- **Government of Nunavut**

Sanikiluaq Truck Fill Station
Evaluation of Existing Condition

Type of Document
Final

Project Name
Assessment of the Sanikiluaq Water Intake

Project Number
OTT-00209718-A0

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Date Submitted
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1 Introduction

Concerns have been expressed by operational staff regarding the status of some of the systems in the truck-fill station in Sanikiluaq. These concerns included slow truck fill, challenges with the operation of the chlorination system and the operational status of the standby generator. The Department of Community and Government Services (CGS) retained **exp** Services to perform an assessment of the current truck-fill station. The following report presents:

- An overview of each system assessed,
- Findings regarding the condition and status of the systems, and
- Recommendations regarding modifications and improvements to these systems.

The assessment of the existing truck-fill facility was conducted during the week November 12, 2012 by technical personnel drawn from the consultant team that had designed and commissioned the existing truck-fill station. This team was assisted by a team of divers from ODS Marine who conducted an underwater inspection of the water intake. Assistance was also provided by representatives of CGS Technical Services and the Hamlet.

2 Water Intake

2.1 General

The water intake was constructed using a pair of 250 mm diameter high density polyethylene (HDPE) pipelines that extend through the truck-fill building wall into the lake. At a point approximately 50 metre from the shore these pipelines are connected together with a 45º lateral (wye). The intake extends a further 85 meters into the lake as a 150 mm HDPE pipeline, to a steel support on the lake bed. The pipeline is retained in position on the lake bottom by concrete ballast weights. Design drawings for the construction of this intake indicate that the support structure was constructed using 50 mm angle and was to be driven into the organic silt on the lake bed, with 900 mm of the structure extending above the bottom. The intake pipeline is secured to the support frame, and an upturned 90º elbow was provided to redirect the piping into the vertical plane. The design drawings depict the intake terminating with a stainless screen above this elbow. The current installation includes a second 90º elbow that redirects the piping into the horizontal was provided and the stainless steel screen was relocated to the end of the new piping.

2.2 Assessment and Findings

The intakes were assessed by the dive team that operated from the ice surface. A copy of the still photos and video gathered during this underwater inspection is attached. The initial dive was conducted at the intake end of the pipeline. A second opening was cut into the ice over the 45º lateral and a second dive was conducted from this point. Most of the intake pipeline was inspected, with the exception of a short segment near the shore, which was not accessible to the divers due to ice cover and rock cover.

In general the intake pipeline was found to be in good to very good condition. There was no indication of post-construction movement. The concrete ballast weights were in position and were found to be in good condition.

The principle findings at the intake are as follows:

- The steel frame supporting the end of the pipe and the screen was in sound condition and the pipeline was securely attached to the frame. The frame was found to be approximately 50 mm above the lake bottom.
- The intake screen is approximately 1.5 metres above the lake bed and is situated at a depth of approximately 4 metres.
- The flanged connection between the pipeline and the mitered elbow, and the connection between the elbows were found to be in good condition. The bolts, back-up rings and gaskets were intact and in good condition. There was evidence of minor corrosion of the metal parts.
- All of the bolts, back-up rings and gaskets at the connections to this fitting were found to be in position and secure.
- The bolts and back-up rings displayed very modest corrosion. These metal parts appear to be suitable to remain in service for some time.

  There was no opportunity for water and silt entry into the intake pipeline at the lateral.
- The back-up ring at the connection between the elbow and the intake screen displayed some deterioration due to corrosion. This ring, together with the blots, was considered suitable to remain in service.
- The screen was found to be in good condition. The screen was coated with vegetation. A photograph of this accumulation is presented in Appendix A of this report.

- It was noted that the intake screen displayed some inwards distortion, which may be indicative of larger than normal pressure difference across the screen.
- The screen was not removed for an internal inspection, as it was felt this would damage the back-up ring making replacement impossible.
- During the inspection the external surface of the screen was cleaned of accumulated vegetation.

Following the external cleaning of the intake screen, both intakes were back-flushed using a Hamlet water truck. Hamlet personnel assisted with this flushing, and the fittings assembled for this purpose were retained by Hamlet staff for future use, should the need arise.

2.3 Recommended Actions

No further short term actions, which require attention prior to next construction season, were identified. An inspection of the intake, by a dive team, on a five year cycle is recommended. This inspection should include cleaning of the screen of accumulated vegetation. The back-up ring that retains the intake screen should be replaced during the next underwater inspection.

It is recommended that operating staff consider back-flushing the intakes, should a drop in pumping capacity be noted.

3 Water Intake Pumps

3.1 General

Water is drawn from the lake through a pair of submersible pumps, one of which is installed in each intake pipeline. These pumps are installed at a point in the pipeline where they are permanently immersed. During a visit in July 2009 to the previous truck-fill facility it was determined that one of the intake pumps had failed. It was concluded that replacement of both pumps was appropriate. A pair of replacement pumps with the following characteristics was ordered.

- Manufacturer — Flowserve - Plueger
- Model — NB66
- Rating — 450 litres per minute into 24 metres of head
- Motor — 5 HP, 240 volt, single phase

Single phase motors were selected for this application due to the electrical arrangements of the truck-fill station that was in service at that time. The 5 HP motors supplied with these pumps were the largest motor size available, at the time, for single phase submersible water pumps.

