location	Value (mm)	Reference
Arviat, Nunavut	203	FSC Architects & Engineers, 2003
Mackenzie Basin, Yukon	241	Serrereze et al, 2003
Lena Basin, Russai	182	Serrereze et al, 2003
Knob Lake, Quebec	280	Church, 1974
Boot Creek, Inuvik, NWT	75	Church, 1974
Mackenzie River Basin, Yukon	216	Yi Yip, 2008
Average	**200**	

References:

FSC Architects & Engineers, 2003. Design Concept for Arviat Sewage Lagoon prepared for Department of Community Government and Transportation, Government of Nunavut.

Church, M. 1974. Hydrology and Permafrost with Reference to Northern North America. In Proceedings: Workshop Seminar on Permafrost Hydrology, 7-20. Ottawa: Canadian National Committee, International Hydrological Decade (IHD).

Yi Yip, Q.M. 2008. Climate Impacts on Hydrometric Variables in Mackenzie River Basin. University of Waterloo, Waterloo, 2008.

Serreze, M.C., D.H. Bromwich, M.P. Clark, A.J. Etringer, T. Zhang and R. Lammers, 2003. Large-scale hydro-climatology of the terrestrial Arctic drainage system. Journal Geophysical Research, 108(D2). Doi:10. 1029/2002JD000919

Appendix C
Projected Water Requirements

Form 1
Annual Water Intake Log
Hamlet of Rankin Inlet

Year: _____

Date	Date of Record	Total Town Supply (Current Month) (m^3)	Total Town Supply (Since Start) (m^3)	Recorded By	Comments
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
Annual Totals					

Form 2
Monthly Water Supply Facility Inspection Form
Hamlet of Rankin Inlet

Inspected By:_____ Date:_____

Wind Direction:_____ Temperature:_____

Precipitation:_____ Ground Cover:_____

Issues and Conditions	Description/Condition/Problems	Action/Maintenance Required
Health and Safety (dangers and concerns)		
Signs		
Access Road and Truck Pad (condition, drainage, snow, surface, etc.)		
Pumps		
Water Intake Screen		
Berm		
Fuel Storage Tanks		

Issues and Conditions	Description/Condition/Problems	Action/Maintenance Required
Wildlife		
Ice		
Litter		
Other Issues and Concerns		

Form 3
Water Supply Facility Planning
Hamlet of Rankin Inlet

Prepared By: _____

Date: _____

Water Supply Facility Planning Issue	Current Operations	To Do Items and Schedule
Health and Safety		
Site Inspection Results/Concerns		
Current Volumes		
Water Treatment Process		
Annual Reporting		
Nunavut Water Board License Requirements		

Water Supply Facility Planning Issue	Current Operations	To Do Items and Schedule
Flow Monitoring		
Staffing		
Equipment		
Costs		
Other Issues/Concerns		

BURNSIDE

Appendix D

Site Photographs

Photo 1: Nipissar Lake Pump house

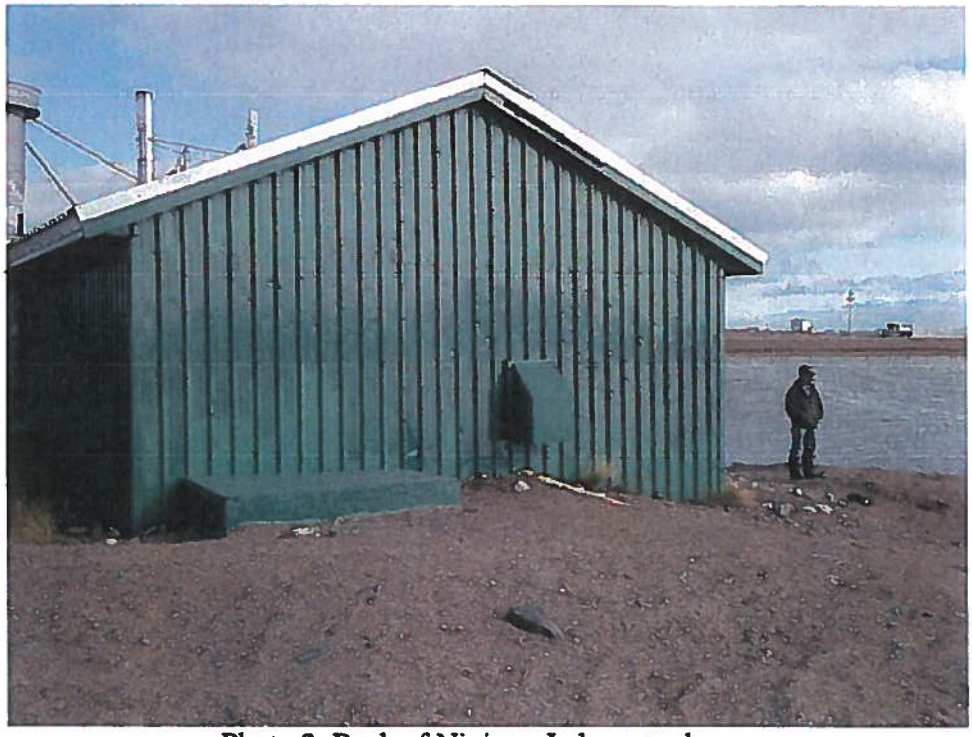

Photo 2: Back of Nipissar Lake pumphouse

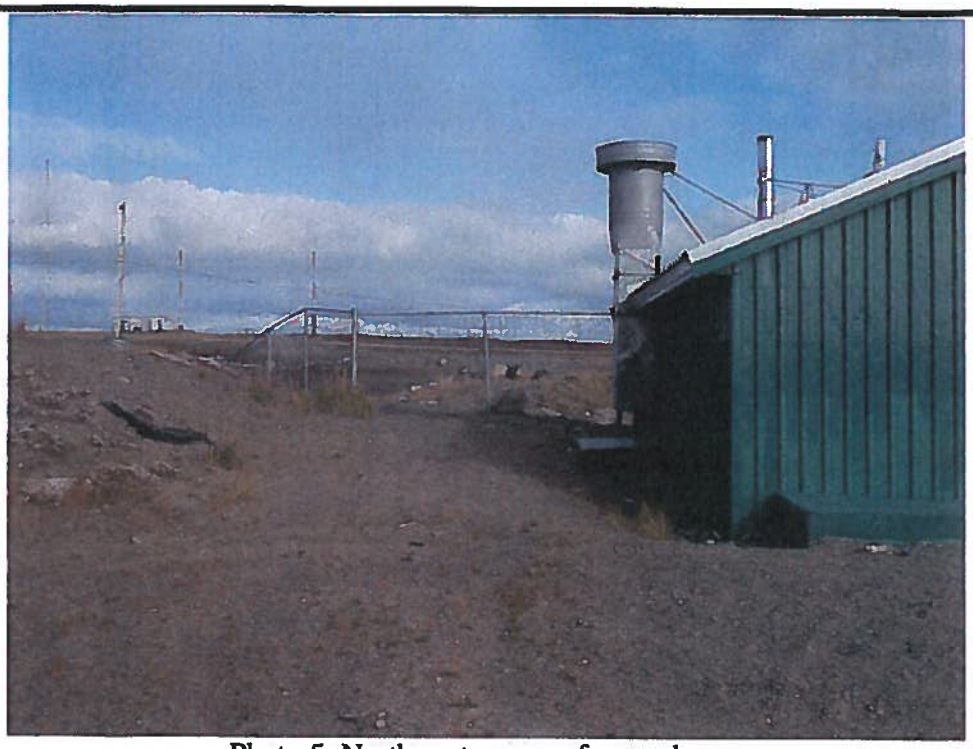

Photo 5: Northwest corner of pump house

Photo 6: Access driveway to pump house

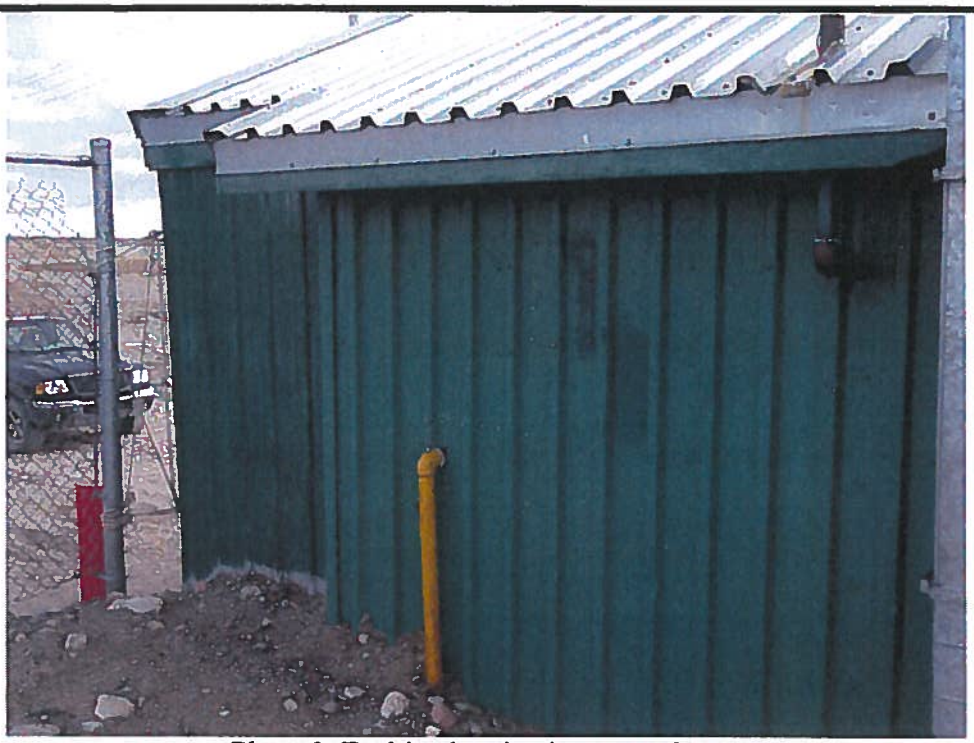

Photo 9: Fuel intake pipe into pumphouse

Photo 10: Fuel storage tank inside of pump house

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Appendix E

Site Forms

NWB Annual Report **Year being reported:** Select

License No: **Issued Date:**
Expiry Date:

Project Name:

Licensee:

Mailing Address:

Name of Company filing Annual Report (**If different from Name of Licensee please clarify relationship between the two entities, if applicable**):

General Background Information on the Project (**optional**):

Licence Requirements: the licensee must provide the following information in accodance with

Select Select

A summary report of water use and waste disposal activities, including, but not limited to: methods of obtaining water; sewage and greywater management; drill waste management; solid and hazardous waste management.

Water Source(s):

Water Quantity:

	Quantity Allowable Domestic (cu.m)
	Actual Quantity Used Domestic (cu.m)
	Quantity Allowable Drilling (cu.m)
	Total Quantity Used Drilling (cu.m)

Waste Management and/or Disposal

- ☐ Solid Waste Disposal
- ☐ Sewage
- ☐ Drill Waste
- ☐ Greywater
- ☐ Hazardous
- ☐ Other:

Additional Details:

A list of unauthorized discharges and a summary of follow-up actions taken.

