PUBLIC SERVICES AND PROCUREMENT CANADA

Waste Fuel Reduction Plan: Isachsen High Arctic Weather Station (HAWS), Nunavut

Prepared for Public Services and Procurement Canada on behalf of Environment and Climate Change Canada (ECCC)

DFRP #: 07527

FCSI #: 07525123

Final Report

Waste fuel drums being Inventoried
July 2023

Incinerator test burn
July 2024

February 2025

151 Holland Ave.
Suite 200
Ottawa, Ontario
Canada
K1Y 0Y2
Telephone
613.729.2402

February 10, 2025

Environmental Services and Contaminated Management
Public Services and Procurement Canada
9700 Jasper Ave NW, Suite 1000
Edmonton, Alberta T5J 4C3

Attention: Mr. Michael Brownlee
Senior Environmental Specialist

Dear Mr. Brownlee:

Nuqsana-Outcome Joint Venture (NOJV) is pleased to provide Public Services and Procurement Canada (PSPC) with the attached Waste Fuel Reduction Plan report for Environment and Climate Change Canada's (ECCC's) Isachsen High Arctic Weather Station (HAWS) in Nunavut.

Should you have any further questions or comments, please contact the undersigned at your convenience.

Yours truly,

DILLON-OUTCOME JOINT VENTURE

Keelan Veitch, B.Sc.
Senior Environmental Project Manager

Don Plenderleith, M.Sc., P.Eng. (NU/NWT)
Environmental Division Manager

Our File: NP2023-16

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Executive Summary

Nuqsana and Outcome Consultants Inc. in joint venture (Nuqsana-Outcome or NOJV) was retained by Public Services and Procurement Canada (PSPC) to complete a Fuel Reduction Plan for the decommissioning and remediation at the Isachsen High Arctic Weather Station (HAWS) on Ellef Ringnes Island in Nunavut (the Site). The purpose of this task is to provide a scope, plan, and schedule for the reduction of waste fuel currently on site at the Isachsen HAWS. Prior to developing this Plan NOJV conducted a waste fuel inventory, product testing and recommissioned two incinerators at the Site which were used for burning (flaring) waste fuel in an earlier phase of the site decommissioning. Identifying the additional equipment required for the fuel reduction plan, and specifying the setup of a dedicated area for fuel incineration are also included in this Plan.

The waste fuel inventory has found that there is approximately 76,200 litres (L) of waste fuel on site. The fuels are contained in varying quantities at four identified locations: Drums, Runway Tanks, Middle/Lower Tank Farms, and 31 Other ASTs. The fuel types are diesel (52,224L), jet fuel, A and B (13,395 L), gasoline (4,665 L), kerosene (1,055 L), oily water (5,302 L) and other (1,190 L).

In the incinerator recommissioning program conducted in the field season of 2024, the incineration chambers that were present on site were upgraded with modern control panels, blowers, pilot burners, and waste fuel pumps. The incinerators were recertified by their original manufacturer, Ketek Group Inc. and tested with the major types of waste fuel present, with the exception of gasoline. The burn rate is 113 L/per hour for all types of fuel. Gasoline must be mixed with other fuels with a higher flashpoint to be incinerated. A standard operating procedure (SOP) for the incinerators has been produced and is included as an appendix to this report.

A plan to incinerate all of the fuel in the 2025 field season has been developed. An incinerator operation area would have to be set up, with the fuel separation mixing tanks, generators for electrical power and the incineration units themselves. A location and a schematic of the operation area is contained in **Appendix E: Incinerator SOP**. Additional equipment required to complete the fuel reduction plan includes: mixing tanks, oily water and fuel separation totes, drum grabber for the loader on site, and spill kits. The fuel reduction plan would have a duration of approximately 42 work days. Following the reduction / removal of waste fuels, the required steps could be taken to properly render the registered tanks out of service.

1.0 Introduction

Nuqsana and Outcome Consultants Inc. in joint venture (Nuqsana-Outcome or NOJV) was retained by Public Services and Procurement Canada (PSPC) to complete a Fuel Reduction Plan for the decommissioning and remediation at the Isachsen High Arctic Weather Station (HAWS) on Ellef Ringnes Island in Nunavut (the Site). The purpose of this task is to provide a scope, plan, and schedule for the reduction of waste fuel currently on site at the Isachsen HAWS. Prior to developing this Plan NOJV conducted a waste fuel inventory, product testing and recommissioned two incinerators at the Site which were used for burning (flaring) waste fuel in an earlier phase of the site decommissioning. Identifying the additional equipment required for the fuel reduction plan, and specifying the setup of a dedicated area for fuel incineration are also included in this Plan.

The work was carried out as a component of the 2024-25 Scope of Work for the Isachsen HAWS provided by PSPC to NOJV in May 2024. The work was carried out for PSPC on behalf of Environment and Climate Change Canada (ECCC) under the Standing Offer Agreement #EW699-220414/011/NCS, project number R.125553.001.

1.1 Objectives of this Task

Reducing the quantity of waste fuel stored at the Isachsen HAWS is a precautionary measure being undertaken to reduce the risk and liability of site contamination from potential releases from the considerable volume (approximately 76,200 L) of waste fuel at the Site. Given the urgency of reducing the risk of contamination, this plan will be implemented ahead of the wholescale decommissioning of the Site. The waste fuel has been accumulating in the 45 years since staffed operations at Isachsen ceased. The volume of unused fuel originates from the partial decommissioning projects in the 1990s, leftover fuel from numerous other projects at Isachsen, and expeditions to the North Pole using Isachsen as a fuel cache location.

From a compliance perspective, the Site is under the federal *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulation* (amended Oct 20, 2020) and the CCME *Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.* Nine of the ten large fuel storage tanks are registered in the Federal Identification Registry for Storage Tank Systems (FIRSTS). Although a formal tank compliance study has not been done, there are non-compliance issues related to inventory control, inspection and record keeping, and corrosion protection.

The total volume of waste fuel is approximately 76,200 L. There are approximately 304 drums that are either full or partially full of waste fuel which contain approximately 20,800 L of various fuel products. The three above ground storage tanks (ASTs) at the runway contribute the largest portion of the waste fuel with a total of approximately 45,800 L of diesel fuel. As well, other ASTs located in various locations

around the Site contain approximately ~9,500 L of various fuel products too. These tanks that are partially full of petroleum product are deemed to still be *in service*.

The objective of the waste fuel reduction plan is to reduce the fuel inventory to zero thereby reducing the risk of contamination from potential future tank or drum leakage. Following the elimination of the product within the tanks, steps can be taken to officially take them out of services, and update their status within FIRSTS.

Table 1-1 below summarizes the ASTs located at the Site and the estimate volume of product contained within them.

Table 1-1: AST Summary Table

Location	Tank ID	Suspected Fuel Type	Estimated Volume of Product (L)
Runway Tanks	Tank 00001914	Diesel	21,221
	Tank 00001920	Diesel	17,170
	Tank 00001923	Diesel	7,427
	Tank 30	n/a	0
Middle and Lower Tank Farm	Tank 00001915	n/a	0
	Tank 00001916	n/a	Assumed 0[1]
	Tank 00001917	n/a	0
	Tank 00001918	Diesel	965
	Tank 00001921	n/a	0
	Tank 00001922	n/a	0
Other AST's	Tank 1	n/a	0
	Tank 2	n/a	0
	Tank 3	n/a	0
	Tank 4	Diesel	25

[1] A visual inspection of the inside of the tank from above could not be performed due to the damaged ladder on the tank.

	Tank 5	n/a	0
	Tank 6	n/a	0
	Tank 7	n/a	0
	Tank 8	n/a	0
	Tank 9	n/a	0
	Tank 10	Diesel (99.9% Water)	840
	Tank 11	Diesel (99.9% Water)	160
	Tank 12	n/a	0
	Tank 13	n/a	0
	Tank 14	Diesel (33.7% water)	50
	Tank 15	Diesel	3,328
	Tank 16	n/a	0
	Tank 17	n/a	0
	Tank 18	n/a	0
	Tank 19	n/a	0
	Tank 20	Diesel	25
	Tank 21	Diesel (99.9% water)	1,130
	Tank 22	Diesel (99.9% water)	1,390
	Tank 23	Diesel (55% water)	200
	Tank 24	n/a	0
	Tank 25	n/a	0
	Tank 26	n/a	0
	Tank 27	Diesel	600
	Tank 28	n/a	0
	Tank 29	n/a	0
	Tank 31	Diesel	850
Operations Building	Two large tanks	n/a	0

Power House	Eight tanks	n/a	0

2.0 Background Information

2.1 Site Description and History of the Site

The Isachsen HAWS has a total area of approximately 450 hectares (ha) and is centered at a latitude of 78o 46' 40" N and 103o 31'40" W longitude facing Louise Bay, on the west-facing side of Ellef Ringnes Island, NU. The federal land reserve is occupied by approximately 21 permanent structures with associated infrastructure, equipment, and supplies. Other features previously identified at the Site, in addition to the 21 structures, include a 1,300-metre-long runway, former water and sewage infrastructure, fuel storage and distribution facilities, power generation equipment, two on-site waste disposal areas (WDAs), another potential WDA, fuels tanks, thousands of empty/partially empty barrels, other abandoned equipment, and debris. A Site Location figure is presented in **Appendix A.**

The supplies for constructing the initial buildings and grading of the runway at Isachsen were mobilized by air and deposited on sea ice between April 3 and 21, 1947. The station operated as one of five Joint (Canadian and American) Arctic Weather Stations for the purpose of measuring meteorological information and relaying it down to weather analysists in the South. One of the weather measurement activities consisted of filling and releasing hydrogen-filled balloons and tracking their movement. The United States left this partnership in 1972. Canada maintained a staffed operation at Isachsen under Transport Canada until 1975 and under Environment Canada until September 1978 when the staffed station was closed.

Since 1978, the weather data collection facilities at Isachsen have been automated and the facilities at the Site have been used to support numerous scientific research groups, and for hosting exercises by the Canadian Rangers. The Meteorological Services of Canada Bureau (MSCB) operates an automated weather station at Isachsen which is available at: Isachsen - Past 24-Hour Conditions - Environment Canada (weather.gc.ca). Access to Isachsen for building materials, equipment and personnel has been exclusively by air (with one exception) including documented access by large transport aircraft (Hercules) in the past. Isachsen was reached by cat train over ice by a remediation contractor in 1995. There is no record of it having been reached by sea.

Waste clean-up efforts began in 1996 with drum crushing, partial fuel incineration and burial of derelict heavy equipment in the West Gully Landfill, but very muddy conditions made the job very difficult. The two incinerators currently on-site were brought to the Site and used for that endeavour.