This pair of pumps was incorporate into the design of the current truck-fill station. The decision to continue the use of single phase motors was reached based upon the desire to retain these pumps, together with the direction to incorporate a generator, which was currently in the community, as the source of standby power.

A flow meter was provided to measure pump discharge rate. It has been reported by representatives of CGS that the water intake pumps were providing approximately 570 litres per minute in February 2012.

3.2 Findings

It was initially noted that the control system was not in use and that the pumps were under manual control. Pump operation was achieved using the pump selector on the control panel, followed by switching on the control panel. This was followed by manually starting a chlorine metering pump. It appeared that pump WP 01 was the preferred selection. Both pumps (WP 01 and WP 02) appear to provide approximately 500 litres per minute. Pump WP 01 appeared to provide a slightly higher rate of flow. Both pumps are performing in a fashion that is consistent with the manufacturer's predictions. Based upon an interpolation of the pump performance curve, the variation in flow, as noted between February and November 2012, would arise from a modest increase in total dynamic head of approximately 3.6 metres (5 psi).

The electrical equipment associated with the pumps appears to be in good condition, and, electrically, the pumps are operating in a satisfactory fashion.

The decision to shut down the control system has some implications that include:

- The external push button control station on the fill arm is not operational in this mode.
- The energy recovery ventilator is not operation in this mode. As a result there is no ventilation of the building.
- The chlorine solution metering pumps do not start automatically.

During the course of the site visit it was recommended to the operating staff that the automated control system be kept in service. This requires that the pump selection control be placed in the “ALT” position and that the panel selector be placed in the “ON” position.

3.3 Recommendations

With regards the lake water pumps the following recommendations are presented.

- Ongoing logging of pump discharge rate should be undertaken. This will provide an indication in changes in pump performance, which will, in turn, demonstrate the need for investigation and action.
- The automated control system for the building should be retained in service. This will permit automated operation of the ventilation and chlorination systems.
- Provision of a push button station for pump operation within the building would be of operational convenience for Hamlet staff. This would permit pump cycling from a location protected from the weather.
- Consideration should be given to simultaneous operation of both pumps. This will reduce the time required to fill trucks without substantially reducing the life span for the pumps. Failure of a pump would be indicated by an increase in truck fill time, which in turn would induce action to resolve this matter. Minor modifications to the controls will be required to achieve this operating mode.

4 Water Filtration

4.1 General

Filtration of potable water supplies that are drawn from surface water sources is a stipulation of the Guidelines for Canadian Drinking Water Quality. Filtration is provided as a public health protection measure, as certain pathogens are not effectively removed if only chlorination is applied. The filtration system incorporated into the design of the Sanikiluaq truck-fill station is based upon cartridge filtration, as this method avoids the issue of management of process wastewater which would be a substantial challenge in this location.

The installed filters are Harmsco Model HUR 3X170FL, which are equipped with three HC/170 cartridges in each housing. Filtration in the sequence of 20 microns (µm), 5 C and 1 µm was provided. Provision was also made to apply chlorine upstream of the filters in an effort to avoid biological growth within the filters. The capacity, as rated by the manufacturer, of these filters is 450 USGPM (1,700 litres per minute).

The piping system at the filters includes bypass valves that permit individual filters to be taken out of service.

4.2 Findings

All of the filters were opened for an internal inspection. The construction of the filter housings provides for only partial draining of the housings to the level of the discharge tubes within the filter cartridges. No filter cartridges were found in any of the filter housings. The interior of the filter housings was found to be generally clean with a small accumulation of a material that appeared to be greenish-brown organic silt. The housing that normally contained the courses filters (20 µm) also displayed a limited accumulation of a material that resembled fish scales. Photos illustrating the internal conditions within the filters are presented in Appendix A of this report.

It was noted that the bottom chamber had been piped to the drainage trench, and that the cartridge chamber had not been provided with such a drain.

The isolation valves for the filters were left in the closed position and all filters were left in bypass mode. The status of the filters was reviewed with the Hamlet staff. It was recommended that the filter housings be disinfected, flushed and that cartridges be re-installed, and that the filters be returned into service.

4.3 Recommendations

It is recommended that the filters be returned to service. This requires that the filter housings be emptied, cleaned, disinfected, flushed of disinfectant solution and that filter cartridges be installed. The disinfection process should be conducted in accordance with AWWA Standard C653-03 Disinfection of Water Treatment Plants. It is also appropriate to replace the gaskets between the housings and the covers at this time. Annual replacement of these gaskets is a typical maintenance requirement for this type of filter.

It is recommended that valved drain piping be provided from the cartridge chamber to the drainage trench. This will facilitate ongoing internal cleaning and maintenance.