Spill No.: (as reported to the Spill Hot-line)
Date of Spill:
Date of Notification to an Inspector:
Additional Details: (impacts to water, mitigation measures, short/long term monitoring, etc)

Revisions to the Spill Contingency Plan

Select

Additional Details:

Revisions to the Abandonment and Restoration Plan

Select

Additional Details:

Progressive Reclamation Work Undertaken

Additional Details (i.e., work completed and future works proposed)

Results of the Monitoring Program including:

The GPS Co-ordinates (in degrees, minutes and seconds of latitude and longitude) of each location where sources of water are utilized;

Select

Additional Details:

The GPS Co-ordinates (in degrees, minutes and seconds of latitude and longitude) of each location where wastes associated with the licence are deposited;

Select

Additional Details:

Results of any additional sampling and/or analysis that was requested by an Inspector

Select

Additional Details: (date of request, analysis of results, data attached, etc)

Any other details on water use or waste disposal requested by the Board by November 1 of the year being reported.

Select

Additional Details: (Attached or provided below)

Any responses or follow-up actions on Inspection/compliance reports

Select

Additional Details: (Dates of Report, Follow-up by the Licensee)

Any additional comments or information for the Board to consider

Date Submitted:		
Submitted/Prepared by:		
Contact Information:	**Tel:**	
	Fax:	
	email:	

BURNSIDE

Appendix F
Annual Monitoring Report Format

NWB Annual Report **Year being reported:** Select

License No: **Issued Date:**
Expiry Date:

Project Name:

Licensee:

Mailing Address:

Name of Company filing Annual Report (**If different from Name of Licensee please clarify relationship between the two entities, if applicable**)**:**

General Background Information on the Project (**optional**)**:**

Licence Requirements: the licensee must provide the following information in accodance with

Select Select

A summary report of water use and waste disposal activities, including, but not limited to: methods of obtaining water; sewage and greywater management; drill waste management; solid and hazardous waste management.

Water Source(s):
Water Quantity:
- Quantity Allowable Domestic (cu.m)
- Actual Quantity Used Domestic (cu.m)
- Quantity Allowable Drilling (cu.m)
- Total Quantity Used Drilling (cu.m)

Waste Management and/or Disposal
- ☐ Solid Waste Disposal
- ☐ Sewage
- ☐ Drill Waste
- ☐ Greywater
- ☐ Hazardous
- ☐ Other:

Additional Details:

A list of unauthorized discharges and a summary of follow-up actions taken.

Spill No.: (as reported to the Spill Hot-line)
Date of Spill:
Date of Notification to an Inspector:
Additional Details: (impacts to water, mitigation measures, short/long term monitoring, etc)

Revisions to the Spill Contingency Plan

Select

Additional Details:

Revisions to the Abandonment and Restoration Plan

Select

Additional Details:

Progressive Reclamation Work Undertaken

Additional Details (i.e., work completed and future works proposed)

Results of the Monitoring Program including:

The GPS Co-ordinates (in degrees, minutes and seconds of latitude and longitude) of each location where sources of water are utilized;

Select

Additional Details:

The GPS Co-ordinates (in degrees, minutes and seconds of latitude and longitude) of each location where wastes associated with the licence are deposited;

Select

Additional Details:

Results of any additional sampling and/or analysis that was requested by an Inspector

Select

Additional Details: (date of request, analysis of results, data attached, etc)

Any other details on water use or waste disposal requested by the Board by November 1 of the year being reported.

Select

Additional Details: (Attached or provided below)

Any responses or follow-up actions on inspection/compliance reports

Select

Additional Details: (Dates of Report, Follow-up by the Licensee)

Any additional comments or information for the Board to consider

Date Submitted:
Submitted/Prepared by:
Contact Information:
Tel:
Fax:
email:

Appendix G
March 25, 2010 Letter to
DFO Regarding Freshwater Intake from
Nippisar Lake

Nuna Burnside Engineering and Environmental Ltd. 15 Townline Orangeville ON L9W 3R4 Canada
telephone 519-941-0342 **fax** (519) 941-8120 **web** info@nunaburnside.com

NUNA BURNSIDE
An Aboriginal Owned Company

March 25, 2010

Ms. Loriena Melnick
Habitat Management Biologist
Fisheries and Oceans Canada – Eastern Arctic Area
PO Box 358
Iqaluit, Nunavut X0A 0H0

Dear Ms. Melnick:

Re: Fresh Water Intake From Nipissar Lake
Type 'A' Water License Application – 3 AM GRA
Rankin Inlet, Nunavut
DFO Habitat File No. N4-09-0037
File No. N-O 14850

1.0 Introduction

As per the letter from Fisheries and Oceans Canada (DFO) to the Nunavut Water Boards (NWB), dated December 16, 2009, and the discussions held during the Technical Meeting teleconference on March 3, 2010, we have obtained additional information to address concerns regarding potential impacts to fish habitat. As outlined herein, we were able to make an assessment of the potential for the intake to impact fish. At this time, we are not able to assess the potential impacts of lake drawdown, due to water taking exceeding the capacity of the Nipissar Lake watershed. As discussed, the GN has undertaken lake studies in 2009 and will continue through 2010, to determine the current and future impacts to lake levels resulting from Hamlet with drawls and the potential impacts on the aquatic environment.

2.0 Water Supply

The community draws its water from the Nipissar Lake, located 2 km northwest of the Hamlet. Nipissar Lake covers an area of 1,090,565 m^3. Using an average depth of 4 metres the estimated volume of the lake is 4,362260 m^3. The total drainage area of Nipissar Lake is 323 hectares. Using an annual precipitation rate of 297.2 mm and an annual evapotranspiration rate of 200 mm, the calculated total recharge to the lake is approximately 314 000 m^3 per year (Nuna Burnside 2009). This is lower than the numbers given in the Nipissar Lake Watershed Model, which calculates the useable storage of the lake to be about 1,400,000 m^3 and the estimated annual recharge as 600,000 m^3 per year (Stanley Assoc., 1996).

The Nipissar Lake pump house has vertical turbine submersible pumps installed inside twin intake lines. Each of the 10 up pumps has a 1020 L/min (17L/sec) capacity. Only one pump operates at a time. Operation of the pump is controlled by the water level in the water storage tank adjacent to the Williamson Lake pump house. An air compressor aerates water around the intake to prevent taste and odour problems.

According to the water use estimates, the Hamlet is using more water per year than the estimated annual recharge of the lake. The Government of Nunavut is conducting studies to identify an alternative water supply that they can pump into the reservoir during the summer months to maintain the water levels in the lake in the future.

3.0 General and Site Information

The name of the water source at the intake location is Nipissar Lake.

The location of Nipissar Lake is 2km northwest of the Hamlet and the pump station located on the east side of the lake 15V 545131.99 m E, 6966238.89 m N.

The type of waterbody is an in-land lake that has no direct connection to any watercourse or estuary associated with Hudson Bay.

The water intake has been elevated above the lake bed by approximately 2.0m. The intake has an air compressor aerates water around the intake to prevent taste and odour problems, this can also prevent fish from entering the intake due to air bubbles surrounding it similar to a bubble curtain used in construction projects to isolate the work area from fish bearing waters. The air bubbles could create a barrier around the intake therefore not allowing fish to enter the intake.

Initial construction of the intake was 30 years ago with modifications to the intake in 2009 based on a previous as built drawing. The intake construction consists of a barrel or cylindrical screen (Stainless Steel) that is aligned vertically and elevated approximately 2.0m from the lake bed.

4.0 Biophysical Information

Potential for fish presence in this waterbody would normally be limited due to the type of waterbody not having direct connection to watercourses or the estuary. Local knowledge states that fish have been released to the lake in the past although fishing is not permitted due to protection of the water supply and its water quality. Native species known to exist in the lake are Arctic grayling *(Thymallus arcticus)* and lake trout *(Salvelinus namaycush)* based on local knowledge (pers. comm. Joe Strickland). Based on the species noted above the potential for reproduction and possibility of smaller sizes and year class of fish may exist if the stock is naturally producing. The potential for forage species such as cyprinids may be possible unless the fish feed primarily on aquatic insects. The fish species known to exist would be classified as subcarangiform.

Physical description of the intake location is on the lake bed elevated 2.0m above the substrate in approximately 5.3m of water. The max depth of the lake is approximately 6.7m. Substrate at depth is reportedly sand and gravel, however there is no confirming documentation. The position of the intake is vertical based on the lake bed.

5.0 Water Use Information

The purpose of water withdrawal is for the consumption and supply for the Hamlet of Rankin Inlet. The inlet consists of 2 intakes with one being a continuous draw depending on consumption uses and reservoir levels. If the reservoir is full then one intake will run continuously but re-circulate the water within the intake system to reduce the potential for freezing during winter conditions. The average intake rate is 17L/sec or 1020L/min for one intake.

Effects on Nipissar Lake from the water taking would primarily be lowering of lake levels during dry periods in the summer. How this is related to the aquatic environment will need to be assessed based on the species known to exist (Arctic grayling and lake trout) and their usage of seasonal depth ranges depending on spawning and forage activities.

Structures associated with the intake include the insulated line, aeration line, pump house and transmission line, reservoir, and distribution system.

The water license application will be for an existing intake and possibly upgrades to the intake screen if required based on DFOs review. Future alternations to the intake are dependent on the findings of the current studies.

6.0 Fish Screen Information

The intake screen open and effective areas will need to be determined based on a rectangular screen opening of 3/16" (4.763mm) and 1" (25.4mm). The intake has been described as cylindrical screen (24"H x 18"Ø) with a sealed top and bottom made of stainless steel. It is unknown at this time what type of screen exists on the intake (i.e. wedge wire, woven wire), and this information must be acquired and verified to determine the "% open area" based on the DFO Fish Screen Guidelines and associated calculations.

Based on a review of the DFO guidelines, protection of fish with a minimum fork length of 25mm must be attained although the largest opening in the existing screen being 1" (25.4mm) therefore allowing for small fish to enter the intake depending on the intake velocity. As mentioned above, the aeration line aerates the water around the intake prior to being drawn into the system to reduce taste and odour issues related to stagnant water. No other cleaning, maintenance, or special requirements are known at this time.

7.0 Calculation Based on Assumptions

If we use a conservative estimate of 50% open area then we can determine what size the intake screen must be to satisfy the guideline requirements based on subcarangiform fish. The result based on a 12"Ø cylinder screen and a flow rate of 17L/sec and the assumed 50% open area the length of the intake screen would need to be 13.2" or longer to ensure that smaller fish can over come the velocity of the intake.

The dimensions of the intake are 24" long and therefore would equate to an open area of approximately 26% based on the DFO guideline calculations. Due to the required efficiency of intake screens it may be safe to assume that the % open area would be

greater than 26% and that the existing screen complies with the DFO Freshwater Intake End-of-Pipe Intake Guidelines (DFO, 1995) based on length of the screen.

8.0 Summary

Based on the information currently available and conservative estimates, the current intake complies with DFO requirements, however the impact to aquatic habitat due to fluctuations to lake level due to seasonal drawdowns remains unknown.

We suggest the new license include the Condition to assess the impact of lake level fluctuations, due to Hamlet water taking, on fish habitat in Nipissar Lake by December 31, 2010. The findings should also include recommendations for action with a time line, should it be required.

If you have any questions or comments, or require further information, please contact our Aquatic Resource Specialist, Chris Pfohl, A.Sc.T., or the undersigned.

Yours truly,

Nuna Burnside Engineering and Environmental Ltd.

Jim Walls, P.Geol.

JW:mm 100325meln.doc 26/03/2010 9:56 AM

Appendix B Spill Contingency Plan

Spill Contingency Plan for Water Supply and Sewage Treatment Facilities Rankin Inlet, Nunavut

Final

Prepared for:
Department of Community and Government Services,
Government of Nunavut

Prepared by:
Stantec Consulting Ltd.
5021 – 49 Street
Yellowknife, NT X1A 2N4

May 2014

Revision Record							
Revision	**Description**	**Prepared By**		**Checked By**		**Approved By**	
	Original	05/01/14	KD	05/05/14	PC	05/09/14	PC

Table of Contents

LIST OF TABLES

LIST OF APPENDICES

1.0 Introduction

This Spill Contingency Plan (SCP) has been developed for use by the Government of Nunavut Department of Community and Government Services (GN-CGS) for the operation of the Water Supply and the Sewage Treatment Facilities (the facilities) located in Rankin Inlet, Nunavut.