The Site has been the subject of numerous studies by various consultants since 1996. Of interest to waste fuel and drum and tank management are the following reports:

- Stantec. *Isachsen Storage Tank Decommissioning Strategy.* (Stantec 2014);
- DOJV. *Isachsen High Arctic Weather Station Data Gap Analysis Report.* (DOJV 2023); and
- NOJV. *2023 Environmental Site Assessment (ESA) Summary Report: Isachsen High Arctic Weather Station (HAWS), Nunavut.* (NOJV 2024).

2.2 Applicable Guidelines and Regulations

Canada. *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulation* (amended Oct 20, 2020)

CCME. *Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products* (2003, with updates to 2015).

Indian and Northern Affairs Canada. *Abandoned Military Site Remediation Protocol. Volume 1, 2008. Appendix B Barrel Protocol*.

Nunavut, Department of Environment. *Environmental Guideline for the Burning and Incineration of Solid Waste*. (2012)

Nunavut, Department of Environment. *Environmental Guideline for Used Oil and Waste Fuel*. (2012)

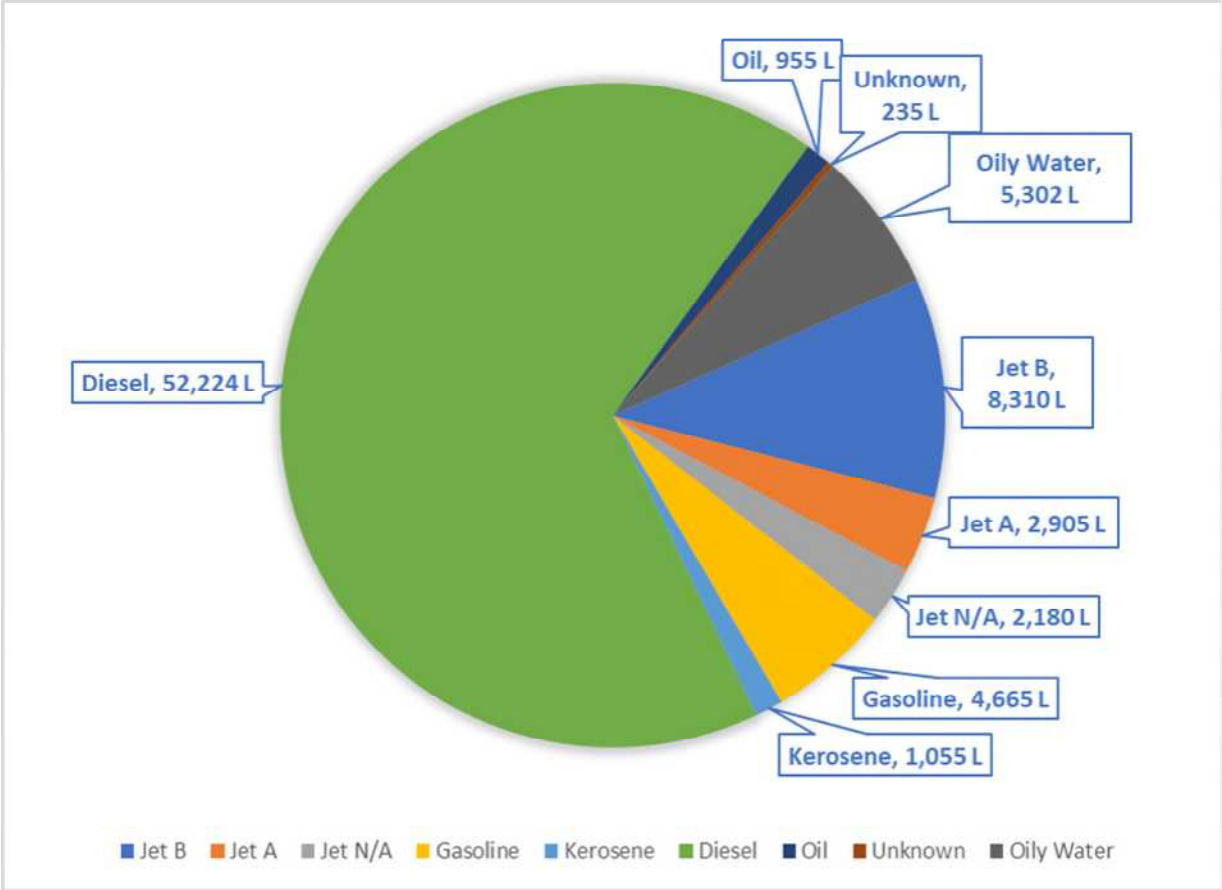
There is no specific regulation or permit required for the use of forced air incinerators for fuel in Nunavut. There is a guideline published by the Nunavut Department of Environment on Burning and Incineration of Solid Waste, which mentions that burning waste with forced air incinerators is a recommended practice. Registration of waste fuel burners is optional. The activity of fuel incineration will require an application for a Land Use Permit to be submitted to the Nunavut Planning Commission at least 100 days prior to the commencement of that activity. This activity is consistent with the land use at Isachsen, so it is not expected to require screening by the NIRB.

Significant amounts of fuel handling will be required in the incineration process and safe handling practices and spill protection measures will need to be in place, and spill clean up equipment will need to be on hand.

3.0 Waste Fuel Inventory Summary

There is approximately 76,200 L of waste fuel on site, the fuels are contained in varying quantities at four identified locations: Drums, Runway Tanks, Middle/Lower Tank Farms, and 31 Other ASTs. Figure 3-1 shows the breakdown of the types of fuels on site. See **Appendix B** for the full Fuel Inventory at the Site.

Figure 3-1: Waste Fuel Types and Volumes



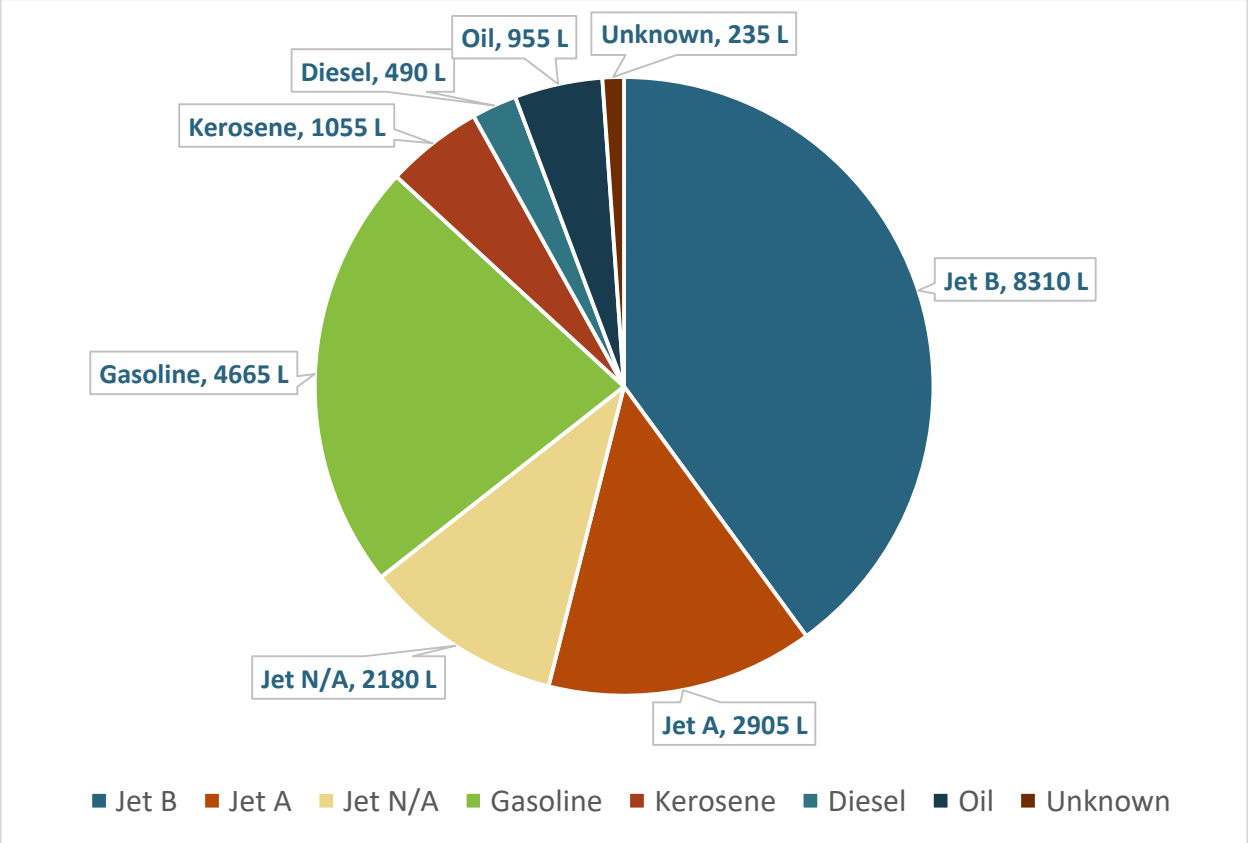
3.1 Fuel in Drums

There are 304 drums with various fuels on site accounting for currently an estimated 20,800 L of waste fuel. The various labels on drums categorized them into 7 fuel groups with 1% of the drums being unknown fuel. There are 49 drums that are open and/or had results displaying high-water content. Figure 3-2 shows the breakdown of the types of fuels contained in the drums at the Site.

Lab analysis completed by NOJV during the 2023 field program also identified that despite the drum labelling and drums being sealed, some drums contained fuel and water mixtures. Therefore, any drum which was not full but sealed has the potential to contain some water content. Using this assumption an estimate of approximately 1,655 L of oily waste water can be dissociated from the 20,800 L of waste fuel in the drums.

As well, lab analysis from 2023 indicated that four drums (Group DR23-AW1) marked *piston oil* contain lead content, above the Abandoned Military Site Remediation Protocol (AMSRP) guideline for incineration. These four drums will require removal from the Site and will be management as liquid hazardous waste.

Figure 3-2: Drum Waste Fuel Types and Volumes



Photographs of the drum fuel inventory are provided in **Appendix C.**

3.2 Fuel in Aboveground Storage Tanks (ASTs)

A site figure showing the AST locations and highlighting the ASTs with product remaining is provided in **Appendix A.**

3.2.1 Runway Tanks

There are four 57,727 L vertical storage tanks at the southwest end of the runway three of which currently contain a combined volume of approximately 45,800 L of waste diesel. Tanks 00001914, 00001920, and 00001923 (the Runway Tanks) contain 21,221 L, 17,170 L and 7,427 L of product, respectively (totalling 45,818 L), Tank 30 is separate off to the side and is empty. Testing and analysis of the product in the Runway Tanks in 2023 identified it as diesel and subsequent testing in 2024 determined the diesel has a sulfur content that is higher than current specifications.