5 Chlorination System

5.1 General

The chlorination system is made up controllers, chlorine measurement equipment and chemical metering pumps. During normal operation, a pair of chlorine measurement and metering systems is in service. One of these systems applies chlorine solution upstream of the filters, to maximize contact time and to reduce the rate of biological growth within the filters. The second chemical metering system applies chlorine downstream of the filters and prior to loading into the trucks to assure appropriate chlorine residual for distribution purposes. Both of the systems include a chlorine analyser, a chlorine controller, a pump interface module and a pair of metering pumps. Disinfection of the raw water will lead to consumption of a portion of the chlorine dose. The chlorine analysers were provided to measure the remaining chlorine level and provide signal based upon chlorine concentration. A Sure-Feed pump interface module controls both pump operation and dosing rate. The metering pumps are installed in a fashion that provides alternation and also provides automatic starting of the standby pump in the event of failure.

A third chlorine metering system is provided for fire service. During fire conditions, water is hauled to the fire using Hamlet water trucks. It was intended that water supplied for this service be chlorinated to reduce the risk of contamination of the community water trucks while they are in use for fire service. With both lake pumps are in service there is a higher than normal flow rate. The metering rate of the third pump was calibrated for this flow condition. A chlorine analyser, controller and interface module was provided for this third chlorination system.

Signals to start the metering pumps are provided by the building control system, based upon the indications from flow switches. These signals are sent from the control panel to the Sure-Feed pump interface module. Direction to run the metering pumps is, in turn, communicated from the interface module to the metering pumps. A flow switch was provided for each chlorination system. The provision of a signal to operate the chlorination system requires that the building control system be powered, but this signal is independent of the position of the pump selection switch.

5.2 Findings

In general most of the chlorination system was found to be out of service, and metering pumps are currently started manually.

The in-line chlorine sensors are currently out of service. The in-line sensor housings are internally coated with a brown deposit. There was no indication of ongoing maintenance to this measurement equipment.

All of the chlorine controllers were found to be powered and appear to be functional. The displays of these controllers provided the following indications.

- Controller #1 — 0.00 PPM; stop key, fault
- Controller #2 — 0.00 PPM; auto
- Controller #3 — 0.15 PPM; auto

A single metering pump (Chemical Metering Pump No. 4) was in operating at the time of the site visit. This metering pump applies chlorine solution ahead of the filtration system. No chlorine is currently applied following filtration. Chlorination is initiated and halted using the stop-start button on the metering pump. It was reported that chlorination during fire service has been discontinued. This is consistent with the display indication of controller #1.

It was noted that operational personnel have become familiar with the metering pumps and are capable of the ongoing maintenance and repair required to keep the pumps in service. It also appears that chlorine concentration of the treated water is measured daily and the operating staff has become familiar with adjustment of the metering pumps to achieve a desirable treated water chlorine concentration.

5.3 Recommendations

As a general recommendation, it is proposed that the general disinfection strategy of applying chlorine, including pre and post filtration be applied. It is also recommended that chlorine be dosed during firefighting operations. This should incorporate the level of automation that was incorporated into the original design. Realizing this operating mode will require that much of the functionality of the chlorination system be re-established.

The chlorine sensors should be returned to serviceable condition. This would require cleaning of the in-line sensor housing, replacement of chlorine measurement membranes and electrolyte and replacement of the pH probes. It is the manufacturer's recommendation that the chlorine probes be serviced every 8 to 10 months, or if they provide unreliable indications. It is also recommended that the pH probe be replaced on an annual basis.

The chlorine controllers are serviceable, but are not in operation for various reasons. Following restoration of operation of the chlorine sensors, the controllers will provide a continuous indication of chlorine concentration in the treated water.

The opportunity to restore automated start-up of the metering pumps concurrent with operation of the lake pumps has been reviewed with the equipment supplier. Few if any modifications are required to provide this mode of operation.

The need to provide a strategy to respond to a failure of some part of the chlorination system must be recognized. This should include a method to easily place the chlorinator into a mode of operation that is independent of chlorine measurement, together with clear instructions on how to revert to this mode of operation.

Operation in manual requires pump feed rate be manually adjusted based in chlorine test results. The Hamlet staff is currently familiar with this method of adjustment of chlorine dosage.

It is recommended that the practice of chlorination both pre and post filtration be re-established. This will reduce the risk of biological accumulation within the filters while reducing the risk of the creation of chlorination by-products. The pre filtration chlorinator should be adjusted to provide a detectable residual following filtration. The post filtration chlorinator should then be adjusted to provide the residual that is desirable for distribution purposes.

It is recommended that the chlorination system be re-commissioned by the manufacturer's representative. This re-commissioning should include training. Consideration should be give to providing this training to a broad group of individuals.

6 Chemical Handling

6.1 General

Calcium hypochlorite was selected as the disinfection chemical due to the long shelf life of the dry powder. This chemical must be shipped by sea to the community, as air shipment is not permitted. Thus, sufficient stock must be maintained in the community to support annual consumption.

Calcium hypochlorite is a relatively easy to manage material. However there are some chemical handling issues that must be recognized. The powder will evolve chlorine gas, which in the long term is very corrosive for metal parts. Spillage of water onto the dry powder can lead to a chemical reaction and the release of chlorine gas. Absorption of humidity into the powdered chemical will lead to the release of chlorine gas. Contamination of the dry powder with combustible materials carries the risk of spontaneous combustion.

One specific group of concerns relating to calcium hypochlorite are the worker safety issues. Appropriate safety equipment, chemical information (MSDS) and training should be provided.