The contact information for the GN-CGS is provided below:

Government of Nunavut
Department of Community and Government Services
Box 490
Rankin Inlet, NU X0E 0G0
(867) 645-2895

This SCP has been developed for the operation of the facilities and the regulatory approvals in accordance with the *Guidelines for Spill Contingency Planning* prepared by Indian and Northern Affairs Canada (INAC 2007) and the Spill Contingency Planning and Reporting Regulations issued under the Nunavut *Environmental Protection Act*.

Upon finalizing this SCP, the document will be in effect. The SCP will be updated and revised annually to reflect site-specific conditions, as needed.

1.1 PURPOSE AND SCOPE

The GN-CGS directs that all personnel working at its facilities are prepared to provide prompt response to any spills. The SCP allows for the prompt and coordinated response of the GN-CGS to any spill located at the Water Supply Facility and the Sewage Treatment Facilities.

The purpose of the SCP is to provide a guide to all site personnel during routine Facility operation and/or the accidental release of sewage, solid waste, hydrocarbons or other hazardous materials related to the operation of the Facilities. Specifically, the SCP ensures:

1. Life and property are protected;
2. Resources are used effectively;
3. Environmental impacts are minimized; and,
4. Essential reporting is completed.

The SCP identifies key response personnel and their roles and responsibilities in the event of a spill, as well as the equipment and other resources available to respond to a spill. To be effective, it is important that all personnel are familiar with their responsibilities and steps to take

in the event of a spill. Personnel should not read the SCP for the first time during an emergency. The SCP details spill response procedures that will minimize potential health and safety hazards, environmental impacts and spill response activities.

2.0 Site Description

The community of Rankin Inlet (or Kangiqliniq, meaning "deep bay/inlet", in Inuktitut) has a total land area of 20.24 km^2, with a population of 2,266 people (StatsCan 2012). Rankin Inlet is situated on Kudlulik Peninsula which protrudes into the Rankin Inlet of Hudson Bay, located approximately at 62º52'00" N, 92º00'00" W. The community is approximately 450 km north of Churchill, Manitoba and approximately 1,100 km east of Yellowknife, Northwest Territories.

The community is mostly residential with several commercial establishments including construction contracting businesses, a grocery store, and a variety of other smaller businesses. Community buildings include a high school, elementary school, arena, swimming pool, the Hamlet of Rankin Inlet office, Government of Nunavut offices and a police station. Future developments in the community include the Nunavut Arctic College Trades Training Centre, Rankin Inlet Healing Centre, Area 5 subdivision expansion project (including the construction of public and GN staff housing complexes. In recent years, the community has supported the progress of the Agnico-Eagle Meliadine Gold Project, located 24 km northwest of the community, which is currently in the advanced exploration and environmental assessment stage.

2.1 WATER SUPPLY, TREATMENT, DISTRIBUTION AND STORAGE

Water supply for the community is taken from Nipissar Lake, located approximately 2 km northwest of the community. During the summer months (June to September), Nipissar Lake is replenished with additional water pumped via a 4.05 km pipeline from the Char River (Figure 1 in Appendix A).

Water is withdrawn from Nipissar Lake and pumped to the Williamson Lake Pump house, where it is chlorinated, stored and distributed using a series of buried utilidors and water mains. For buildings that are not connected to the utilidor system, water is delivered using water trucks.

2.2 SEWAGE COLLECTION AND TREATMENT

Underground sanitary sewers are used throughout the community to direct sewage, wastewater, and storm water to the Sewage Treatment Facility (STF). Upon arrival at the STF, the sewage undergoes primary treatment before being discharged into the Hudson Bay. For buildings that are not connected to the sanitary sewage system, sewage is collected by vacuum truck and transported to the STF.

2.3 POTENTIAL CONTAMINANTS

Potential contaminants that may be released during the operation of the Facilities are identified in Table 2-1 below.

Table 2-1: Overview of Potential Contaminants

Material	Storage Location	Maximum Quantity
Sewage	Lift Stations	N/A – Continuous Flow
	Force Main	N/A – Continuous Flow
Fuel Storage	Water Treatment Plant/ Williams Lake Pump House	10,000 gallons
	Nipissar Lake Lift Station	2,500 gallons
	Con Shed Storage Facility	4 x 250 gallons
Chlorine Gas	Williams Lake Pump House	1,500 lbs (10 x 150 lbs cylinders)
	Con Shed Storage Facility	7,500 lbs (50 x 150 lbs cylinders)
Fluosilicic Acid	Williams Lake Pump House	410 L (two x 205 L drums)
	Con Shed Storage Facility	8,200 L (40 x 205 L drums)
Calcium hypochlorite	Con Shed Storage Facility	100 L (five x 20 L pails)

2.4 ADDITIONAL COPIES

Copies of the SCP are located at each of the pump houses and inside of the sea canister located adjacent to the water intake pump at the Char River. A copy of the SCP can also be located at the GN-CGS Rankin Inlet office and the Nunavut Water Board.

3.0 Response Organization

The GN-CGS will be responsible for preparing and implementing a detailed SCP during the entire Project duration. Whenever a spill is identified, the GN-CGS Regional Project Manager will be contacted as soon as possible.

The GN-CGS has limited equipment and personnel in the community to address a large spill. In the case of a large spill, it may require the combined efforts of the GN-CGS and the Hamlet of Rankin Inlet to address the issue.

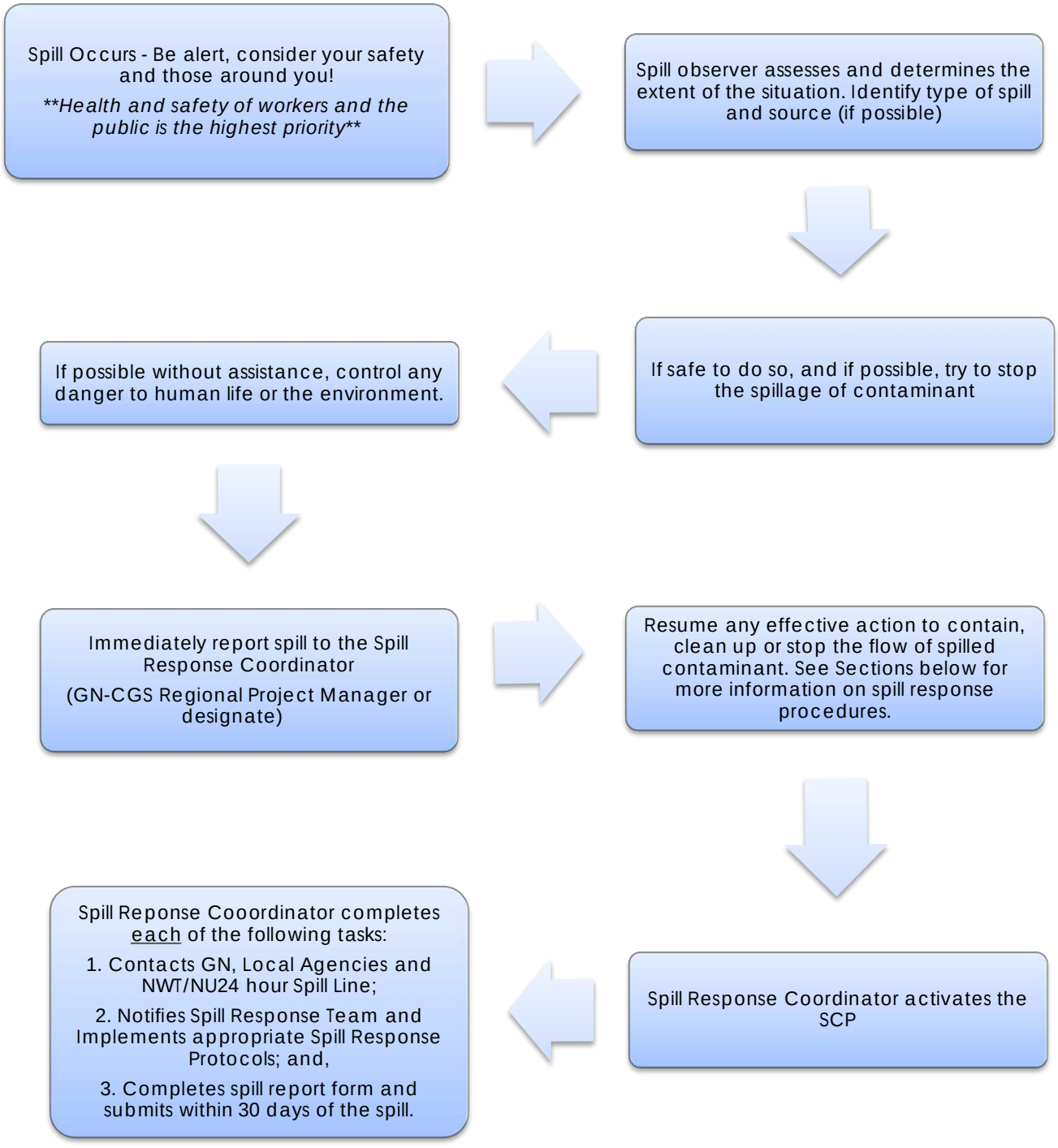
In the event of a spill, the GN-CGS Regional Project Manager or his/her Designate will serve as the Spill Response Coordinator.

The GN-CGS Regional Project Manager or his/her Designate will appoint Hamlet Public Works personnel to the Spill Response Team and will provide the necessary training.

3.1 RESPONSE ORGANIZATION PROCEDURE

The following illustration outlines the sequence of events that must be followed in the event of a spill at the Facilities:

Response Organization
May 2014



3.3 EMERGENCY CONTACT INFORMATION

Table 3-1 provides contact information for personnel who may be contacted to provide advice, expertise, and supply resources in the event of a spill.

Table 3-1: Off-Site Spill Contingency Contact Information

Contact	Location	Telephone number
Fire Department	Rankin Inlet, NU	(867) 645-2598
RCMP Detachment	Rankin Inlet, NU	(867) 645-0123
Community Health Center	Rankin Inlet, NU	(867) 645-8300
GN-CGS – Facilities Manager	Rankin Inlet, NU	(867) 645-8154
24-Hour Emergency Spill Report Line	Yellowknife, NT	(867) 920-8130
Aboriginal Affairs and Northern Development Canada – Inspector	Rankin Inlet, NU	(867) 645-2831
Government of Nunavut – Regional Engineer	Rankin Inlet, NU	(867) 645-4074
Hamlet of Rankin Inlet	Rankin Inlet, NU	(867) 645-2895

The following agencies can be contacted for assistance in spill reporting, response and/or clean-up and remediation.

Table 2-2: Regulatory agencies' Spill Contingency Contact Information

Agency	Legislation	Contact Information
Nunavut Water Board	*Nunavut Waters and Surface Right Tribunal Act*	Phone: (867) 360-6338 Fax: (867) 360-6369
Nunavut Impact Review Board	*Nunavut Land Claims Agreement Act*	Phone: (867) 983-2593
Government of Nunavut Department of Environment	*Nunavut Environmental Protection Act*	Phone: (867) 975-7700 Fax: (867) 975-7740
Environment Canada	Canadian *Environmental Protection Act*, 1999	Phone: (867) 975-4464 Fax: (867) 975-4645
Fisheries and Oceans Canada (Iqaluit)	*Fisheries Act*	Phone: (519) 383-1813 Fax: (519) 464-5128
Transport Canada (Coast Guard)	*Transportation of Dangerous Goods Act*	Phone: (867) 979-5269 Fax: (867) 979-4260

4.0 Reporting Procedure

All spills or potential spills of contaminants must be reported to the 24-hour Northwest Territories – Nunavut Emergency Spill Report Line to ensure that an investigation may be undertaken by the appropriate government authority. Reporting of any spills associated with the Project should be completed by the Spill Response Coordinator or their designate.