3.2.2 Middle and Lower Tank Farms

There are six registered 57,727 L tanks located at the Middle (1) and Lower (5) Tank Farms north of the Main Station complex, along the main road. Tank 00001918 contained approximately 965 L of waste fuel and Tank 00001916 could not be assessed due to damage to its ladder. The other five tanks were confirmed to be empty via inspection from an access hatch on top of the tanks or from an open inspection hatch near the bottom of the tank (Tank 00001922).

3.2.3 Other Above Ground Storage Tanks (ASTs)

There are 31 other ASTs located around the Site. Eleven tanks were confirmed to have fuel remaining within them with a combined volume of approximately 8,600 L. Lab analysis completed by NOJV during the 2024 field program found some of the ASTs have high water content within the fuel caused by the tanks being unsealed and open to the elements. As a result, there is an estimated quantity of 3,650 L of oily waste water that can be dissociated from the 8,600 L fuel total.

Photographs of the tank inventory with waste fuel present are provided in **Appendix C.**

3.3 Fuel Testing Results

In 2023 NOJV completed fuel analysis from the Runway Tanks and collected one representative sample from each drum group as determined by the physical fuel label, drum appearance and proximity to each other. Many drums contained fuel water mixtures, and one drum sample group (DR23-AW) had lead content exceeding the AMSRP incineration protocol guidelines.

In 2024 NOJV completed a full inspection (as possible) of the other 37 ASTs on Site in accordance with Working from Heights protocols. Eleven tanks were found to contain fuel and/or fuel water mixtures. Additionally, a more comprehensive suite of diesel testing was carried out on the Runway Tanks to determine the quality of the diesel and if re-use was possible. The diesel had high sulfur content exceeding the current guidelines.

Refer to **Appendix B** for the 2023 and 2024 fuel analytical results.

4.0 Incinerator Recommissioning

4.1 Incinerator Background

In March 1996 a fuel incineration system with two incineration chambers was brought to the Site by the Nunasi Corporation under contract with PWGSC. The system was used to burn off waste fuel from drums prior to drum crushing. The incinerator was built by the Ketek Group Inc. (Ketek) from Edmonton, AB. The incineration system had a small gas-powered motor driving a single blower with a manifold to six air hoses (three for each incineration chamber). This system had a basic control panel used to ignite the incinerators and pump waste fuel into the two incineration chambers (Figure 4-1 below).

Figure 4-1: Previous Fuel Incineration System in Operation (1996).

During NOJV's 2023 work program the incinerator conditions and parts were documented. The blower/control panel had been stored in the New Garage and incineration chambers were found partially sunk in the mud south of the Runway Tanks (Figure 4-2 below). This sparked an investigation into whether these units could be recommissioned for future incineration of the remaining waste fuels on the Site.

Figure 4-2: Fuel Incinerator Condition in 2023.

In early 2024 NOJV consulted Ketek about recommissioning the incineration system. Ketek advised that the control panel and blower units were likely not operable or up to current incinerator safety standards, however, the incineration chambers could likely be reused provided that the refractory lining was still in good condition.

4.1.1 Current Conditions of the Runway Tanks Berm, Liner and Spill Prevention Measures

In 1996 a fuel containment berm was built around the Runway Tanks. The berm capacity totaled approximately 41,029 L (Figure 4-2 below).

Figure 4-3-2 Original Berm around the Runway Tanks in 1996

The current conditions of the berm have since changed with the addition of a liner placed overtop a drum berm with some exterior soil shaping. The liner is tied down using the weight of some plywood wedged underneath the tanks as well as with soil which may have been placed to protect the liner from tearing. However, there is evidence of tearing of the liner around the northwestern corner of the berm and the drums forming the berm have separated over time, leaving notable sagging of the liner in each of the corners. Photos of the current state of the Runway Tanks and berm conditions are presented in **Appendix C.**

Site visits have shown the berm to hold some pooling water. This pooling water is an accumulation of mostly snow melt as Isachsen receives minimal precipitation throughout the year. The amount of seasonal pooling noted within the berm depends on the year and the timing of the investigation. No PHC sheen or odour has been noted within the pooling water and the water tends to evaporate within the berm by mid to late summer. The minimal volume of seasonal pooling water within the berm is not expected to affect the capacity of the berm as it stands in its current state.

The berm capacity total of 41,029 L, even if rendered leakproof, is insufficient to contain the volume of one of the tanks, plus 10%; all three tanks have the same capacity of 57,727 L. However, at present the volume of product in the fullest of the three tanks is 21,221 L, thus there is approximately 93% additional containment capacity within the berm for the product within the fullest tank. If repaired, the

containment berm will adequately contain a leak caused by failure of any one tank with their current volumes of fuel.

Should more than one of the runway tanks fail, the berm would overfill and lead to leakage primarily in the southwestern direction. A figure showing the Runway Tanks Berm and adjacent topography is presented in **Appendix A.**

4.2 2024 Incinerator Recommissioning Activities

The 2024 incinerator recommissioning activities included an assessment and measurements by ATCO to assist Ketek in preparing their recommissioning plan and parts list. Ketek had on file the original shop drawings and specifications of the system deployed at the Site. Although there was still some uncertainty about the condition of the incineration chambers, the plan was made to fabricate new components for the incinerators in order to bring the system up to the current safety standards and to enable the two incineration chambers to operate independently of one another.

The additions included: individual control panels and blowers for each incinerator, new blower hoses, new fuel lines, a waste oil pump and filter and new ignitors/burners for each incineration chamber. The parts were transported to the Site in July 2024. Six pails of new refractory cement were also brought to Resolute Bay in case the incineration chambers need repair.

On site assembly of the control panels and blower stands was completed by Ketek on July 14-15, 2024. Test burns were completed on the following day.

After connecting the control panels and blowers to each incineration chamber, the incineration systems operated exactly as intended. Certificates from Ketek confirming the recommissioning of the incineration chambers is provided in **Appendix D.** Test burn results are summarized in section 4.2.1. Following successful test burns, the incinerators were disassembled. The sensitive parts (control panels, blowers, waste oil pump and hoses) were stored in the New Garage, and the incineration chambers were sealed (to prevent snow/water from entering the chambers) and left outside as movement was deemed unnecessary and could risk damage to the chambers. Outside storage of the incineration chambers will suffice given that they had been historically stored outside unsealed from 1996 until 2024 without structural damage occurring.

4.2.1 Test Burn Results

Test burns were completed with one drum of each of the major waste fuel types (Diesel, Jet A and B, and Kerosene) being run through the incinerators. Gasoline was not burned on the advice of Ketek because it is too volatile without dilution via mixing with a fuel with a higher flashpoint (i.e diesel or oil). All the fuels burned cleanly with no visible smoke at the certified rate of approximately 113 L/per hour. Each fuel type requires some fuel rate adjustment depending on the volatility (see **Appendix E Incinerator Standard Operating Procedure (SOP)** for fuel rate adjustment instructions).

The pilot burner is required for the initial ignition of fuels as well as assisting with incineration of high-water content and oily fuels. The pilot burner must be supplied with clean diesel at an intake rate of 16 L/hour until a steady state of incineration is achieved. During a test burn of high-water content fuel, the pilot flame went out which caused water to pool at the bottom of the incineration chamber. The water pooling was rectified by turning on the pilot burner for a few minutes which evaporated the watery fuel mixture out of the chamber.

Constant monitoring of the incinerators while in operation is a requirement. As well, a 3 hr cooldown of the incineration chambers is required where the blowers are running with no fuel or ignition source on.

The incinerators must be setup and operated in accordance with the layout and procedures as outlined in **Appendix E: Incinerator SOP**. It is advised that mixing tanks be used to supply the waste fuel to the incinerators for continuous operation.

5.0 Fuel Reduction Plan

5.1 Safety and Environmental Considerations

5.1.1 Setup and Location, Spill Plan and Equipment Required for Area of Incinerator Operation

5.1.1.1 Location

The proposed incinerator operation location is on the southern side of the runway, west of the Runway Tanks as shown in the figure included as part of **Appendix E: Incinerator SOP**. The setup will require a minimum area of 90 m^2 for adequate spacing of all the components of the fuel incineration system. This proposed location is ideal due to the firmer ground offered by the runway edges. The ground firmness is an important safety factor providing favorable working condition for both personal and the heavy equipment used for maneuvering drums and tanks around. Firm ground also lessens the sinking and rutting of the service vehicles and possibilities of a spill cause by unstable ground. The location also allows for efficient transfer requiring less pumping pressure from the runway tanks as it is downhill of the tanks so fuel from the runway tanks can simply flow via hoses and hydrostatic pressure, regulated by valves at the tanks and at the incineration area end point.

5.1.1.2 Spill Response Plan

A site-specific Spill Response and Mitigation Plan should be prepared by the personal undertaking the Fuel Reduction Plan. Specifying areas of concern, clean-up equipment and actions to be taken in the case of a spill. All personal working on the Fuel Reduction program must be adequately trained for the tasks they are undertaking.

5.1.1.3 Additional Equipment Required

A few clearly marked clean-up kits in locations to be determined within a Spill Response and Mitigation Plan must include, at minimum, the following items:

- Personal protective equipment appropriate for the chemicals present
- Absorbent material or other methods to contain the spills (e.g., sand, absorbent socks, etc.)
- Neutralizing material
- Shovel, scoops, pans, containers, vacuum/pumps, broom, and dustpan, as needed, and made of appropriate material
- Heavy-duty trash bags or containers for the waste
- Labels for identification of the hazardous waste

- Caution tape to isolate the spill area
- First aid supplies, where appropriate

A mounted and covered 10lb ABC fire extinguisher (or larger) is required near incineration operations to meet requirements outlined by Occupational Safety Act O. Reg. 213/91, s. 53 (1). for construction projects.

Ten additional portable rig mats are required to aid with maneuverability, surface stability and minimize sinking and rutting at the incineration area will be required during incineration activities.

Two steel UN rated mixing tanks (~1,300 L) for regulation compliant transport or storage of waste fuels will be required. One for each incinerator to allow for proper mixing of waste fuels as per the Incinerator SOP found in **Appendix E**, thereby reducing down-time and facilitate the continual mixing of waste fuels and incinerator operation.

Five 1,250 L IBC plastic totes for oily water separation of high-water content fuels. The plastic sides will allow visual identification of the thickness of the floating phase (fuel) so that it can be drawn off for incineration. When the job is complete these totes can be relocated offsite while containing waste water which cannot be incinerated in the future.