6.2 Findings

At the outset of the site visit it was noted that the disinfection chemical had been supplied in 20 litres pails. Purchase of this material in this type of pail is much preferable to bags, as this fashion of supply leads to much less spilled power. It also provides the opportunity to keep the container closed.

It was also noted that the annual supply of the chemical, together with the annual stock of filter cartridges was stored in the generator room. Corrosion of metal part, especially exposed copper was noted. It is likely that all of the electrical equipment has been affected to some degree by chlorine.

During the site visit, in response to a suggestion from the engineering team, the Hamlet relocated the disinfection material to another building. At the end of the visit the stock of chemical that was stored in the building was limited to the pail of dry powder that was in service.

Evidence of spilled powdered chemical was noted in the area of the chlorine solution mixing tank. This spilled powder is a source of chlorine gas, which causes corrosion of metal parts. Evidence of this corrosion was noted in locations such as within the energy recovery ventilation system.

No personnel protective equipment for operating staff was located during the site visit. MSDS information was not identified at the site

6.3 Recommendations

It is recommended that the practice of storing the disinfection material at a location, other than the truck-fill station, be continued.

It is recommended that a general clean-up of the truck-fill station be conducted. This would include a clean-up of evidence of spilled disinfection powder. Following this initial clean-up, operational staff should be specifically vigilant about minimizing spillage of powdered chemical and routine clean-up in the area of the chlorine mixing tank.

7 Building

7.1 General

The building can be described as being in good to very good condition. There were no external indications of vandalism. The envelope was found to be sound, without inappropriate air leakage. Internal lighting levels were appropriate and all lighting fixtures were operational. It was noted that the door lock set had been damaged. It was also noted that it is currently not possible to lock the door. A lack of control of access creates the risk of unauthorized entry.

7.2 Recommendations

It is recommended that a new lock set, which includes a keyed lock, be provided.

8 Mechanical Systems

8.1 Heating

8.1.1 General

The heating system for the building consists of a fuel fire unit heater situated in the pump room. This heater is controlled by a thermostat. Early in the life of the facility some concerns were expressed regarding the exhaust flue for this heater. The flue was subsequently modified.

8.1.2 Findings

At the time of the site visit the unit heater was operating satisfactorily. The thermostat was cycling the heater. The heater has capable of providing a comfortable environment with the truck-fill station building.

8.1.3 Recommendations

No further action is recommended in connection with the heating system.

8.2 Energy Recovery Ventilation

8.2.1 General

An energy recovery ventilation (ERV) system was provided in the pump room. This ventilator recovers heat from the exhausted air and uses this recovered heat to warm incoming make-up air. Controls signals for the operation of the ERV are provided by the building control panel. Limit switches on the motorized dampers for fresh and exhaust air interlock the operation of the ERV through the control panel. Operation of the ERV requires that the building control system (CP-01) be in service.

8.2.2 Findings

Initially, during the site visit the ERV was found to be out of service. It was determined that some combination of control panel shut down and inappropriate position of the motorized dampers was preventing start-up of the ERV. It was also noted that the ERV and especially the internal electrical components were demonstrating the effects of corrosion due to chlorine.

Following the cleaning of some connections, resetting of the dampers and activation of the building controls the ERV returned to operation.

8.2.3 Recommendations

It is recommended that the ERV be maintained in service. This includes maintaining the building controls (CP-01) in service. Continued operation of the ERV will reduce the corrosion impacts due to chlorine.

8.3 Mechanical Room Exhaust Fan

8.3.1 General

A chlorine detector has been provided in the general area of the solution mixing and storage tanks. Indication of high chlorine levels causes a pair of motorized dampers to open and the exhaust fan to operate. The fan can also be manually started.

8.3.2 Findings

The exhaust fan and associated motorized dampers were found to be operational.

8.3.3 Recommendations

No further action is recommended at this time.

9 Electrical Distribution

9.1 General

The facility was constructed with 120/240 volt single phase supply and distribution. A 25 kVA standby generator, together with an automatic transfer switch have been incorporated into the system. The electrical distribution equipment is located in the generator room. The decision to make use of single phase power was based upon direction to incorporate an existing generator into the design of the facility.

Comments regarding the standby generator are provided in a subsequent section of this report.

9.2 Findings

The electrical distribution equipment was found to be serviceable. There was evidence of corrosion due to chlorine, which had been stored in the generator room. A photograph indicating the corrosion of the ground bus bas is provided in Appendix A of this report. It is likely that some degree of corrosion has occurred within the various electrical panels and equipment in the generator room.

9.3 Recommendations

The key issue with the electrical distribution equipment is corrosion due to chlorine. A general clean-up of the truck-fill station should be undertaken, with a specific target of removing any spilled powdered chemical. A general maintenance of the electrical equipment is also appropriate. This would include confirming the condition of connections and cleaning of contacts that may have been affected by chlorine.

10 Standby Generator

10.1 General

The original electrical installations include a 25 kVA standby generator and automatic transfer switch. This generator had been previously mobilized to the community and was re-purposed into the truck-fill station project. The scope of specified work associated with the generator and transfer switch included motorized dampers for modulation of room temperature during generator operation and provision of a battery charger.