To Report a Spill:

1. Fill out the Northwest Territories/Nunavut Spill Report Form (found in Appendix B of this SCP) as completely as possible before calling in the spill report.
2. Contact the Government of the Northwest Territories/Nunavut 24-hour Emergency Spill Report Line:

   24-HOUR EMERGENCY SPILL REPORT LINE (867) 920-8130
3. Where fax is available, fax the completed Northwest Territories/Nunavut Spill Report Form to (867) 873-6924. Alternatively, if email is available, email the completed Northwest Territories – Nunavut Spill Report Form to spills@gov.nt.ca.

Any person reporting a spill is required to give as much information as possible. However, reporting of a spill should not be delayed if all of the necessary information is not known. Additional information can be provided later. From the Consolidation of Spill Contingency Planning and Reporting Regulations (1998), as much of the following information should be reported during the initial spill report:

- Date and time of spill
- Location of spill
- Direction if the spill is moving
- Name and phone number of a contact person close to the location of the spill
- Type of contaminant spilled and quantity
- Cause of spill
- Whether spill is continuing or has stopped
- Description of existing contaminant
- Action taken to contain, recover, clean up, and dispose of spilled contaminant
- Name, address and phone number of person reporting the spill
- Name of owner or person in charge, management or control of contaminants at the time of the spill.

In addition to reporting to the 24-hour Emergency Spill Report Line, an Aboriginal Affairs and Northern Development Canada (AANDC) Inspector must be notified of a spill immediately after occurrence. A copy of the completed Spill Report Form should be forwarded to them.

5.0 Action Plans

5.1 SPILL PREVENTION

The most likely spill possibilities at the Facilities would be spillage from sewage pump-out activities; leakage or failure from sewage lines; spillage or leakage from chlorine containment or injection lines; leakage of diesel from on-site generators; spillage when refueling generators; or, a vehicular accident. Primary spill prevention measures will include:

- All Project personnel will receive spill contingency training prior to beginning work.
- All contaminants will be stored at designated storage areas more than 30 m from the high-water mark of any waterbody.
- All fuel storage vessels will have secondary containment such as containment trays, berms, and/or double-walled tanks designed to hold 110% of total volume of stored fuel.
- All fuel storage and transfer operations will take place at a designated fuel storage area and will be conducted by trained personnel.
- Emergency spill response kits will be kept at the Nipissar Lake Pump house, Williamson Lake Pump house, the Char River sea canister and any designated fuel storage areas, in case of fluid leaks or spills from machinery.
- Spill mats and/or drip pans/trays will be placed under all mobile fueling containers and under equipment when not in use.
- All stationary activities will be conducted at least 30 m from the ordinary high water mark of any waterbody or watercourse, where possible.
- All equipment and vehicles used for operations will be in good working order and free of leaks.
- Identified equipment or vehicle deficiencies will be repaired.
- Regular inspection and maintenance will be conducted for all hoses and lines associated with the Facilities.
- All sewage and solid waste will be contained and sealed in watertight containers.
- Drips will be cleaned up immediately.

5.2 SPILL RESPONSE

The following steps outline the general spill response procedures for initial actions to be taken to contain and clean up a contaminant spill, as well as disposing of contaminated materials.

5.2.1 Chlorine Gas Release

Potential impacts of failure and release of chlorine gas would be to public health and surrounding infrastructure. The chlorine gas is held in ventilated and restricted access rooms. Chlorine gas will disperse to the atmosphere leaving no residue, however in liquid form it is corrosive and therefore should be cleaned up and disposed of using proper procedures and

equipment. Refer to the attached Transport Canada Emergency Guidebook (2012) Guide 124 – Gases – Toxic and/or Corrosive – Oxidizing.

Any person finding a discharge of chlorine gas or a malfunction of chlorine gas in the facilities should immediately report the incident to the GN-CGS Facilities Manager. Use the Response Organization to notify the proper authorities (Section 3.3). In the event of a spill or leak, enclosed spaces should be ventilated; do not access unventilated areas without proper respiratory and protective clothing/gloves. Eliminate all sources of ignition and where possible elevate the cylinder such that gas and not liquid escapes.

If there is a chlorine gas leak or spill during transportation follow the emergency response plan developed as per the TDG regulations. The TDG plan must be shipped with the dangerous goods and be readily available. If no emergency plan is available follow the Transport Canada Emergency Guidebook (2012) Guide 124 – Gases – Toxic and/or Corrosive – Oxidizing provided in Appendix C.

From the Transport Canada Emergency Guidebook (2012) the initial isolation and protective action distances for chlorine are:

Table 5-1: Chlorine Gas Initial Isolation and Protective Distances

	Small Spills (from a small package or a small leak from a large unit)			**Large Spills** (from a large package or from many small packages)		
Chemical Name	First Isolate in All directions	Then Protect Persons Downwind during		First Isolate in All directions	Then Protect Persons Downwind during	
		Day	Night		Day	Night
Chlorine	60 m	0.4 km	1.6 km	600 m	3.5 km	8.0 km

5.2.2 Fluosilicic Acid

Fluosilicic acid is a toxic substance that can cause severe burns and destruction to tissue of the mucous membranes and upper respiratory tract when inhaled. Fluosilicic acid is a liquid and should be stored in a tightly closed container in a well-ventilated area. After use, container must be resealed and kept upright to prevent leaks. Refer to the attached Transport Canada Emergency Guidebook (2012) Guide 154 – Substance – Toxic and/or Corrosive (Non-combustible) provided in Appendix C.

In the event of an accidental spill, wear respiratory protection and avoid breathing in the vapors. Evacuate personnel from the area. Any person finding a leak of fluosilicic acid in the facilities should immediately report the incident to the GN-CGS Facilities Manager. Notify the

proper authorities (Section 3.3). If inhaled, move to fresh air immediately. If the liquid has made contact with skin or eyes, rinse thoroughly with plenty of water. The substance is not combustible; however, over time, the substance may decompose to produce corrosive or toxic fumes. Use water spray, alcohol resistant foam, dry chemical or carbon dioxide to extinguish flames. More detailed information on this substance can be found on the attached MSDS sheet in Appendix D.

For clean-up, soak up with absorbent pads and contain pads in sealed containers. Dispose of pads as hazardous waste at the community landfill.

5.2.3 Other Chemicals (Gasoline, diesel, sewage)

Gasoline, diesel and sewage spills could potentially affect the public and the surrounding environment. When fuel spills, vapors may travel to sources of ignition and flash back or collect in confined areas. Raw sewage spills can be a concern to public health. If a fuel or sewage leak is observed, stop the flow of contaminant if safe to do so. Immediately report the incident to the GN-CGS Facilities Manager and notify the proper authorities (Section 3.3).

For fuel spills, isolate the spill or leak area for a minimum of 50 m in all directions. Refer to the attached Transport Canada Emergency Guidebook (2012) Guide 128 – Flammable Liquids (Non-polar/Water Immiscible), provided in Appendix C. All fuel contaminated soils should be treated in the local landfarm in accordance with normal operating procedures. Small quantities of material can be stored in labelled drums at the hazardous waste storage area in the landfill.

A small sewage spill can occur from a truck lead or household tank. If the spill is small, cleanup may be accomplished with a vacuum truck. Any residual sewage can be diluted with water. For larger spills, the area must be contained with berms. Vacuum trucks and/or excavators can be used to remove contaminated material. All sewage contaminated materials will be transported to the sewage treatment facility (liquids) or landfill facility for disposal.

5.2.3.1 Spills on Snow/Ice

1. Once a spill is identified, all sources of ignition should be turned off (e.g., no smoking, shut off engines).
2. The spilled material (e.g., gasoline, diesel, sewage etc.) should be identified, if possible.
3. The affected area should be secured, ensuring the area is safe for entry and does not represent a threat to human health and safety of the spill responders. Public access (if any) of the area should be restricted.
4. If possible, identify where the spill is coming from (the source). Determine if the spill is still occurring (i.e., still leaking) or if the spillage has stopped. If the spill has not stopped, determine if it is safe to stop or control the spill (e.g., plug hole, close valve, upright container).
5. If the spill is too large to be controlled with the spill materials at hand, contact the GN-CGS facilities representative to report the spill immediately and request assistance (see Section 3.0 for contact information). Use materials on hand to attempt to control the spill.

6. If the spill is small enough to be controlled with the spill response materials at hand, prevent spilled contaminants from spreading or entering waterways by using sorbent materials or a snow/soil dyke down slope from the spill. This is especially the case with liquid contaminants (e.g., gasoline, diesel).
7. Once the spill has been controlled and further spreading prevented, contact the GN-CGS facilities representative and report the spill (see Section 3.0 for contact information). The GN-CGS facilities representative is responsible to report the spill to the 24-Hour Emergency Spill Report Line.
8. If possible with the spill response materials at hand, clean up the remaining spilled contaminant and store contaminated materials in a secure container for disposal. Impacted snow should be stored in drums for proper disposal.

5.2.4 Spills on Land

1. Once a spill is identified, all sources of ignition should be turned off (e.g., no smoking, shut off engines).
2. The spilled material (e.g., gasoline, diesel, sewage, etc.) should be identified, if possible.
3. The affected area should be secured, ensuring the area is safe for entry and does not represent a threat to human health and safety of the spill responders. Public access (if any) of the area should be restricted.
4. If possible, identify where the spill is coming from (the source). Determine if the spill is still occurring (i.e., still leaking) or if the spillage has stopped. If the spill has not stopped, determine if it is safe to stop or control the spill (e.g., plug hole, close valve, upright container), or contain the spill (e.g., place a container or tarp with built up edges under the spill source to contain the spill).
5. If the spill is too large to be controlled with the spill materials at hand, contact the GN-CGS facilities representative and report the spill immediately and request assistance (see Section 3.0 for contact information). Use materials on hand to attempt to control the spill.
6. If the spill is small enough to be controlled with the spill response materials at hand, prevent spilled contaminants from spreading or entering waterways by using sorbent (oil-absorbing) materials or a soil dyke down slope from the spill. This is especially the case with liquid contaminants (e.g., gasoline, diesel).
7. If some contaminant has entered a waterway, follow procedures in Section 5.2.5 to contain and clean-up the contaminant in the water.
8. Once the spill has been controlled and further spreading prevented, contact the GN-CGS site representative and report the spill (see Section 3.0 for contact information). The GN-CGS facilities representative is responsible to report the spill to the 24-Hour Emergency Spill Report Line.
9. If possible with spill response materials at hand, clean up the remaining spilled contaminant and store contaminated materials in a secure container for proper disposal. Do not flush the affected area with water.
10. If possible, remove any contained liquid by pumping into secure drums.