A portable spill containment berm capable of containing the capacity of the largest mixing tank (~1,300 L) or drums plus 10% the volume of the sum of all storage tanks within the secondary containment berm

Approximately 50-100 bung caps and adhesive sealers for sealing open or cracked fuel drums to prevent water entry and residual fuel escape until crushing or decommissioning can be completed.

A field-erected shelter or tent for the incinerator operators to stay dry while monitoring the incineration activities.

A submersible or adequately equipped (intrinsically safe) pump and minimum 100 m hose for fuel transfer from the Runway Tanks and other ASTs into the mixing tanks or drums.

A Rotary Drum Pump for drum fuel transfer

A drum grabber attachment for the on-site Kubota backhoe or Komatsu loader to transport full drums to the incineration area.

Two 8000-Watt generators capable of an output Voltage of 125/250 VAC, 30 Amperes, at a frequency of 60Hz in Phase 1 operation

5.1.2 Transfer of Fuels

5.1.2.1 Drums

To prevent accidents and back strain, a steel drum grabber attached to the forks of the Komatsu loader or Kubota backhoe should be used to transfer drums over long distances. Given the large number of drums, a double drum grabber is recommended.

Where machine access is not possible, drums must be propped upright and inspected for leaks prior moving the drum to a machine accessible spot. Missing bung caps need to be replaced with a new bung cap prior to movement. If drum leaks are observed the drum must immediately be oriented to a position that minimizes leaking and implement spill kits to clean the impacted area. If drums are compromised or suspected of being compromised the contents must be transferred to sturdy new containers prior to movement.

The transfer of fuel from any fuel drum should be completed using a proper drum pump. When transferring fuels into a mixing tank for incinerator operation see the Incinerator SOP in **Appendix E** for product mixing information and recommended proportions.

5.1.2.2 Runway Tanks

Fuel transfer from the large ASTs at the runways should be completed by installation of a fuel line into the main valve of Tank 00001914. Tank 00001914 (western-most tank) is the only tank with a suitable main valve for a fuel line connection. A valve on the other end of the fuel line will be used to control the flow to the incinerator mixing tanks as needed. Both valves will be shut off when fuel is not being transferred to the mixing tank.

Tank 00001914 will be drained of fuel first, then a portable intrinsically safe pump will be used to transfer fuel from Tank 00001920 and then from Tank 00001923 into Tank 00001914 in separate stages. This will allow the hose with double valves from Tank 00001914 to continue to feed the mixing tank at the incinerator area as needed and set by the operators.

5.1.2.3 Other ASTs

Fuel transfer from the other ASTs will require pumping their contents to sturdy new drums or to a fuel separation tote which can then be transported to the incinerators. A mobile tote needs to be CSA certified and securely attached to the forks of the loader.

Access to some ASTs will require personal trained in working at height and a 26 ft ladder for accessing Tank 00001916 to determine if product exists.

5.2 Recovery and Management of Emptied Drums and Tanks

Once the waste fuel was been removed from the drums, they will be sealed and consolidated at one location for future processing and crushing during the next phase of the decommissioning activities at the Site.

Following removal of the waste fuels from the ASTs, a licensed petroleum fitter will need to certify the tanks as out of service and updates will need to made to FIRSTS database. Removal of any sludge or residual fuels that cannot be removed using the pump during the Fuel Reduction program will occur during the next phase of the decommissioning activities at the Site. As well, the tanks abatement (lead paint) and actual deconstruction will also occur during the next phase of the decommissioning activities at the Site.

6.0 Schedule for Fuel Reduction Activities

6.1.1 Estimated Duration of Incineration Activities

Each incinerator has an average fuel burn rate of 113 Liters per hour. The total fuel volume to be incinerated is approximately 76,200 Liters. An operation time of at least 10 hours per day would allow for daily inspections and maintenance of the incineration system including the 3 hour cool down period. Barring any down-time for repairs that cannot be effectively mitigated on-site and unforeseen weather delays, the time needed to incinerate all the fuel at Isachsen is approximately 34 days.

The typical separation time required for water to dissociate from a fuel mixture is a half hour and batches will be decanted very day. This operation would be done concurrently with burning so would not add time to the overall duration.

Five days will likely be needed to set up the incineration area and prepare the large mixing tanks for commencement and three days for teardown thus an approximate 42-day field program will be required for total fuel reduction.

6.1.2 2025-26 Proposed Field Schedule and Activities

The proposed field schedule for 2024 Fuel Reduction Plan is:

Date	Fuel Reduction Activities
June 20th – June 23rd	Mobilization to Site; Set up of the camp
June 24th	Mobilization of Incineration Operations Personal
June 25th — June 30thth	Setup of Incineration Area
July 1st – Aug 3rd	Incineration of Waste Fuels
Aug 4th to 7th	Teardown of Incineration Area, storing the sensitive incinerator parts in the New Garage
Aug 8th	Shipping out of oily water and piston oil (hazardous liquid waste)

7.0 Summary and Conclusions

There are approximately 76,200 litres (L) of waste fuel currently on the Site. The fuels are contained in varying quantities at four identified locations: Drums, Runway Tanks, Middle/Lower Tank Farms, and 31 Other ASTs. The fuel types are diesel (52,224L), jet fuel, A and B (13,395 L), gasoline (4,665 L), kerosene (1,055 L), oily water (5,302 L) and other (1,190 L).

In the incinerator recommissioning program conducted in the field season of 2024, the incineration chambers that were present on site were upgraded with modern control panels, blowers, pilot burners, and waste fuel pumps. The incinerators were recertified by their original manufacturer, Ketek Group Inc. and tested with the major types of waste fuel present, with the exception of gasoline. The burn rate is 113 L/per hour for all types of fuel. Gasoline must be mixed with other fuels with a higher flashpoint to be incinerated. A standard operating procedure (SOP) for the incinerators has been produced and is included as an appendix to this report.

A plan to incinerate all of the fuel in the 2025 field season has been developed. An incinerator operation area would have to be set up, with the fuel separation mixing tanks, generators for electrical power and the incineration units themselves. A location and a schematic of the operation area is contained in **Appendix E: Incinerator SOP**. Additional equipment required to complete the fuel reduction plan includes: mixing tanks, oily water and fuel separation totes, drum grabber for the loader on site, and spill kits. The fuel reduction plan would have a duration of approximately 42 work days. Following the reduction / removal of waste fuels, the required steps could be taken to properly render the registered tanks out of service.

Closure

This report was prepared exclusively for the purpose, project, and site locations outlined in the report. The report is based on information provided to, or obtained by, Nuqsana-Outcome as indicated in the report, and applies solely to site conditions and the regulatory and planning frameworks existing at the time of the site investigation. Nuqsana-Outcome's report represents a reasonable review of available information within an established work scope and schedule.

This report was prepared by Nuqsana-Outcome for the sole benefit of our federal client. The material in it reflects Nuqsana-Outcome's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Nuqsana-Outcome accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust that this information is satisfactory for your requirements.

Sincerely,

NUQSANA-OUTCOME JOINT VENTURE

Prepared by:

Eric Grimminck, EIT.
Junior Environmental Engineer

Reviewed by:

Don Plenderleith, P. Eng
Environmental Division Manager

8.0 References

Canada. *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulation* (amended October 2020).

CCME. *Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products* (PN 1326)

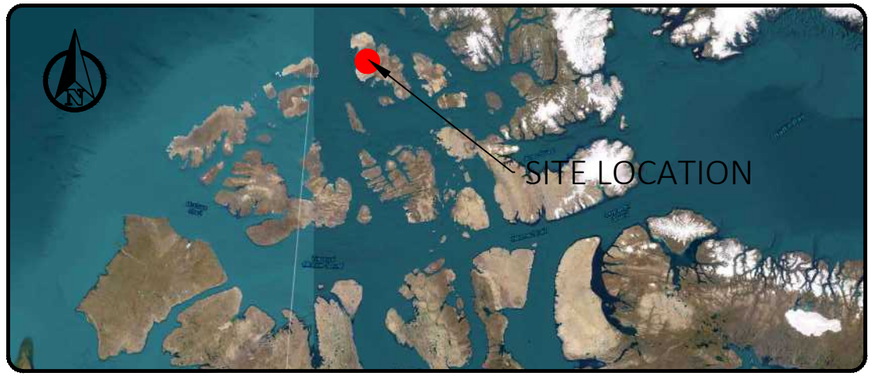
Dillion-Outcome Joint Venture (DOJV) 2023. *Isachsen High Arctic Weather Station Data Gap Analysis Report*. December 2023

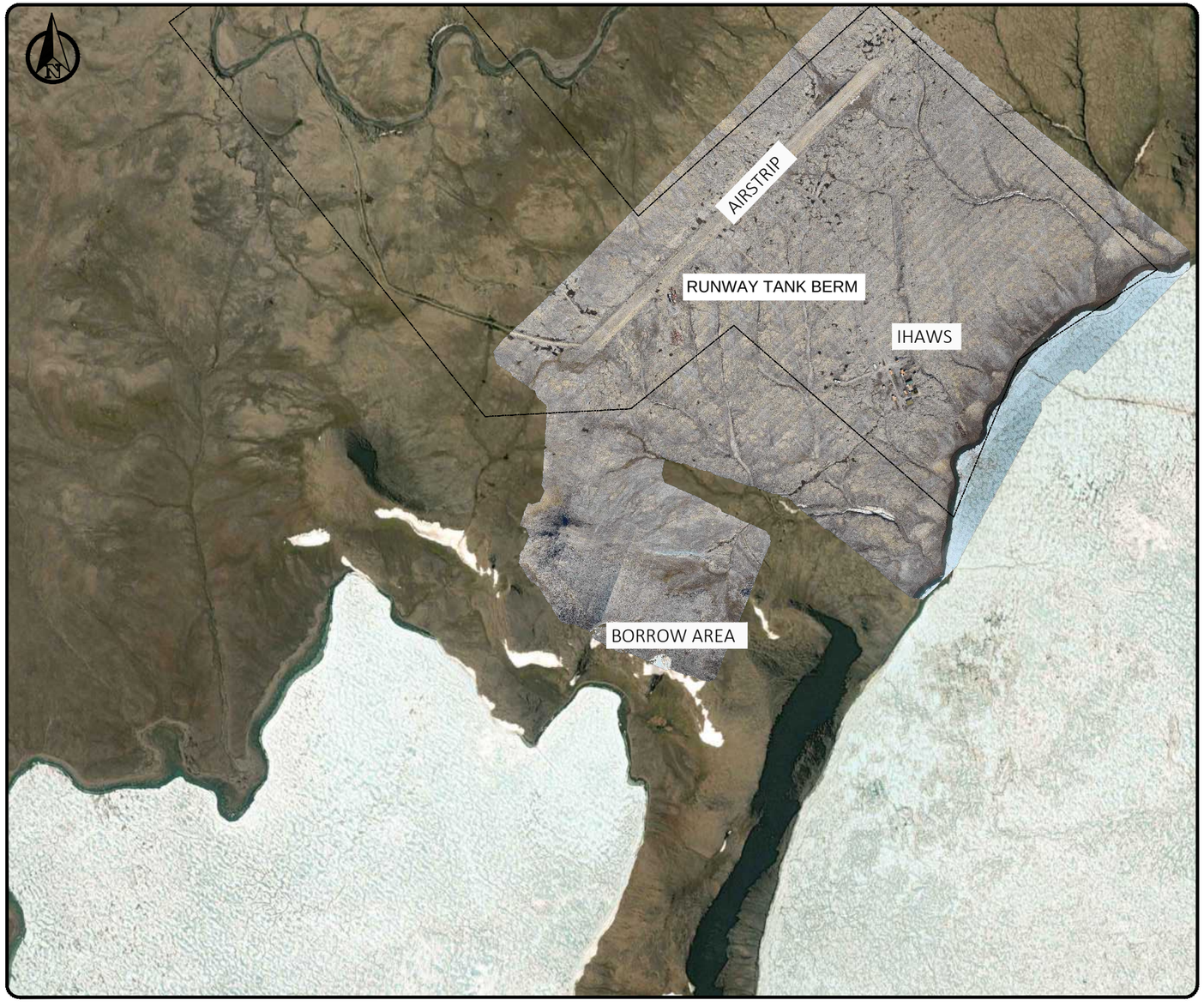
INAC. *Abandoned Military Sites Remediation Protocol, Volume 1 – Main Report.* December 2008.