10.2 Findings

The generator was initially found to be out of service. It was noted that there was no power to generator control panel and that the block heater was not operating. A defective internal electrical connection was located within the generator control panel and this issue was rectified. Following an attempt to start the generator it was determined that the engine fuel system required bleeding. The fuel system condition was resolved and the generator was successfully started. It was also noted that resolution of the internal connection issue within the generator controls returned the engine block heater to service.

Initially the motorized modulating dampers were not operating properly. It was determined that some wiring had been misconnected. Following resolution of this issue, the motorized dampers functioned properly.

The generator was tested, both with and without load, and it performed satisfactorily. This included operation during truck fill cycles. Simulation of a failure of electrical supply demonstrated that the automatic transfer switch was operating correctly.

Subsequent to the installation of the generator in the truck-fill station, the alternator was replaced. The original alternator remains on site.

A battery charger was not found during the site visit.

10.3 Recommendations

It is recommended that a battery charger be provided. It is also recommended that this generator be the subject of an ongoing maintenance program.

11 Fuel System

11.1 General

The fuel system includes an external storage tank, a transfer pump set, a day tank, a PLC based controller and piping. Fuel is pumped from the external storage tank into the day tank a duplex transfer pump set. The design of the system provides for the transfer of fuel based upon the level in the day tank, which is measured using an ultrasonic transmitter. An ultrasonic transmitter was also provided for the external storage tank. Both the day tank and the external storage tank are equipped with mechanical float gauges.

A transfer pump has been provided to provide fuel to the unit heater in the pump room. The return from this unit heater is directed into the day tank. Fuel requirements for the generator are drawn directly from the day tank and return flow is directed to the exterior storage tank.

The fuel system is under the surveillance of an independent, PLC based, control system. These controls monitor tank levels and command transfer pump operation based upon day tank levels.

11.2 Findings

Initially the fuel transfer system was found to be shut down. The PLC was restarted, and following this re-initiation presented indications of exterior and day tanks levels.

Based on observations of the panel indications of tank levels, it was concluded that the indication of day tank level was instable during operation of the transfer pumps. It was also noted that the inflow point from the transfer pumps was in close proximity to the ultrasonic transmitter. This may be the result of several conditions including interference from the spray of fuel into the tank and misinterpretation of the fuel level due to waves due to the fuel splashing into the tank.

Subsequent to the site visit, a review of the photographs taken during a visit to the site in December 2010 was undertaken. It is noted that the level transmitter was changed following the 2010 visit. We also note that the current transmitter makes use of a different sensing technology from the original installation. No information has been obtained regarding the reason for the change of this transmitter. It is also noted that the new transmitter is located in closer proximity to the fuel inflow point that the original transmitter. No operating instructions for the current transmitter were located at the site. Due to a lack of operating instructions the impact of adjustment to various parameters of the level transmitter could not be investigated. There is also the potential for interference between the ultrasonic beam and the tank wall.

11.3 Recommendations

It is recommended that the reliable automated operation of the fuel transfer pumps be re-established. It appears that reliable measurement of the level in the day tank is key to the reliability of this system.

12 Wastewater Collection

A preference has been expressed by Hamlet staff that this tank be equipped with a float switch and an external indicating light. .

12.1 General

Wastewater that is generated within the facility is pumped into a translucent tank within the building.

12.2 Findings

A preference has been expressed by Hamlet staff that this tank be equipped with a float switch and an external indicating light.

12.3 Recommendations

It is recommended that the installation be modified to incorporate the changes requested by the Hamlet staff.

13 Operations

In general it was noted that a general clean-up of the interior of the truck-fill station was in order. Good housekeeping is an important measure to reduce the effects of the dry powdered chlorine on the internal equipment. Good housekeeping also carries the advantages of providing a more pleasant environment for operational personnel.

Maintenance in service of the ventilation system will aid in reducing the impact of chlorine upon the equipment within the building. This will require ongoing confirmation of the functionality of the ERV, occasional resetting of the controls, lubrication and maintenance and replacement of the air filters.

It is appropriate that the building be kept locked, especially outside of working hours. In addition to the risks if vandalism and internal damage, there is a concern for exposure to chlorine, both as powder and solution, to unauthorized persons that may enter the building.

It was noted that an up to date Operations and Maintenance Manual was not available. This lack of technical information hindered some activities during the assessment of the facility. Of greater concern is the added challenges for operational staff due to a lack of access to instructions and technical information relating to the installed equipment.

14 Consultation with Hamlet

During the course of the site visit a series of meetings were held with Hamlet staff. These meetings provided an opportunity to convey the intent of the site visit; report progress and findings; and express some initial recommendations. The following is a brief summary of these interactions with local representatives.

Date and Time	Princicple Local Representatives	Purpose
November 13, 2012; 15:00	Mayor, SAO, Foreman, one driver	Introduction
November 14, 2012; 9:00	Mayor, SAO, Foreman, one driver	Report on pending dive
November 14, 2012; 16:30	Mayor, SAO, Foreman	Report dive findings
November 15, 2012; 9:00	Mayor, SAO, Foreman	Update on activities
November 15, 2012; 16:30	Mayor, SAO, Foreman	Overview of findings
November 16, 2012; 9:00	SAO	Thank you and team departure

15 Acknowledgements

Activities during the site visit were greatly facilitated by the assistance of Hamlet and Government of Nunavut staff. This assistance enhanced the quality and depth of the findings of the engineering team. Specific acknowledgement is made for the assistance provided by the following representatives.