5.2.5 Spills in Water

1. Once a spill is identified, all sources of ignition should be turned off (e.g., no smoking, shut off engines).
2. The spilled material (e.g., gasoline, diesel, sewage etc.) should be identified, if possible.
3. The affected area should be secured, ensuring the area is safe for entry and does not represent a threat to human health and safety of the spill responders. Public access (if any) of the area should be restricted.
4. If possible, identify where the spill is coming from (the source). Determine if the spill is still occurring (i.e., still leaking) or if the spillage has stopped. If the spill has not stopped, determine if it is safe to stop or control the spill (e.g., plug hole, close valve, upright container).
5. If the spill is too large to be controlled with the spill materials at hand, contact the GN-CGS facilities representative and report the spill immediately and request assistance (see Section 3.0 for contact information). Use materials on hand to attempt to control the spill.
6. If the spill is small enough to be controlled with the spill response materials at hand, use sorbent booms to contain the spill for recovery. Place sorbent sheets on the water within the boomed area to help contain the contaminant. For narrow waterways such as streams, place one or more sorbent booms across the waterway, downstream of the spill location, and anchor the booms on each bank.
7. Once the spill has been controlled and further spreading prevented, contact the GN-CGS facilities representative and report the spill (see Section 3.0 for contact information). The GN-CGS facilities representative is responsible to report the spill to the 24-Hour Emergency Spill Report Line.
8. If possible with spill response materials at hand, clean up the remaining spilled contaminant within the boom area. Store contaminated materials in a secure container for proper disposal.

5.3 ADDITIONAL SPILL DELINEATION OR MONITORING

In the event of a large spill or a spill in which not all of the spilled contaminant can be readily cleaned up with materials at hand (as described in Section 5.2), delineation of the affected area may be required. This would include subsurface investigation of the area (i.e., digging of test pits, soil sampling, installation of monitoring wells) to determine how large and how deep the contaminant affected the subsurface soil and/or groundwater (horizontal and vertical extent of the spill). The delineation would result in the development of an appropriate remediation plan for the affected area. In this case, a qualified environmental consultant should be retained to provide advice on how to proceed with delineation and remediation of a large spill.

6.0 Resource Inventory

6.1 ON-SITE RESOURCES

6.1.1 Personnel

All personnel hired to work on the sites will be trained on-site in spill prevention, response and clean-up measures (see Section 7.0).

6.1.2 Equipment

The following is a list of equipment available to respond to possible spills.

- Loader
- Dozers
- Haul/dump trucks
- Excavator
- Personnel pick-up trucks, ATVs and snowmobiles.

6.1.3 Spill Kits

6.1.3.1 Spill Kit Locations

At least one spill kit will be clearly marked and present at the Williamson Lake Pump house, the Nipissar Lake Pump house and the Char River sea canister. Additional spill kits will be placed with working equipment and crews.

6.1.3.2 Spill Kit Contents

The following outlines the recommended minimum requirements for contents of spill kits to be used; the GN-CGS facilities representative is responsible to supply the spill kits. Each spill kit will be regularly inspected to ensure it always contains the following, at a minimum:

- 1 – 205 L open top steel drum with lid, bolting ring and gasket (spill kit container)
- 10 disposable large 5 mil polyethylene bags (dimensions 65 cm x 100 cm) with ties
- 4 – 12.5 cm x 3 m (5 in. x 10 ft.) sorbent booms
- 10 kg bag of sorbent particulate
- 100 sheets (1 bale) of 50 cm x 50 cm sorbent sheets
- 2 large (5 m x 5 m) plastic tarps
- 1 roll duct tape
- 1 utility knife
- 1 field notebook and pencil
- 1 rake

- 1 pick-axe
- 3 spark-proof shovels
- 4 Tyvex® splash suits
- 4 pairs chemical resistant gloves
- 4 pairs of splash protective goggles
- Instruction binder, including the SCP.

The entire spill kit contents, with the exception of the spark-proof shovels, can be stored within the 205 L steel drum. The drum should be sealed securely to protect the spill kit contents though should always be accessible without the use of tools (i.e., finger tight bolt ring). The drum's bolt ring should be inspected regularly during facility inspections to ensure it turns freely and is lubricated.

Extra spill response materials should also be available for use, in addition to the spill kit contents. These include:

- 10 – 205 L open top steel drum with lid, bolting ring and gasket
- 2 spark-proof shovels
- 50 disposable large 5 mil polyethylene bags (dimensions 65 cm x 100 cm)
- 10 – 12.5 cm x 3 m (5 in. x 10 ft.) sorbent booms
- 5 – 10 kg bags of sorbent particulate
- 500 sheets (5 bales) of 50 cm x 50 cm sorbent sheets
- 2 Tyvex® splash suits
- 2 pairs of chemical resistant gloves
- 2 pairs of splash protective goggles

7.0 Training and Exercises

7.1 OUTLINE

The GN-CGS facilities representative will be responsible for providing a qualified supervisor and training personnel in spill response. All individuals hired to work at the facilities should have their basic first aid and Workplace Hazardous Materials and Information System (WHMIS) training before working at any of the Facilities.

A training session on spill prevention and response will be held for all facility employees on an annual basis, or when initially hired. Training exercises, including proper use of spill kits, will provide hands-on training for individuals on spill response procedures and equipment. Training exercises can be held during the training session for all individuals or at another time for individuals directly involved with handling of hazardous materials.

The training session should review this SCP and include information on:

- Individuals roles and responsibilities in regards to spill prevention, detection, response and clean-up
- Location(s) of hard copies of the SCP, maps and spill kits
- Equipment available for spill response
- Content of spill kits
- Initial actions and spill reporting procedures and,
- Spill response and clean-up actions.

7.2 SCHEDULE

The training session and exercises will be provided as part of the Worker Orientation and held annually thereafter.

The GN-CGS facilities representative will keep records of all individuals who attend the training session and exercises, as well as copies of their training certificates (e.g., first aid, WHMIS).

8.0 References

Indian and Northern Affairs Canada (INAC). 2007. Guidelines for Spill Contingency Planning. Water Resources Division, INAC, Yellowknife, NT. Accessed 14 February 2014. Available at: http://www.aadnc-aandc.gc.ca/eng/1100100024236/1100100024253.

Statistics Canada. 2012. Rankin Inlet, Nunavut (Code 1320) and New Brunswick (Code 13) (table). Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWE. Ottawa. Released October 24, 2012. http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E (accessed April 27, 2014).

Transport Canada, U.S. Department of Transportation, Secretariat of Transport and Communications. 2012. Emergency Response Guidebook – 2012. http://www.tc.gc.ca/media/documents/canutec-eng/ERG2012.pdf (accessed May 1, 2014).

Appendix A Figures

Sources: Imagery - Microsoft BING. Thematic Data - FSC Architects and Engineers

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

Nipissar Lake Resupply Line - Site Plan

Appendix B Northwest Territories – Nunavut Spill Report Form

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

C	LAND USE PERMIT NUMBER (IF APPLICABLE)	WATER LICENCE NUMBER (IF APPLICABLE)
D	GEOGRAPHIC PLACE NAME OR DISTANCE AND DIRECTION FROM THE NAMED LOCATION	REGION ☐ NWT ☐ NUNAVUT ☐ ADJACENT JURISDICTION OR
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 ☐ AANDC ☐ 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 C 2012 Emergency Response Guidebook Guides

POTENTIAL HAZARDS

HEALTH

- **TOXIC; may be fatal if inhaled or absorbed through skin.**
- Fire will produce irritating, corrosive and/or toxic gases.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Runoff from fire control may cause pollution.

FIRE OR EXPLOSION

- Substance does not burn but will support combustion.
- Vapors from liquefied gas are initially heavier than air and spread along ground.
- These are strong oxidizers and will react vigorously or explosively with many materials including fuels.
- May ignite combustibles (wood, paper, oil, clothing, etc.).
- Some will react violently with air, moist air and/or water.
- Cylinders exposed to fire may vent and release toxic and/or corrosive gas through pressure relief devices.
- Containers may explode when heated.
- Ruptured cylinders may rocket.

PUBLIC SAFETY

- **CALL EMERGENCY RESPONSE Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- As an immediate precautionary measure, isolate spill or leak area for at least 100 meters (330 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Keep out of low areas.
- Ventilate closed spaces before entering.

PROTECTIVE CLOTHING

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.
- Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible.

EVACUATION

Spill

- See Table 1 - Initial Isolation and Protective Action Distances.

Fire

- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

EMERGENCY RESPONSE

FIRE

Small Fire

CAUTION: These materials do not burn but will support combustion. Some will react violently with water.

- Contain fire and let burn. If fire must be fought, water spray or fog is recommended.
- **Water only; no dry chemical, CO_2 or Halon®.**
- Do not get water inside containers.
- Move containers from fire area if you can do it without risk.
- Damaged cylinders should be handled only by specialists.

Fire involving Tanks

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from tanks engulfed in fire.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

SPILL OR LEAK

- Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.
- Do not touch or walk through spilled material.
- Keep combustibles (wood, paper, oil, etc.) away from spilled material.
- Stop leak if you can do it without risk.
- Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material.
- Do not direct water at spill or source of leak.
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Prevent entry into waterways, sewers, basements or confined areas.
- Isolate area until gas has dispersed.
- Ventilate the area.

FIRST AID

- Move victim to fresh air.
- Call 911 or emergency medical service.
- Give artificial respiration if victim is not breathing.
- **Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.**
- Administer oxygen if breathing is difficult.
- Clothing frozen to the skin should be thawed before being removed.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Keep victim warm and quiet.
- Keep victim under observation.
- Effects of contact or inhalation may be delayed.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

POTENTIAL HAZARDS

HEALTH

- **TOXIC**; inhalation, ingestion or skin contact with material may cause severe injury or death.
- Contact with molten substance may cause severe burns to skin and eyes.
- Avoid any skin contact.
- Effects of contact or inhalation may be delayed.
- Fire may produce irritating, corrosive and/or toxic gases.
- Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution.

FIRE OR EXPLOSION

- Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes.
- Some are oxidizers and may ignite combustibles (wood, paper, oil, clothing, etc.).
- Contact with metals may evolve flammable hydrogen gas.
- Containers may explode when heated.
- For UN3171, if Lithium ion batteries are involved, also consult GUIDE 147.

PUBLIC SAFETY

- **CALL EMERGENCY RESPONSE Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate enclosed areas.

PROTECTIVE CLOTHING

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.
- Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible.

EVACUATION

Spill

- See Table 1 - Initial Isolation and Protective Action Distances for highlighted materials. For non-highlighted materials, increase, in the downwind direction, as necessary, the isolation distance shown under "PUBLIC SAFETY".

Fire

- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

EMERGENCY RESPONSE

FIRE

Small Fire

- Dry chemical, CO_2 or water spray.

Large Fire

- Dry chemical, CO_2, alcohol-resistant foam or water spray.
- Move containers from fire area if you can do it without risk.
- Dike fire-control water for later disposal; do not scatter the material.

Fire involving Tanks or Car/Trailer Loads

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Do not get water inside containers.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from tanks engulfed in fire.

SPILL OR LEAK

- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements or confined areas.
- Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
- DO NOT GET WATER INSIDE CONTAINERS.

FIRST AID

- Move victim to fresh air.
- Call 911 or emergency medical service.
- Give artificial respiration if victim is not breathing.
- **Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.**
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- For minor skin contact, avoid spreading material on unaffected skin.
- Keep victim warm and quiet.
- Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

POTENTIAL HAZARDS

FIRE OR EXPLOSION

- **HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames.**
- Vapors may form explosive mixtures with air.
- Vapors may travel to source of ignition and flash back.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Vapor explosion hazard indoors, outdoors or in sewers.
- Those substances designated with a **(P)** may polymerize explosively when heated or involved in a fire.
- Runoff to sewer may create fire or explosion hazard.
- Containers may explode when heated.
- Many liquids are lighter than water.
- Substance may be transported hot.
- For UN3166, if Lithium ion batteries are involved, also consult GUIDE 147.
- **If molten aluminum is involved, refer to GUIDE 169.**

HEALTH

- Inhalation or contact with material may irritate or burn skin and eyes.
- Fire may produce irritating, corrosive and/or toxic gases.
- Vapors may cause dizziness or suffocation.
- Runoff from fire control or dilution water may cause pollution.