Nuqsana-Outcome Joint Venture Inc. (NOJV) 2024. *2023 Environmental Site Assessment (ESA) Summary Report, Isachsen High Arctic Weather Station (HAWS), Nunavut.* March 2024

Appendix A

Figures





GENERAL NOTES

1. ALL UNITS IN METERS UNLESS OTHERWISE NOTED.
2. COORDINATE SYSTEM IS NAD83 (CSRS) / UTM ZONE 13N

LEGEND

●	SITE LOCATION
▬	PROPERTY LINE

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151 HOLLAND AVE SUITE 200
OTTAWA, ONTARIO
K1Y 0Y2
t:613.729.2402

ISACHSEN HIGH ARCTIC WEATHER STATION

ELLIF RINGNESS ISLAND, NUNAVUT

RUNWAY TANK BERM COMPLIENCE

SITE LOCATION AND OVERVIEW

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P2023-16 ISACHSEN.dwg	01 OF 09	00

INTERIOR SURFACE AREA OF BERM≈ 93 m^3
HEIGHT OF BERM (MEASURED ON SITE)≈ 0.55 m
VOLUME OF BERM≈ 41 m^3
BERM CAPACITY≈ 41,000 L

GENERAL NOTES

1. ALL MEASUREMENTS IN METRES UNLESS OTHERWISE NOTED
2. COORDINATE SYSTEM IS NAD83 (CSRS) / UTM ZONE 13N

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K1Y 0Y2
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RUNWAY TANK BERM COMPLIENCE

TANK BERM DIMENSIONS

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SLOPE AROUND TANK BERM

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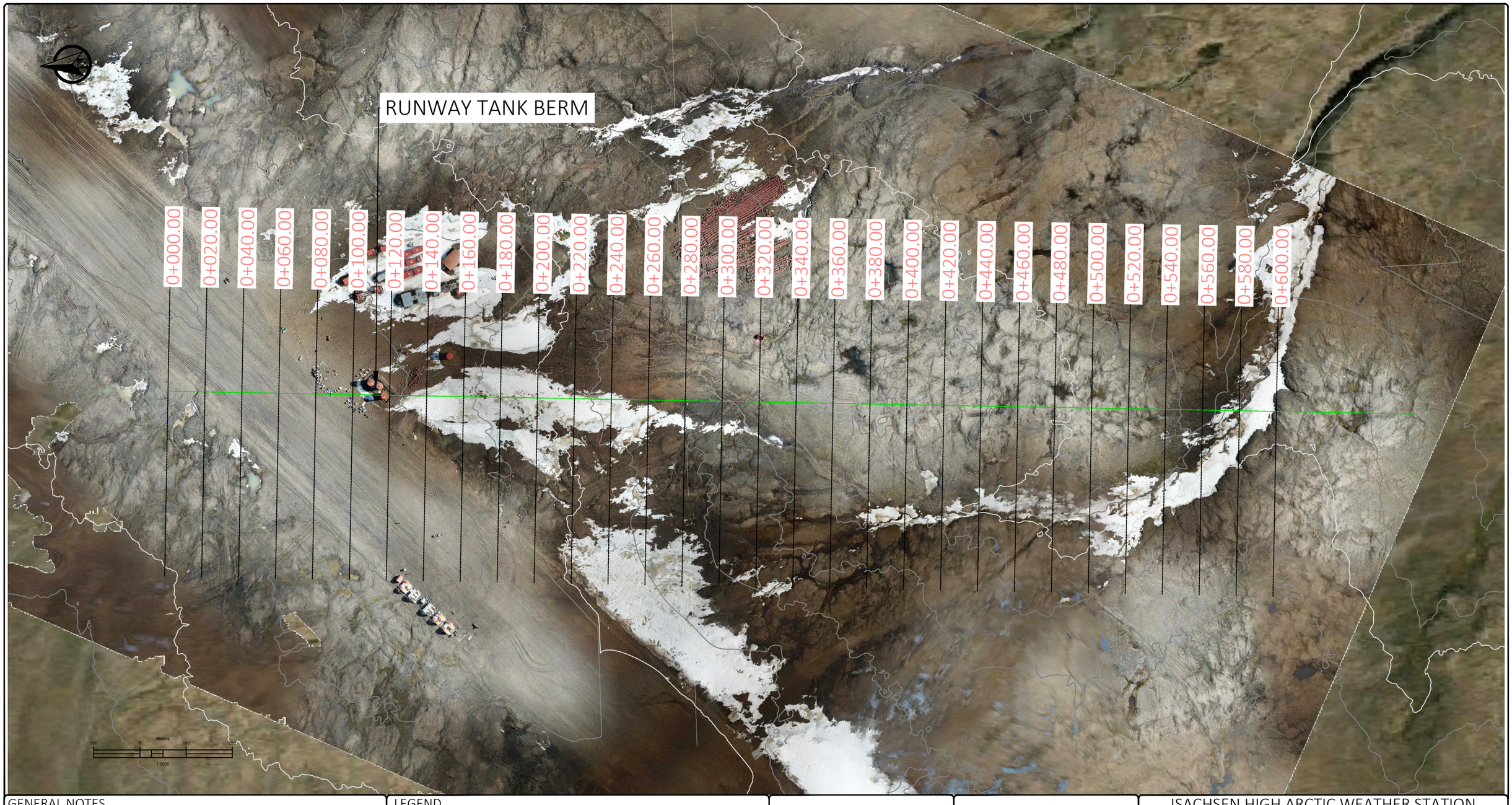

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RUNWAY TANK BERM COMPLIENCE

ALIGNMENT VIEW

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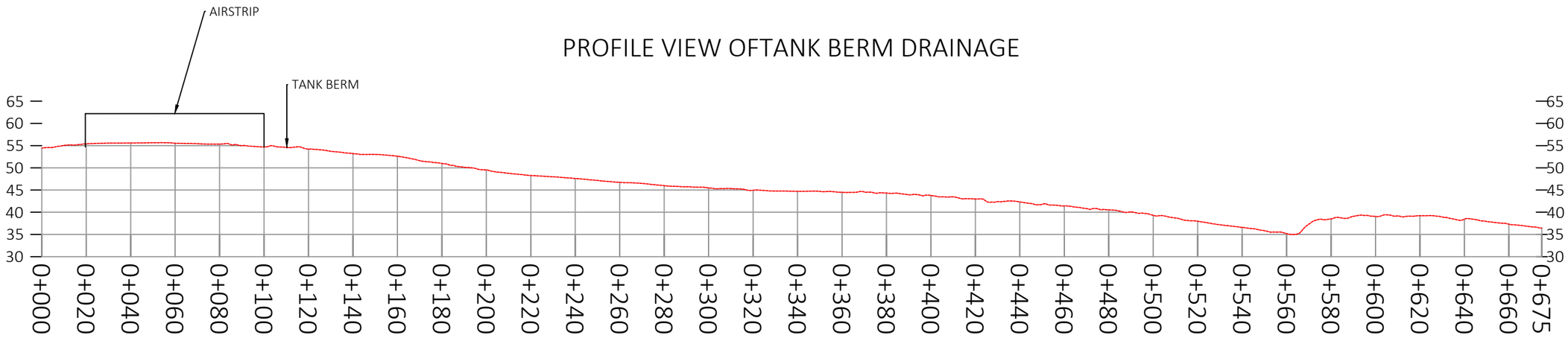
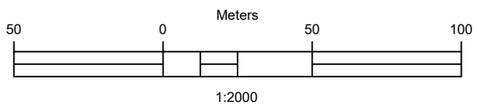
P2023-16 ISACHSEN BORROW ASSESSMENT - Copy.dwg	04 OF 09	00

PROFILE VIEW OFTANK BERM DRAINAGE





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PROFILE VIEW

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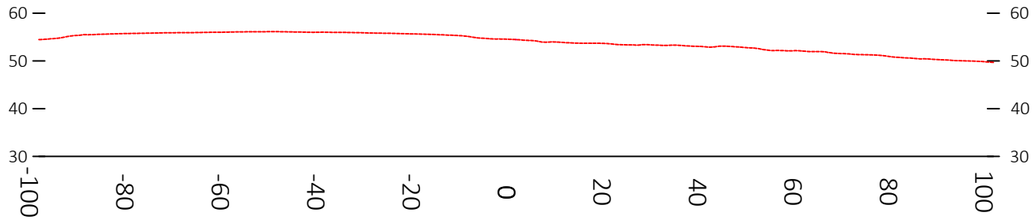