Andre Larabie, SAO

Moses, Hamlet Foreman

Kenny. Water truck driver

Daniel Essiambre. Technical Services, CGS, Government of Nunavut

16 Summary

The findings of the recent assessment of the Sanikiluaq truck-fill station may be summarizes as follows:

- The intake, including the connections and supporting frame was found to be in good condition, and is generally suitable to remain in continuing service.
- Some degree of corrosion of the back-up ring securing the screen to the intake was noted. This ring is nearing the end of its service life.
- The water intake pumps are providing a discharge flow rate that is slightly higher than the operating point that was chosen during the selection of these pumps. There appears to be a modest reduction in pumping capacity, based upon observations taken in February 2012.
- At the outset of the visit, it was observed that routine operation included manual pump starting. The building controls were normally shut off. This has implications on several building systems including pumping, chlorination and ventilation.
- No cartridges were found in the filter housings. At the end of the site assessment the filters were left in a bypass mode, awaiting internal cleaning and cartridge installation.
- The chlorination system was operating in manual mode with a single chlorinator providing chemical feel ahead of the filters.
- With the exception of the chlorine measurement system, the chlorination system equipment seems to in functional condition.
- The stock of chlorination chemical has been removed from the building, with the exception of a single container, which provides for the routine and ongoing need for make-up of chlorine solution.
- No personnel protective equipment of MSDS information, as relates to the chlorination materials was located.
- The building was found to be in good condition. The only building deficiency noted as a lack of a lock for the entry door.
- The heating system is performing as intended. The energy recovery ventilation system was returned to service during the visit. The mechanical room exhaust fan appears to operate as intended.
- The electrical distribution equipment appears suitable for continued service. There is significant potential for internal corrosion of this equipment due to the past practice of storing chlorination chemical in the generator room.
- The standby generator was returned to service during the assessment visit. The generator and transfer switch appear to operate appropriately. It was noted that there is currently no battery charger for the standby generator.
- In general fuel system is operating properly, with the exception of the measurement of the level in the day tank. Instability with the day tank level measurement has raised issues with the operation of the fuel system, including frequent false alarms.
- The wastewater collection tank does not have an indicating light, external to the building that demonstrates the need for service by the Hamlet sewage trucks.
- A general housekeeping of the truck-fill station is in order. This will reduce the ongoing damage, including corrosion, arising from the chlorination chemical.
- It is appropriate the building be kept locked.
- A complete and up to date Operating and Maintenance Manual is currently not available.

17 Recommendations

Based upon the various observations and findings the following recommendations are presented.

- The water intake should be inspected, by divers, on a 5 year cycle. The bask-up ring retaining the intake screen should be replaced during the next of these inspections.
- Backflushing of the intake should be considered as one response, should there be a reduction in pump delivery.
- Ongoing logging of pump performance (discharge flow rate) should be initiated. This can take the form of a minor modification to the existing chlorine monitoring records.
- The building control system should remain in constant service, This includes operation of the water supply pumps. A push button control station, internal to the truck-fill station, should be provided.
- The water filters should be cleaned and returned into service.
- The chlorination system should be returned into automated operation. Re-commissioning by the equipment supplied is an appropriate method to achieve this mode of operation.
- The operating instructions for the station should include clear direction regarding the most appropriate fashion to place the chlorination system into manual mode, should an equipment issue required this mode of operation.
- Appropriate information and training should be provided regarding safe chemical handing. Appropriate personnel safety equipment should be provided.
- An appropriate lock should be installed in the entry door and the building should be kept locked.
- A battery charger is required for the standby generator.
- Reliable automated operation of the fuel transfer system should be re-established. This will require, among other actions, reliable and stable measurement of the day tank level.
- It is the preference of Hamlet staff that an indicating like be provided for the wastewater tank.
- A general clean-up of the truck-fill station should be undertaken.
- A general cleaning and maintenance of the electrical equipment should be undertaken. This clean-up will serve to mitigate the impact of chlorine upon this equipment, as well as extend the useful life of this equipment.
- An Operations and Maintenance Manual that is complete and up to date should be provided to the operating staff.