PUBLIC SAFETY

- **CALL EMERGENCY RESPONSE Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate closed spaces before entering.

PROTECTIVE CLOTHING

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.

EVACUATION

Large Spill

- Consider initial downwind evacuation for at least 300 meters (1000 feet).

Fire

- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

EMERGENCY RESPONSE

FIRE

CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.

CAUTION: For mixtures containing alcohol or polar solvent, alcohol-resistant foam may be more effective.

Small Fire

- Dry chemical, CO_2, water spray or regular foam.

Large Fire

- Water spray, fog or regular foam.
- **Do not use straight streams**.
- Move containers from fire area if you can do it without risk.

Fire involving Tanks or Car/Trailer Loads

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from tanks engulfed in fire.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

SPILL OR LEAK

- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements or confined areas.
- A vapor suppressing foam may be used to reduce vapors.
- Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
- Use clean non-sparking tools to collect absorbed material.

Large Spill

- Dike far ahead of liquid spill for later disposal.
- Water spray may reduce vapor; but may not prevent ignition in closed spaces.

FIRST AID

- Move victim to fresh air.
- Call 911 or emergency medical service.
- Give artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Wash skin with soap and water.
- In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin.
- Keep victim warm and quiet.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

Appendix D MSDS Sheets

Brenntag Canada Inc.

BRENNTAG

MATERIAL SAFETY DATA SHEET

CHLORINE, LIQUEFIED GAS

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Brenntag Canada Inc.
43 Jutland Rd.
Toronto, ON
M8Z 2G6
(416) 259-8231

Website: http:\\www.brenntag.ca

WHMIS#:	00010002
Index:	GCD0016/10C
Effective Date:	2008 January 15
Date of Revision:	2010 August 03

EMERGENCY TELEPHONE NUMBERS (FOR EMERGENCIES INVOLVING CHEMICAL SPILLS OR RELEASE)

Toronto, ON (416) 226-6117	Montreal, QC (514) 861-1211	Winnipeg, MB (204) 943-8827
Edmonton, AB (780) 424-1754	Calgary, AB (403) 263-8660	Vancouver, BC (604) 685-5036

PRODUCT IDENTIFICATION

Product Name:	Chlorine, Liquefied Gas.
Chemical Name:	Chlorine.
Synonyms:	Not available.
Chemical Family:	Halogen.
Molecular Formula:	Cl_2.
Product Use:	Bacteriacide in water treatment. Chemical intermediate.

DO NOT RE-USE EMPTY CONTAINERS. RETURN ALL CONTAINERS TO BRENNTAG CANADA.

WHMIS Classification / Symbol:

A: Compressed Gas
C: Oxidizer
D-1A: Very Toxic (acute effects)
D-2A: Very Toxic (chronic effects)
E: Corrosive

READ THE ENTIRE MSDS FOR THE COMPLETE HAZARD EVALUATION OF THIS PRODUCT.

2. COMPOSITION, INFORMATION ON INGREDIENTS (Not Intended As Specifications)

Ingredient	*CAS#*	*ACGIH TLV*		*% Concentration*
Chlorine	7782-50-5	0.5 ppm	*A4	95 - 100

A4 = Not classifiable as a human carcinogen. (ACGIH-A4).

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Corrosive! Toxic! May be fatal if inhaled. Causes severe skin and eye burns. Gas is extremely irritating to eyes and respiratory tract. See "Other Health Effects" Section. Strong, offensive odor. Strong oxidizer. Contact with other combustible material can cause fire. Liquefied compressed gas. Contents under pressure. Ruptured containers may rocket.

POTENTIAL HEALTH EFFECTS

Inhalation:	Corrosive! Toxic! Product may cause severe irritation of the nose, throat and respiratory tract. Repeated and/or prolonged exposures may cause productive cough, running nose, bronchopneumonia, pulmonary oedema (fluid build-up in lungs), and reduction of pulmonary function. Chlorine reacts with water or humidity to produce Hydrochloric Acid and Hypochlorous Acid. (3,4) Toxic effects may be delayed. See "Other Health Effects" Section.
Skin Contact:	Corrosive! Chlorine vapours may cause burning and prickling sensations, reddening and blisters. Direct contact with liquid causes severe local irritation, blistering and burns. Avoid handling when the skin is moist, wet or abraded. Chlorine reacts with water or humidity to produce Hydrochloric Acid and Hypochlorous Acid. (3,4) Burns (chemical) can occur if not promptly removed.
Skin Absorption:	May be absorbed through intact skin. Skin absorption is a secondary concern to the continual destruction of tissue while the product is in contact with the skin.
Eye Contact:	Extremely corrosive! This product causes corneal scarring and clouding. Glaucoma, cataracts and permanent blindness may occur. Chlorine reacts with water or humidity to produce Hydrochloric Acid and Hypochlorous Acid. (3,4)
Ingestion:	Corrosive! Product is a gas. Ingestion is not a likely route of exposure.
Other Health Effects:	Corrosive effects on the skin and eyes may be delayed, and damage may occur without the sensation or onset of pain. Strict adherence to first aid measures following any exposure is essential. May cause frostbite, olfactory fatigue, tooth erosion, cardiovascular effects, shock, central nervous system (CNS) depression, asphyxia and cyanosis. Olfactory fatigue is a term used to describe a condition characterized by the temporary loss of odour perception. CNS depression is characterized by headache, dizziness, drowsiness, nausea, vomiting and incoordination. Severe overexposures may lead to coma and possible death due to respiratory failure. Cyanosis is characterized by navy blue, almost black lips, tongue, and mucous membranes, with skin colour being slate gray. Further manifestation is characterized by headache, weakness, dyspnea, dizziness, stupor, respiratory distress and death due to anoxia. Asphyxia is characterized by increased breathing volume, accelerated pulse rate, muscular incoordination, faulty judgement, emotional instability, fatigue, nausea, vomiting, bewilderment, gasping respiration and unconsciousness. Chlorine: Inhalation exposure can result in primary irritation of the respiratory tract, gradual loss of pulmonary function and asthma-like attacks in suseptible individuals. Acute exposure is characterized by the irritation of the respiratory tract causing runny nose, sore throat, coughing, chest discomfort, shortness of breath and reduced lung function. Overexposure may lead to bronchitis, bronchial spasm and pulmonary oedema. Chronic exposure may lead to asthmatic attack in certain individuals, with the following symptoms: chest tightness, wheezing, cough and shortness of breath. (3)

4. FIRST AID MEASURES

FIRST AID PROCEDURES

Inhalation:	Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is no breathing AND no pulse. Oxygen administration may be beneficial in this situation but should only be administered by personnel trained in its use. Obtain medical attention IMMEDIATELY.
Skin Contact:	Flush skin with running water for a minimum of 20 minutes. Start flushing while removing contaminated clothing. If irritation persists, repeat flushing. Obtain medical attention IMMEDIATELY. See "Note to Physicians" below. When treating frost bite, flush affected areas with water no warmer than 44 Deg. Celsius. Do not use heated water or dry heat and frozen parts should not be rubbed before or after thawing.
Eye Contact:	Immediately flush eyes with running water for a minimum of 20 minutes. Hold eyelids open during flushing. If irritation persists, repeat flushing. Obtain medical attention IMMEDIATELY. Do not transport victim until the recommended flushing period is completed unless flushing can be continued during transport. When treating frost bite, flush affected areas with water no warmer than 44 Deg. Celsius. Do not use heated water or dry heat and frozen parts should not be rubbed before or after thawing.
Ingestion:	Do not attempt to give anything by mouth to an unconscious person. If victim is alert and not convulsing, rinse mouth out and give 1/2 to 1 glass of water to dilute material. IMMEDIATELY contact local Poison Control Centre. Vomiting should only be induced under the direction of a physician or a poison control centre. If spontaneous vomiting occurs, have victim lean forward with head down to avoid breathing in of vomitus, rinse mouth and administer more water. IMMEDIATELY transport victim to an emergency facility.

Note to Physicians:	Treatment for corrosive chemical contact with skin after initial flushing procedures: 1. Immerse the exposed part immediately in ice water to relieve pain and to prevent swelling and blistering. Place cold packs, ice or wet cloths on the burned area if immersion is not possible. 2. Remove anything that is constrictive, such as rings, bracelets or footwear, before swelling begins. 3. Cover the exposed part with a clean, preferably sterile, lint-free dressing. 4. For severe exposure, immediately seek medical attention and monitor breathing and treat for shock. Medical conditions that may be aggravated by exposure to this product include neurological, cardiovascular and skin disorders, diseases of the skin, eyes or respiratory tract.

5. FIRE-FIGHTING MEASURES

Flashpoint (°C)	*AutoIgnition Temperature (°C)*	Flammability Limits in Air (%): *LEL*	*UEL*
Not Flammable.	Not applicable.	Not applicable.	Not applicable.

Flammability Class (WHMIS):	Not regulated.
Hazardous Combustion Products:	Thermal decomposition products are toxic and may include oxides of chlorine and irritating gases. Chlorine reacts with water or humidity to produce Hydrochloric Acid and Hypochlorous Acid. These two acids cause metal corrosion. (3,4)
Unusual Fire or Explosion Hazards:	Although non-combustible in air, chlorine supports the combustion of other materials. Flammable gases and vapours will form explosive mixtures with chlorine. Chlorine cylinders and tonne containers are equipped with fusible plugs. The fusible plugs are designed to melt at temperatures above 70 Deg. Celsius to reduce the internal pressure of the cylinder by releasing Chlorine gas. Expansion of liquid and change of state from liquid to vapour will allow mixture to encompass a large area. If tank is involved in a fire situation, a BLEVE (Boiling Liquid Expanding Vapour Explosion) may result. Ruptured containers may rocket. Where possible, elevate the leak to the highest position such that gas and not liquid escapes. This product is a strong oxidizer. Strong oxidizers can cause ignition of combustible or oxidizable materials. May decompose violently on contact with metals, or their salts, dusts or other contaminants.
Sensitivity to Mechanical Impact:	Not expected to be sensitive to mechanical impact.
Rate of Burning:	Not available.
Explosive Power:	Not available.
Sensitivity to Static Discharge:	Not expected to be sensitive to static discharge.
EXTINGUISHING MEDIA	
Fire Extinguishing Media:	Use media appropriate for surrounding fire and/or materials.
FIRE FIGHTING INSTRUCTIONS	
Instructions to the Fire Fighters:	Fire-exposed containers should be kept cool by spraying with water to reduce pressure. Isolate materials that are not involved in the fire and protect personnel. Cool containers with flooding quantities of water until well after the fire is out. Chlorine reacts with water or humidity to produce Hydrochloric Acid and Hypochlorous Acid. These two acids cause metal corrosion. (3,4) Remove containers from fire zone whenever possible. Ventilate low lying areas such as sumps or pits where dense vapours may collect.
Fire Fighting Protective Equipment:	Use self-contained breathing apparatus and special protective clothing.

6. ACCIDENTAL RELEASE MEASURES

Information in this section is for responding to spills, leaks or releases in order to prevent or minimize the adverse effects on persons, property and the environment. There may be specific reporting requirements associated with spills, leaks or releases, which change from region to region.