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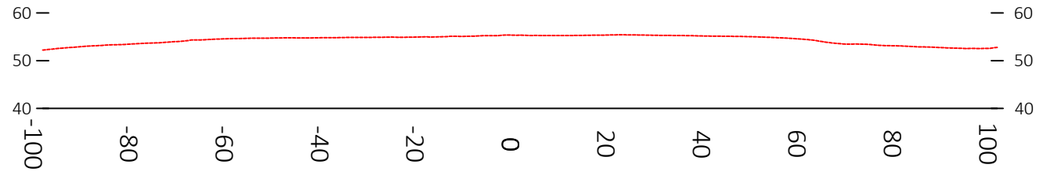

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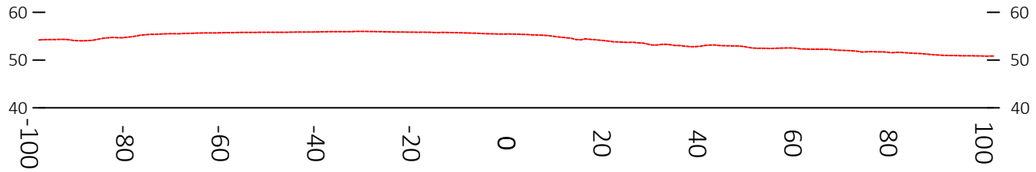

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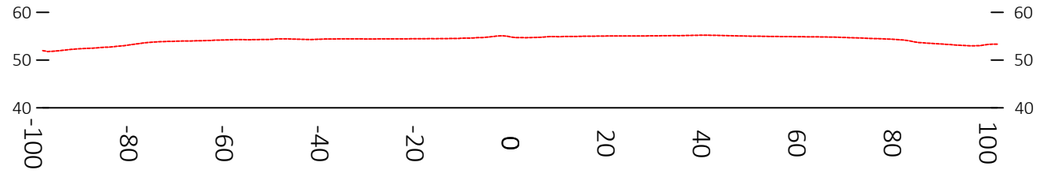

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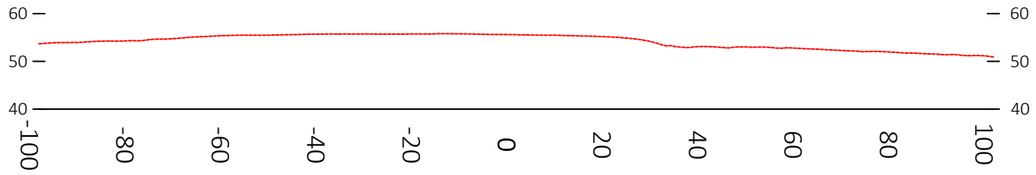

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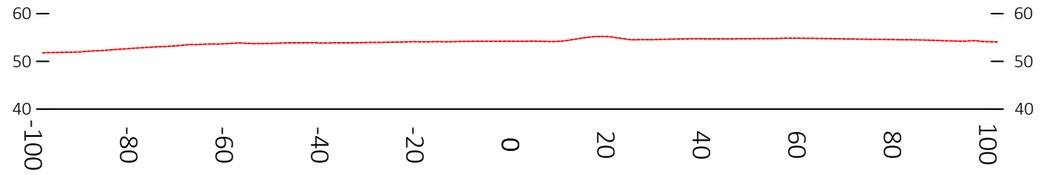

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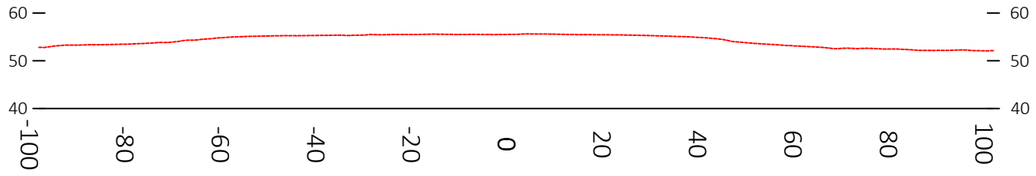

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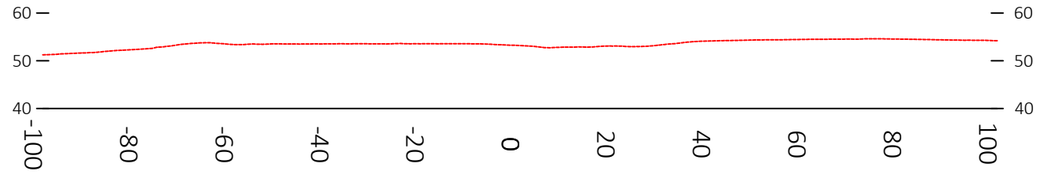

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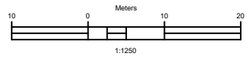

GENERAL NOTES

1. ALL MEASUREMENTS IN METRES UNLESS OTHERWISE NOTED
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K1Y 0Y2
t:613.729.2402

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RUNWAY TANK BERM COMPLIENCE

SECTION VIEWS: 0+000 - 0+140

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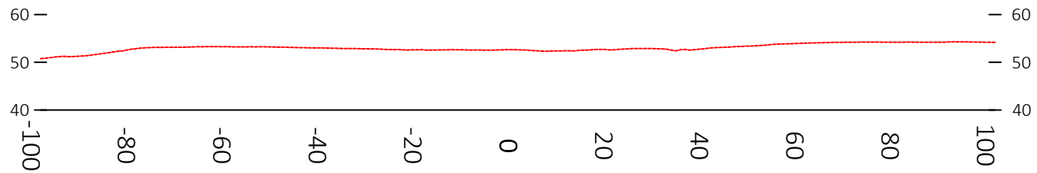

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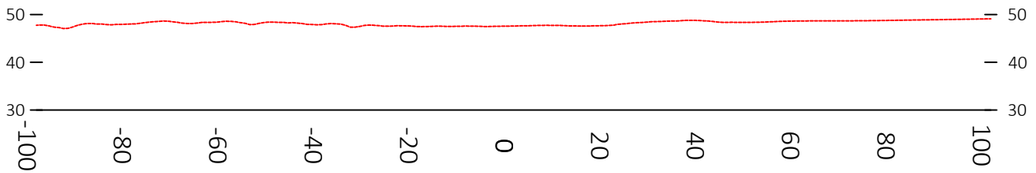

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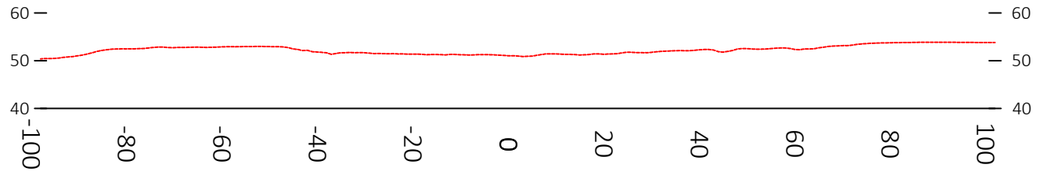

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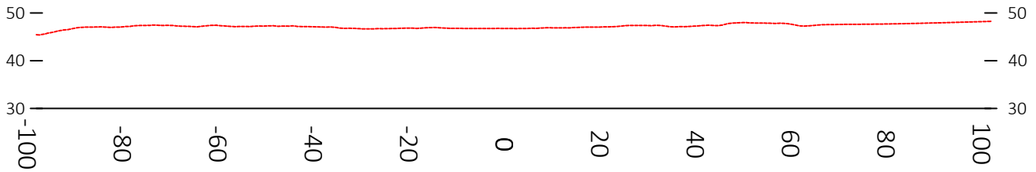

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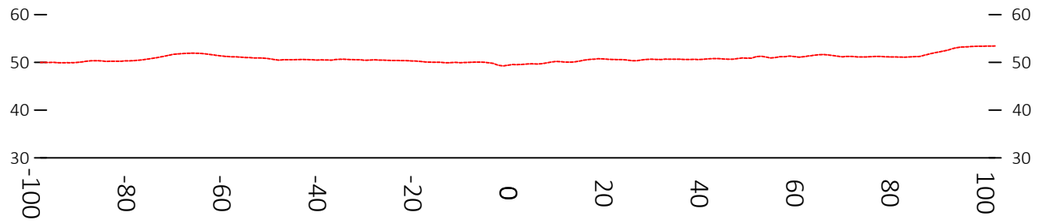

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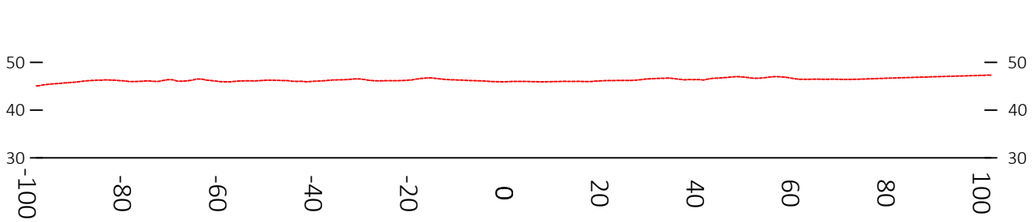

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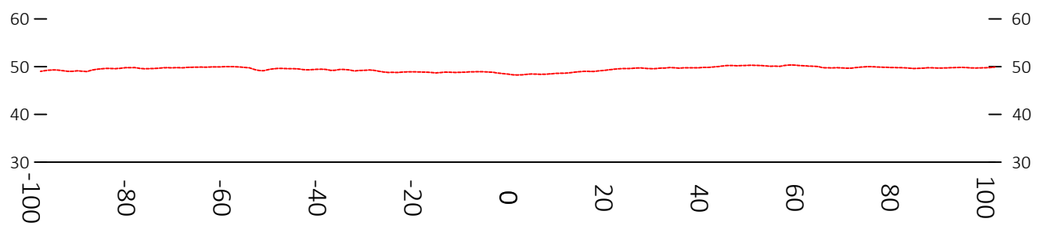

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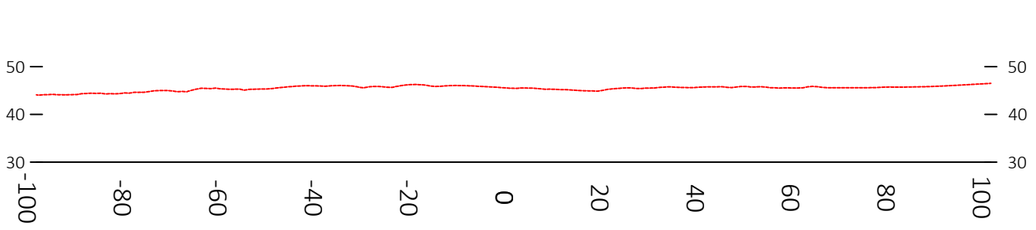