Appendix A – Photographs

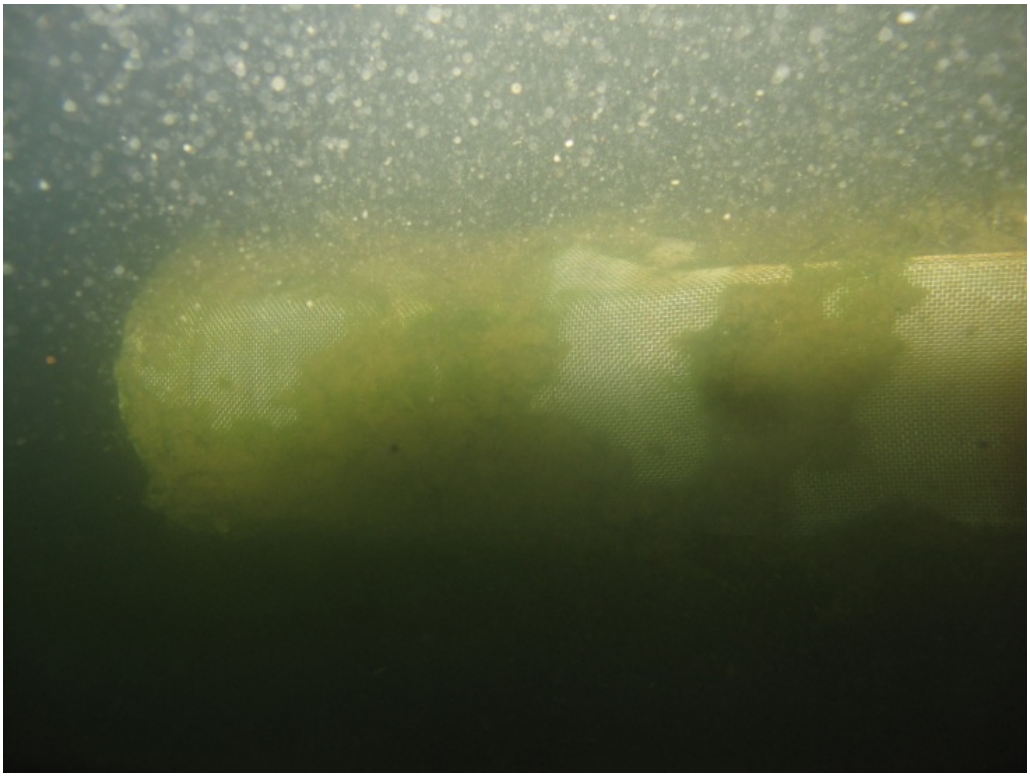

Photo 1: Intake Screen Prior to Cleaning

Photo 2: Typical Ballast Weight

Photo 3: Typical Flanged Joint at Lateral

Photo 4: Filter Housing 20 Micron

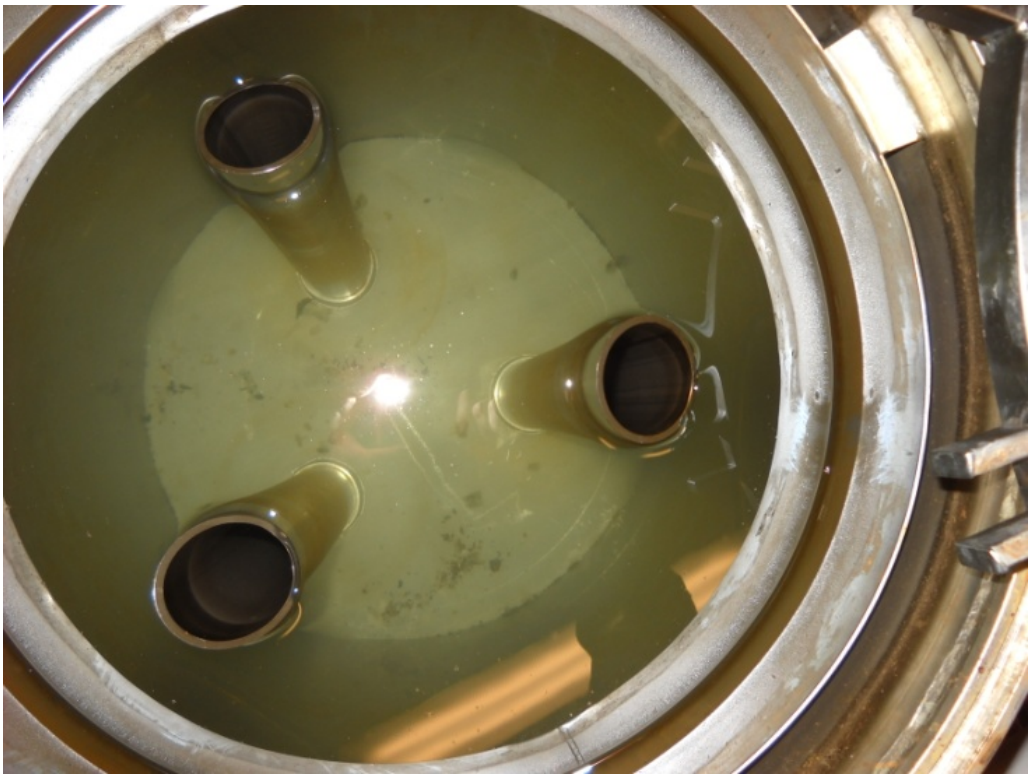

Photo 5: Filter Housing 5 Micron

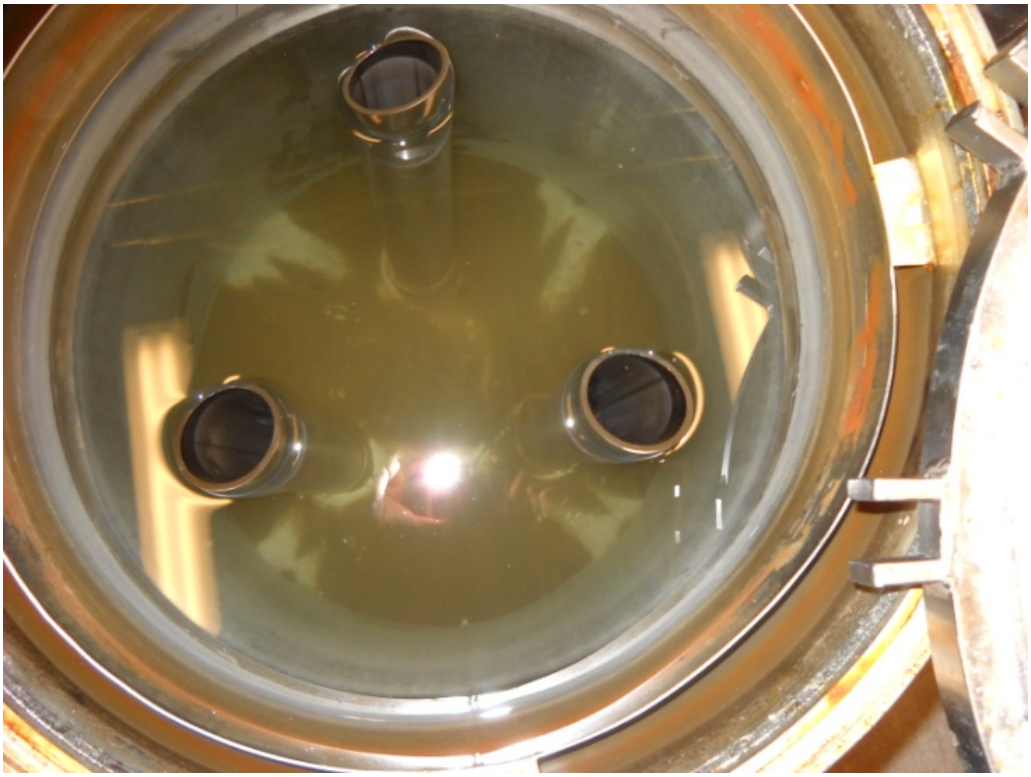

Photo 6: Filter Housing 5 Micron

Photo 7: Metering Pumps