Containment and Clean-Up Procedures:	In all cases of leak or spill contact vendor at Emergency Number shown on the front page of this MSDS. See Section 13, "Deactivating Chemicals". Wear respirator, protective clothing and gloves. Ruptured containers may rocket. Ventilate enclosed spaces. Where possible, elevate the leak to the highest position of the cylinder, such that gas and not liquid escapes. Apply emergency device. Eliminate all sources of ignition. Move unprotected personnel upwind of leaking container. Call emergency response naming the chemical and the type of container that is leaking. Consider the use of fog-nozzles to control vapours. Do not immerse in water. Notify applicable government authority if release is reportable or could adversely affect the environment. Vapour knock down water is corrosive and toxic, thus it should be diked for containment. Ensure compatible materials are used. For a leaking container: dispose of contents to a safe out-of-doors area or a hood with forced ventilation. Attach appropriate control valve provided with a trap or check valve and a long piece of flexible hose connected to the valve outlet. Discharge the gas at a moderate rate into an adequate amount of approximately 15% aqueous Sodium Hydroxide or other alkali or reducing solution in suitable container. When all the gas is discharged, close the cylinder valve and tag the cylinder as defective. (3)

7. HANDLING AND STORAGE

HANDLING

Handling Practices:	9 Vapours are heavier than air. Use self-contained breathing apparatus. Secure containers at all times. Fix leaks promptly. Immerse contaminated clothing in water immediately and KEEP WET until discarded or laundered. Avoid moisture contamination. Chlorine reacts with water or humidity to produce Hydrochloric Acid and Hypochlorous Acid. These two acids cause metal corrosion. (3,4) Do not store or transport with food or feed. Keep away from combustibles and incompatible materials.
Ventilation Requirements:	See Section 8, "Engineering Controls".
Other Precautions:	Use only with adequate ventilation and avoid breathing vapours. Avoid contact with eyes, skin or clothing. Wash thoroughly with soap and water after handling. Wash contaminated clothing thoroughly before re-use.

STORAGE

Storage Temperature (°C):	Ideal storage temperature is 10-27 Deg. Celsius. Do not expose sealed containers to temperatures above 51 °C or Below - 29 °C. (3)
Ventilation Requirements:	Do not use in poorly ventilated or confined areas without proper respiratory protection. Ventilation should be corrosion proof.
Storage Requirements:	Store in a cool, well-ventilated area. Keep away from heat, sparks and flames. Keep containers closed. Do not expose sealed containers to temperatures above 51 °C. Use of a Chlorine gas monitor with local and remote alarms and monitoring is strongly recommended. Secure containers at all times. Fix leaks promptly. Regularly inspect process equipment, piping and detection equipment. Chlorine cylinders and tonne containers are equipped with fusible plugs. The fusible plugs are designed to melt at temperatures above 70 Deg. Celsius to reduce the internal pressure of the cylinder by releasing Chlorine gas. Avoid storage of cylinders for more than 6 months. (3)
Special Materials to be Used for Packaging or Containers:	Chlorine is stable in steel containers at room temperatures when stored dry. Intense local heat above 200 C on steel walls can cause steel to ignite chlorine. (3) Equipment for storage, handling or transportation should NOT be made of: stainless steel. Confirm suitability of any material before using.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Recommendations listed in this section indicate the type of equipment, which will provide protection against overexposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.

ENGINEERING CONTROLS

Engineering Controls:	Local exhaust ventilation required. Ventilation should be corrosion proof. Make up air should be supplied to balance air that is removed by local or general exhaust ventilation. Ventilate low lying areas such as sumps or pits where dense vapours may collect. Restrict access to storage area. Post warning signs. Consider leak detection and alarm systems. For personnel entry into confined spaces (i.e. bulk storage tanks) a proper procedure must be followed. It must include consideration of, among other things, ventilation, testing of tank atmosphere, provision and maintenance of SCBA, and emergency rescue. Use the "buddy" system. The second person should be in view and trained and equipped to execute a rescue. (4)

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Eye Protection:	Use full face-shield and gas-tight goggles when there is potential for contact. Contact lenses should not be worn when working with this material.
Skin Protection:	Gloves and protective clothing made from neoprene, viton, butyl rubber or nitrile rubber should be impervious under conditions of use. Prior to use, user should confirm impermeability. Skin protection should be insulated against cold temperatures. Do not use gloves or protective clothing made from leather, polyethylene, PVC, rubber or plastic. Discard contaminated gloves.
Respiratory Protection:	DO NOT USE chemical cartridge respirators with oxidizable sorbents (charcoal). Chlorine: Up to 5 ppm, wear a chemical cartridge respirator with Chlorine or acid gas cartridges; up to 10 ppm self-contained breathing apparatus (SCBA). (3,4) Use an air-supplied respirator if concentrations are high or unknown. If while wearing a respiratory protection, you can smell, taste or otherwise detect anything unusual, or in the case of a full facepiece respirator you experience eye irritation, leave the area immediately. Check to make sure the respirator to face seal is still good. If it is, replace the filter, cartridge or canister. If the seal is no longer good, you may need a new respirator. (4) Immediately Dangerous to Life and Health (IDLH) value: 10 ppm. (4) The purpose of establishing an IDLH value is to ensure that the worker can escape from a given contaminated environment in the event of failure of the most protective respiratory equipment. In the event of failure of respiratory protective equipment, every effort should be made to exit immediately. (4)
Other Personal Protective Equipment:	Wear an impermeable apron and boots. Locate safety shower and eyewash station close to chemical handling area. Take all precautions to avoid personal contact. Use of a Chlorine gas monitor with local and remote alarms and monitoring is strongly recommended.

EXPOSURE GUIDELINES

SUBSTANCE	*ACGIH TLV*	*OSHA PEL*		*NIOSH REL*	
	(STEL)	*(TWA)*	*(STEL)*	*(TWA)*	*(STEL)*
Chlorine	1 ppm	---	1 ppm (Ceiling)	---	0.5 ppm (Ceiling)

9. PHYSICAL AND CHEMICAL PROPERTIES (Not intended as Specifications)

Physical State:	Gas.
Appearance:	Greenish yellow liquified gas.
Odour:	A sharp, pungent, irritating odour.
Odour Threshold (ppm):	0.2 - 0.4 ppm. (3)
Boiling Range (°C):	-35. (3)
Melting/Freezing Point (°C):	-101. (3)
Vapour Pressure (mm Hg at 20° C):	4 788 - 5 120. (3)
Vapour Density (Air = 1.0):	2.47 - 2.67. (3)
Relative Density (g/cc):	1.33 - 1.47. (3)
Bulk Density:	88.76 lb/ft³ @ 15.6 C.
Viscosity:	0.346 mPa @ 20 C. (3)
Evaporation Rate (Butyl Acetate = 1.0):	Not available.
Solubility:	Slightly soluble in water.
% Volatile by Volume:	100. (3)
pH:	1.5 - 2.0 (0.8 % solution). (3)
Coefficient of Water/Oil Distribution:	Not applicable.
Volatile Organic Compounds (VOC):	0 %.
Flashpoint (°C):	Not Flammable.

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY

Under Normal Conditions:	Stable.
Under Fire Conditions:	Although non-combustible in air, chlorine supports the combustion of other materials.
Hazardous Polymerization:	Will not occur.

Conditions to Avoid:	High temperatures, sparks, open flames and all other sources of ignition. Avoid contact with water. Chlorine reacts with water or humidity to produce Hydrochloric Acid and Hypochlorous Acid. These two acids cause metal corrosion. (3,4)
Materials to Avoid:	This product is a strong oxidizer. Strong oxidizers can cause ignition of combustible or oxidizable materials. May decompose violently on contact with metals, or their salts, dusts or other contaminants. Reacts with water or humidity to produce Hydrochloric Acid and Hypochlorous Acid. These two acids cause metal corrosion. (3,4) Chlorine reacts with combustible, organic or nitrogen compounds (hydrocarbons, cleaning solvents, paints or thinners, oil, grease gasoline, petroleum products, turpentine, alcohols, carbon disulphide, hydrogen acetylene, hydrogen, ether and ammonia). (3,4) Strong oxidizers. Lewis or mineral acids. Metal halides. Carbon. Lead. Sulphides. Reducing agents. Fluorine. Metal Acetylides. Halogenated compounds. Diethyl Zinc. Metal hydrides. Sulfamic Acid. Diethyl Ether. At ordinary temperatures: Dry Chlorine (gas or liquid) is not corrosive to most common metals, including steel, stainless steel, silver, iron, cast iron, nickel and its alloys, copper, brass, bronze, lead platinum and tantalum. Dry Chlorine (gas or liquid) reacts with aluminum, zinc, arsenic, gold, mercury, class 300 stainless steel, titanium, selenium, tellurium and tin. (3,4) At high temperatures: Dry Chlorine is corrosive to most metals. The reaction rate of dry Chlorine increases rapidly above a temperature which is characteristic for the metal. (3,4)
Decomposition or Combustion Products:	Thermal decomposition products are toxic and may include oxides of chlorine and irritating gases. Chlorine reacts with water or humidity to produce Hydrochloric Acid and Hypochlorous Acid. These two acids cause metal corrosion. (3,4)

11. TOXICOLOGICAL INFORMATION

TOXICOLOGICAL DATA:

SUBSTANCE	*LD50 (Oral, Rat)*	*LD50 (Dermal, Rabbit)*	*LC50 (Inhalation, Rat, 4h)*
Chlorine	---	---	147 ppm (1)

Carcinogenicity Data:	The ingredient(s) of this product is (are) not classed as carcinogenic by ACGIH, IARC, OSHA or NTP. See "Other Studies Relevant to Material".
Reproductive Data:	No adverse reproductive effects are anticipated.
Mutagenicity Data:	No adverse mutagenic effects are anticipated.
Teratogenicity Data:	No adverse teratogenic effects are anticipated.
Respiratory / Skin Sensitization Data:	None known.
Synergistic Materials:	Mortality in Chlorine-Nickel test groups for rainbow trout was found to be higher than that of either nickel or chlorine alone. The relevance to humans is not known. Incidences of respiratory sensitization in platinum refinery workers increased following a spill of chlorine. (3)
Other Studies Relevant to Material:	Effects in rats during acute inhalation exposure to Chlorine were primarily attributed to its severe irritant effects. Repeated inhalation of Chlorine (1, 3 or 9 ppm for 6 weeks) by rats resulted in respiratory irritation, reduced body weight gain, organ weight changes, increased white blood cells, some animal deaths and changes in liver, kidney, spleen, thymus and gastric mucosa. Longer term (1 year) inhalation of Chlorine (0.1, 0.5 or 2.3 ppm) by monkeys resulted in eye and upper respiratory tract irritation. Effects observed in rabbits following repeated inhalation (up to 9 months) were weight loss, nasal irritation, sneezing and laboured respiration. Life-time inhalation of Chlorine (up to 2.5 ppm) produced nasal cell injury in rats and mice. No effects were observed in guinea pigs after repeated inhalation (87 days) or in mice after drinking chlorinated water (33 or 55 days). Repeated exposure of rats to 30 ppm Chlorine in their drinking water resulted in reduced spleen weights and immunological effects. Long term (2 years) administration of Chlorine in drinking water (70, 140 or 275 ppm) resulted in an increase in leukemia in female rats at 140 ppm only. No adverse effects on fertility, life span, growth pattern, hematology or histology were seen in rats given chlorinated water (100 mg Chlorine / Litre daily) throughout the entire lifespan for 7 consecutive generations. No birth defects were observed in mice after drinking chlorinated drinking water during pregnancy. Chlorine produced no genetic changes in standard tests using animals. A positive response was observed in a test using human cells, while mixed responses have been reported in a variet of tests using bacterial cells or animal cells. (3)

12. ECOLOGICAL INFORMATION

Ecotoxicity:	Highly toxic to aquatic life. Fish toxicity: critical concentration = 0.3 mg/L Aesthetic: critical concentration = 0.5 mg/L Plant: critical concentration = 100 mg/L 72-HR LC50 = 0.5 mg/L, Daphnia Magna 96-HR LC50 = 0.02 mg/L, Daphnia Magna 96-HR LC50 = 0.08 to 0.18 mg/L, Brook Trout 96-HR LC50 = 0.07 mg/L, Channel Catfish Fingerlings 96-HR LC50 = 0.44 to 2.32 mg/L, Bluegill Sunfish 96-HR LC50 = 1.6 mg/L, Redsid Shiner 96-HR LC50 = 0.70 mg/L, Blackside Dance Exposure of Sand-dollar sperm to 0.002 mg/L for 5 minutes resulted in a 50 percent reduction in egg fertilization. Depressed shoot and total plant dry weight and shoot length were reported when the aquatic plant myriophyllum spicatum was continuously exposed to chlorine (as low as 0.05 mg total residual chlorine/L) for 96 hours. Chlorine is considered to be phytotoxic and has bactericidal, algicidal and fungicidal properties. Chlorine does not appear to retard seed germination. (3) This product does not bioaccumulate in aquatic or terrestrial food chains.
Environmental Fate:	In an uncontrolled spill scenario where the concentration of Chlorine is well above those used for drinking water, it can be dangerous if allowed to contaminate irrigation water supplies, lakes, streams, ponds or rivers.