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GENERAL NOTES

1. ALL MEASUREMENTS IN METRES UNLESS OTHERWISE NOTED
2. COORDINATE SYSTEM IS NAD83 (CSRS) / UTM ZONE 13N

LEGEND

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ISACHSEN HIGH ARCTIC WEATHER STATION

ELLIF RINGNESS ISLAND, NUNAVUT

RUNWAY TANK BERM COMPLIENCE

SECTION VIEWS: 0+160 - 0+300

OUTCOME PROJECT NUMBER:	DRAWN BY:	SCALE:
P2023-16	C.PETERKA	1:1250
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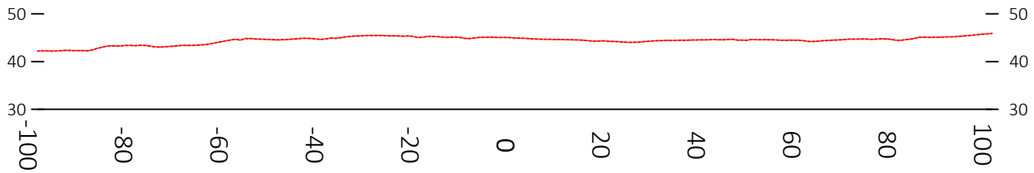

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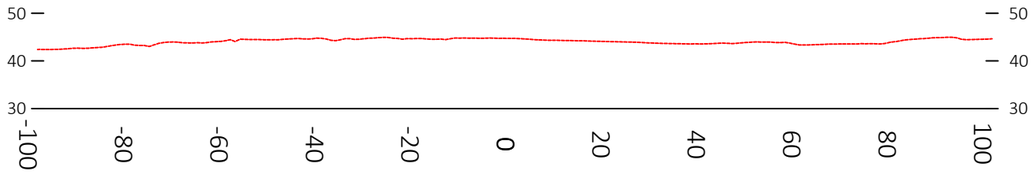

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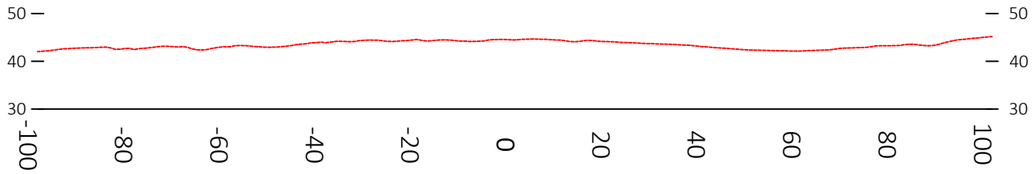

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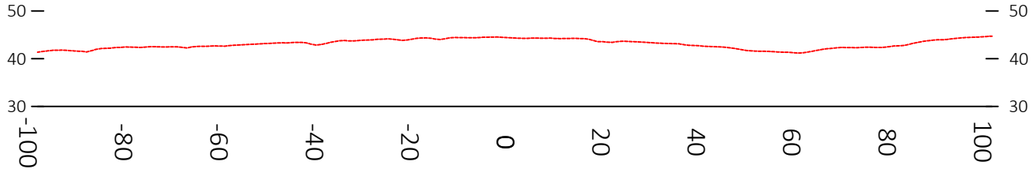

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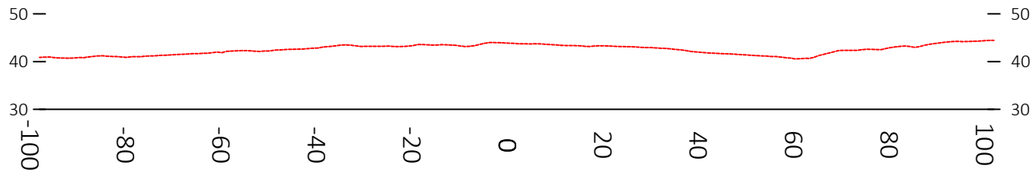

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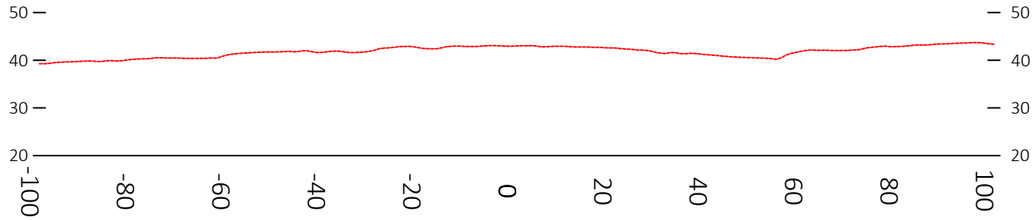

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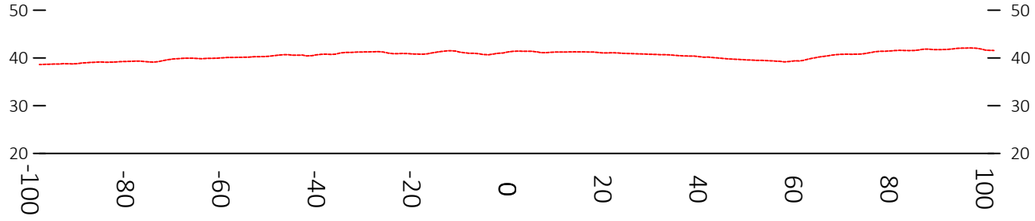

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SECTION VIEWS: 0+320 - 0+460

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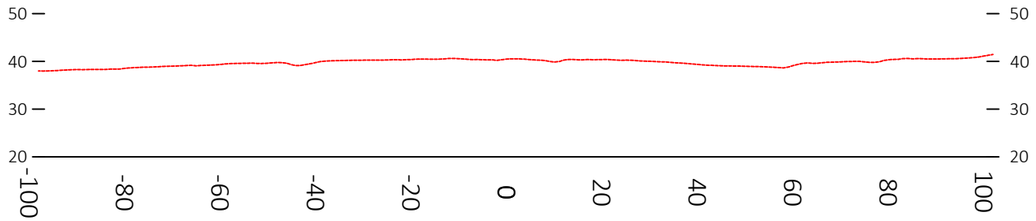

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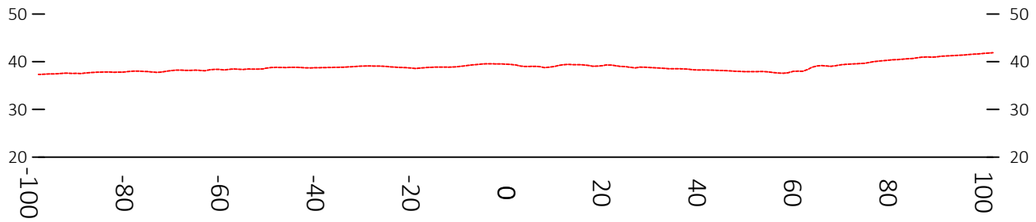

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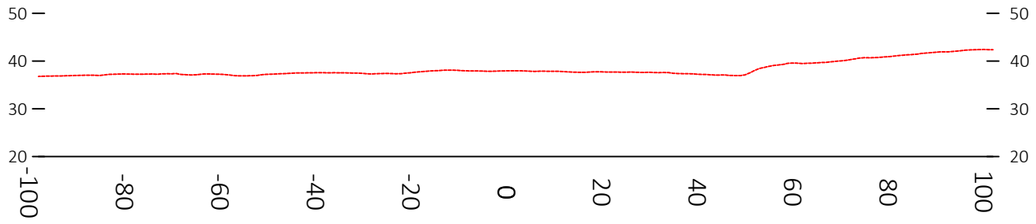

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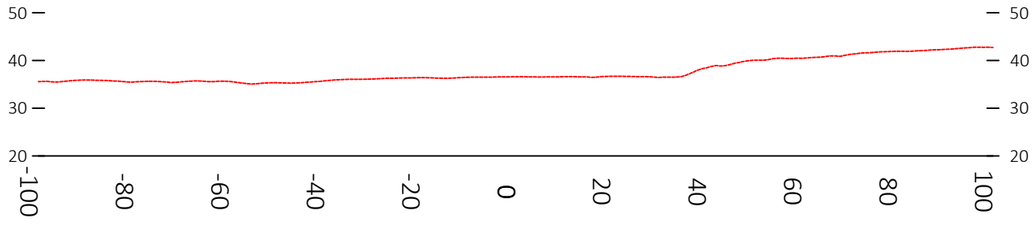

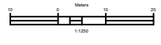

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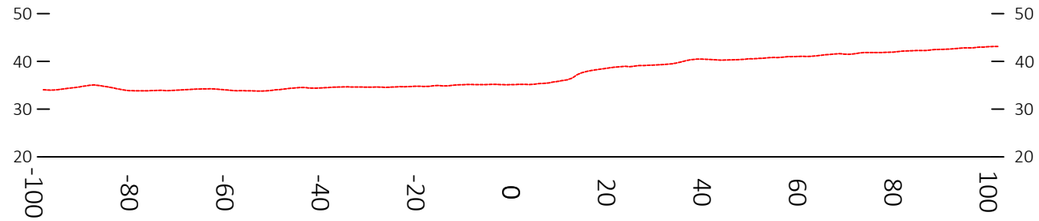

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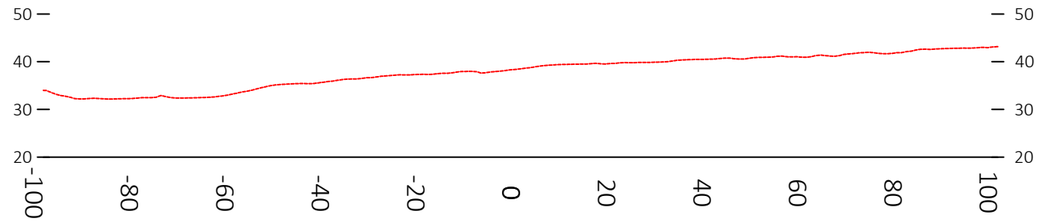

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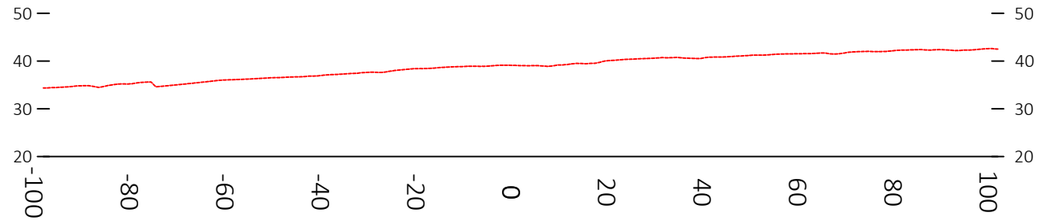