Photo 8: Chlorine Controller

Photo 9: Inline Chlorine Measurement

Photo 10: Metering Pump Interface

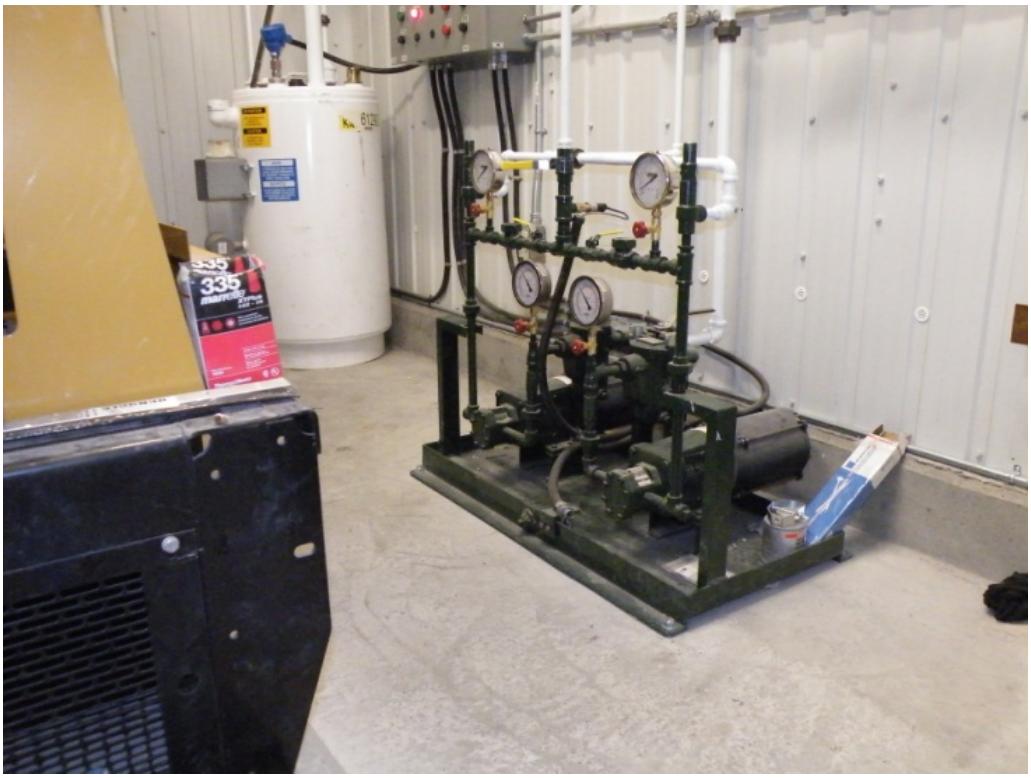

Photo 11: Transfer Pumps and Day Tank (December 2010)

Photo 12: Day Tank (November 2012)

Photo 13: Day Tank Level Sensor

Photo 14: Facility Control Panel

Appendix B – Photographs and Videos from Underwater Inspection (see attached Disc)