13. DISPOSAL CONSIDERATIONS

Deactivating Chemicals:	Chlorine gas will disperse to the atmosphere leaving no residue. Gaseous material can be absorbed in alkaline solutions of Caustic Soda, Soda Ash or Hydrated Lime. When absorbing Chlorine in alkaline solutions, the reaction is exothermic. Ensure the absorption is controlled as to heat and reaction. (3) Since hypochlorites are formed, solutions must be treated with reducing agents such as sodium sulphite before disposal. Do not immerse container in caustic solution. Liquid and/or solid residues from neutralization must be disposed of in a permitted waste management facility. (3) Hypochlorites: Carefully neutralize by adding hydrogen peroxide: one US pint of 35 % hydrogen peroxide solution per pound of hypochlorite to be neutralized. Dilute the neutralized residue with water. (3)
Waste Disposal Methods:	This information applies to the material as manufactured. Reevaluation of the product may be required by the user at the time of disposal since the product uses, transformations, mixtures and processes may influence waste classification. Dispose of waste material at an approved (hazardous) waste treatment/disposal facility in accordance with applicable local, provincial and federal regulations. Do not dispose of waste with normal garbage, or to sewer systems.
Safe Handling of Residues:	See "Waste Disposal Methods".
Disposal of Packaging:	Empty containers retain product residue (liquid and/or vapour) and can be dangerous. See Section 13, "Deactivating Chemicals". Do not expose such containers to heat, flame, sparks, static electricity, or other sources of ignition; they may explode and cause injury or death. Return empty containers. DO NOT REFILL COMPRESSED GAS CONTAINERS. RETURN TO BRENNTAG CANADA FOR CARE AND MANAGEMENT.

14. TRANSPORTATION INFORMATION

CANADIAN TDG ACT SHIPPING DESCRIPTION:

CHLORINE, Class 2.3(8), UN1017.

Label(s): Toxic Gases, Corrosives. Placard: Toxic Gases.

ERAP Index: 500. Exemptions: None known.

Marine: P (Marine Pollutant).

Please consult the North American Emergency Response Guidebook, via the UN#, for guidance in addressing spills.

US DOT CLASSIFICATION (49CFR 172.101, 172.102):

CHLORINE, Class 2.3(8), UN1017.

Label(s): Poison Gas, Corrosive. Placard: Poison Gas.

CERCLA-RQ: 10 lb / 4.54 kg Exemptions: Not applicable.

Special Documentation Addition: Chlorine, Poison - Inhalation Hazard, Zone B.
Marine: P (Marine Pollutant).

IMO: Marine Pollutant: Chlorine.

Please consult the North American Emergency Response Guidebook, via the UN#, for guidance in addressing spills.

15. REGULATORY INFORMATION

CANADA

CEPA - NSNR: This material is included on the DSL under the CEPA.

CEPA - NPRI: This material is on the NPRI list of substances.

Controlled Products Regulations Classification (WHMIS):

A: Compressed Gas
C: Oxidizer
D-1A: Very Toxic (acute effects)
D-2A: Very Toxic (chronic effects)
E: Corrosive

USA

Environmental Protection Act: This material is included on the TSCA Inventory.

OSHA HCS (29CFR 1910.1200): Compressed Gas. Oxidizer. Highly Toxic. Chronic Effects. Corrosive.

NFPA: 4 Health, 0 Fire, 0 Reactivity (3)

HMIS: 4 Health, 0 Fire, 0 Reactivity (3)

INTERNATIONAL

The following component or components of this product appear on the European Inventory of Existing Commercial Chemical Substances: Chlorine.

16. OTHER INFORMATION

REFERENCES

1. RTECS-Registry of Toxic Effects of Chemical Substances, Canadian Centre for Occupational Health and Safety RTECS database.
2. Clayton, G.D. and Clayton, F.E., Eds., Patty's Industrial Hygiene and Toxicology, 3rd ed., Vol. IIA,B,C, John Wiley and Sons, New York, 1981.
3. Supplier's Material Safety Data Sheet(s).
4. CHEMINFO chemical profile, Canadian Centre for Occupational Health and Safety, Hamilton, Ontario, Canada.
5. Guide to Occupational Exposure Values, 2008, American Conference of Governmental Industrial Hygienists, Cincinnati, 2008.
6. Regulatory Affairs Group, Brenntag Canada Inc.
7. The British Columbia Drug and Poison Information Centre, Poison Managements Manual, Canadian Pharmaceutical Association, Ottawa, 1981.

To obtain revised copies of this or other Material Safety Data Sheets, contact your nearest Brenntag Canada Regional office.

British Columbia: 20333-102B Avenue, Langley, BC, V1M 3H1
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Alberta: 6628 - 45 th. Street, Leduc, AB, T9E 7C9
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Prepared By: Regulatory Affairs Group, Brenntag Canada Inc., (416) 259-8231.

Material Safety Data Sheet

Version 3.6
Revision Date 11/22/2012
Print Date 06/05/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	Fluosilicic acid
Product Number	:	01301
Brand	:	Sigma-Aldrich
Supplier	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone	:	+1 800-325-5832
Fax	:	+1 800-325-5052
Emergency Phone # (For both supplier and manufacturer)	:	(314) 776-6555
Preparation Information	:	Sigma-Aldrich Corporation Product Safety - Americas Region 1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards
Toxic by ingestion, Corrosive

GHS Classification
Acute toxicity, Oral (Category 4)
Acute toxicity, Dermal (Category 3)
Skin corrosion (Category 1B)
Serious eye damage (Category 1)

GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)

H302	Harmful if swallowed.
H311	Toxic in contact with skin.
H314	Causes severe skin burns and eye damage.

Precautionary statement(s)

P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER or doctor/ physician.

HMIS Classification

Health hazard:	3
Chronic Health Hazard:	*
Flammability:	0
Physical hazards:	0

NFPA Rating

Health hazard:	3

Fire: 0
Reactivity Hazard: 0

Potential Health Effects

Inhalation May be harmful if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract.
Skin May be harmful if absorbed through skin. Causes skin burns.
Eyes Causes eye burns.
Ingestion Toxic if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : Fluorosilicic acid
Hexafluorosilicic acid
Hydrogen hexafluorosilicate

Formula : H_2F_6Si
Molecular Weight : 144.09 g/mol

Component		Classification	Concentration
Hexafluorosilicic acid			
CAS-No. EC-No. Index-No.	16961-83-4 241-034-8 009-011-00-5	Skin Corr. 1B; H314	30 - 50 %

For the full text of the H-Statements and R-Phrases mentioned in this Section, see Section 16

4. FIRST AID MEASURES

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.Continue rinsing eyes during transport to hospital.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability
Not flammable or combustible.

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products
Hazardous decomposition products formed under fire conditions. - Hydrogen fluoride, silicon oxides

6. ACCIDENTAL RELEASE MEASURES

Personal precautions
Wear respiratory protection. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE

Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

Conditions for safe storage
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Basis
Hexafluorosilicic acid	16961-83-4	TWA	2.5 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
Remarks	Varies with compound			
		TWA	2.5 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z2
	Z37.28-1969			
		TWA	2.5 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Bone damage Fluorosis Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen varies			
		TWA	2.5 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000

Personal protective equipment

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection
Tightly fitting safety goggles. Faceshield (8-inch minimum). Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	clear, liquid
Colour	light yellow

Safety data

pH	1.0 - 1.2 at 10 g/l
Melting point/freezing point	no data available
Boiling point	no data available
Flash point	no data available
Ignition temperature	no data available
Autoignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	no data available
Water solubility	no data available
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability
Stable under recommended storage conditions.

Possibility of hazardous reactions
no data available

Conditions to avoid
no data available

Materials to avoid
Strong oxidizing agents, Metals, Alkalis, Strong acids, Stoneware, glass

Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Hydrogen fluoride, silicon oxides
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50
no data available

Inhalation LC50
no data available

Dermal LD50
no data available

Other information on acute toxicity
no data available

Skin corrosion/irritation
no data available

Serious eye damage/eye irritation
Eyes: no data available

Respiratory or skin sensitization
no data available

Germ cell mutagenicity
no data available

Carcinogenicity

IARC:	3 - Group 3: Not classifiable as to its carcinogenicity to humans (Hydrofluoric acid)
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)
no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)
no data available

Aspiration hazard
no data available

Potential health effects

Inhalation	May be harmful if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract.
Ingestion	Toxic if swallowed.
Skin	May be harmful if absorbed through skin. Causes skin burns.
Eyes	Causes eye burns.

Signs and Symptoms of Exposure
Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea

Synergistic effects
no data available

Additional Information
RTECS: Not available

12. ECOLOGICAL INFORMATION

Toxicity

no data available

Persistence and degradability
no data available

Bioaccumulative potential
no data available

Mobility in soil
no data available

PBT and vPvB assessment
no data available

Other adverse effects

no data available

13. DISPOSAL CONSIDERATIONS

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1778 Class: 8 Packing group: II
Proper shipping name: Fluorosilicic acid
Reportable Quantity (RQ): 10001 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG
UN number: 1778 Class: 8 Packing group: II EMS-No: F-A, S-B
Proper shipping name: FLUOROSILICIC ACID
Marine pollutant: No

IATA
UN number: 1778 Class: 8 Packing group: II
Proper shipping name: Fluorosilicic acid

15. REGULATORY INFORMATION

OSHA Hazards
Toxic by ingestion, Corrosive

SARA 302 Components
The following components are subject to reporting levels established by SARA Title III, Section 302:

	CAS-No.	Revision Date
Hydrofluoric acid	7664-39-3	1993-04-24

SARA 313 Components
SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Acute Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Hexafluorosilicic acid	16961-83-4	1993-04-24
Hydrofluoric acid	7664-39-3	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Water	7732-18-5	
Hexafluorosilicic acid	16961-83-4	1993-04-24
Hydrofluoric acid	7664-39-3	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
Water	7732-18-5	
Hexafluorosilicic acid	16961-83-4	1993-04-24

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Text of H-code(s) and R-phrase(s) mentioned in Section 3

H314	Causes severe skin burns and eye damage.
Skin Corr.	Skin corrosion

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.