0+600.00

GENERAL NOTES

1. ALL MEASUREMENTS IN METRES UNLESS OTHERWISE NOTED
2. COORDINATE SYSTEM IS NAD83 (CSRS) / UTM ZONE 13N

LEGEND

outcome CONSULTANTS
151 HOLLAND AVE SUITE 200
OTTAWA, ONTARIO
K1Y 0Y2
t:613.729.2402

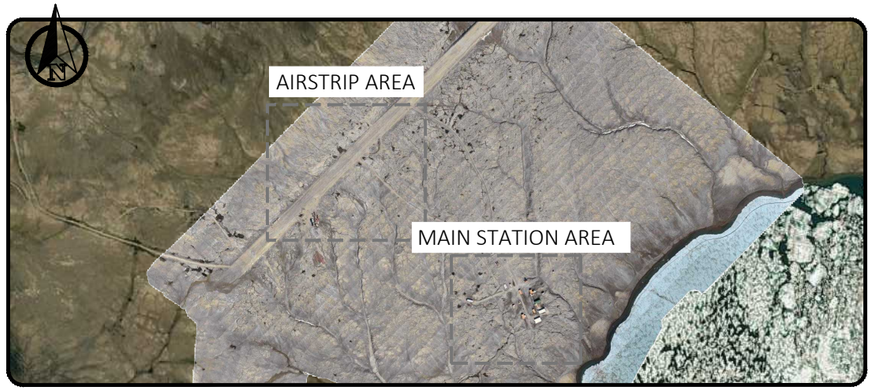
ISACHSEN HIGH ARCTIC WEATHER STATION

ELLIF RINGNESS ISLAND, NUNAVUT

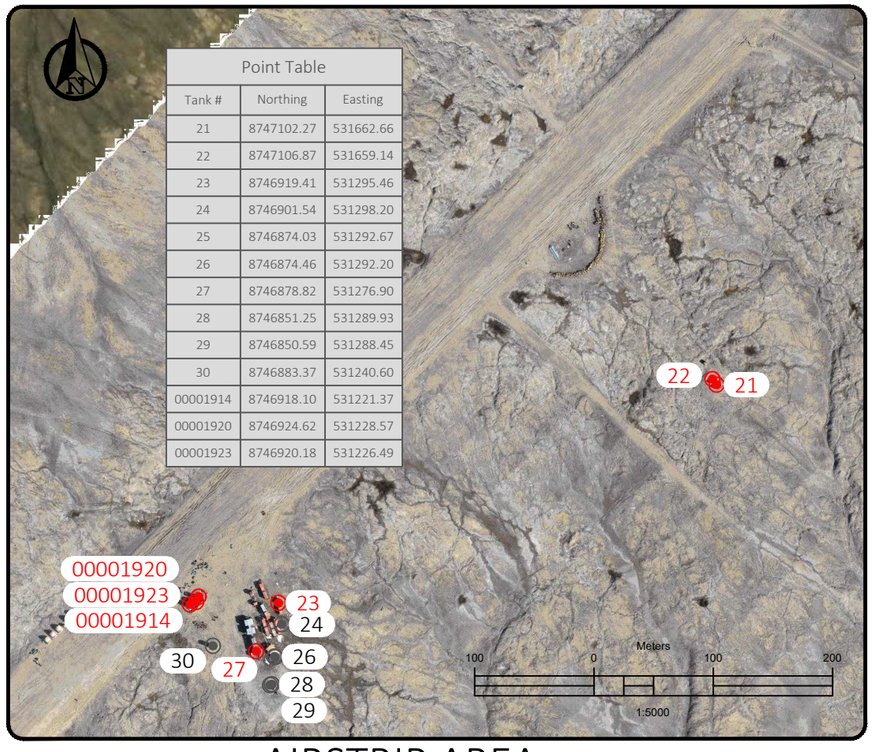
RUNWAY TANK BERM COMPLIENCE

SECTION VIEWS: 0+480 - 0+600

OUTCOME PROJECT NUMBER:	DRAWN BY:	SCALE:
P2023-16	C.PETERKA	1:1250
CLIENT PROJECT NUMBER:	CHECKED BY:	PUBLISH DATE:
------	K.VEITCH	2024-11-15
DRAWING NAME:	SHEET NUMBER:	REV:
P2023-16 ISACHSEN BORROW ASSESSMENT - Copy.dwg	09 OF 09	00

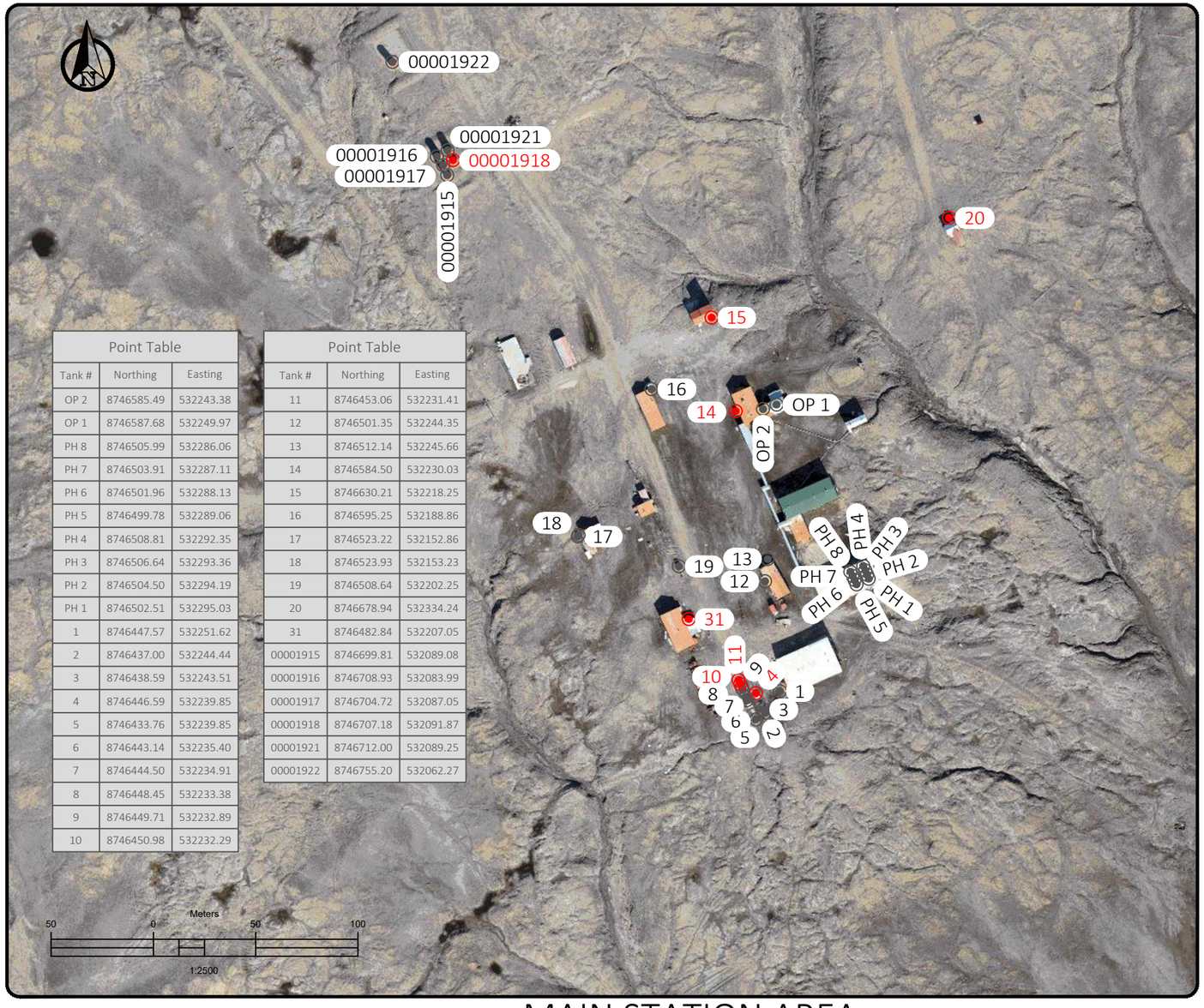


KEY PLAN



Point Table		
Tank #	Northing	Easting
21	8747102.27	531662.66
22	8747106.87	531659.14
23	8746919.41	531295.46
24	8746901.54	531298.20
25	8746874.03	531292.67
26	8746874.46	531292.20
27	8746878.82	531276.90
28	8746851.25	531289.93
29	8746850.59	531288.45
30	8746883.37	531240.60
00001914	8746918.10	531221.37
00001920	8746924.62	531228.57
00001923	8746920.18	531226.49

AIRSTRIP AREA



Point Table		
Tank #	Northing	Easting
OP 2	8746585.49	532243.38
OP 1	8746587.68	532249.97
PH 8	8746505.99	532286.06
PH 7	8746503.91	532287.11
PH 6	8746501.96	532288.13
PH 5	8746499.78	532289.06
PH 4	8746508.81	532292.35
PH 3	8746506.64	532293.36
PH 2	8746504.50	532294.19
PH 1	8746502.51	532295.03
1	8746447.57	532251.62
2	8746437.00	532244.44
3	8746438.59	532243.51
4	8746446.59	532239.85
5	8746433.76	532239.85
6	8746443.14	532235.40
7	8746444.50	532234.91
8	8746448.45	532233.38
9	8746449.71	532232.89
10	8746450.98	532232.29

Point Table		
Tank #	Northing	Easting
11	8746453.06	532231.41
12	8746501.35	532244.35
13	8746512.14	532245.66
14	8746584.50	532230.03
15	8746630.21	532218.25
16	8746595.25	532188.86
17	8746523.22	532152.86
18	8746523.93	532153.23
19	8746508.64	532202.25
20	8746678.94	532334.24
31	8746482.84	532207.05
00001915	8746699.81	532089.08
00001916	8746708.93	532083.99
00001917	8746704.72	532087.05
00001918	8746707.18	532091.87
00001921	8746712.00	532089.25
00001922	8746755.20	532062.27

MAIN STATION AREA

GENERAL NOTES

1. ALL MEASUREMENTS IN METRES UNLESS OTHERWISE NOTED
2. COORDINATE SYSTEM IS NAD83 (CSRS) / UTM ZONE 13N
3. OP BUILDING (2) TANKS INSIDE
4. PH BUILDING (8) TANKS INSIDE

LEGEND

◉ ##	TANK LOCATION AND ID
◉ ##	TANK WITH PRODUCT LOCATION AND ID

outcome CONSULTANTS
151 HOLLAND AVE SUITE 200
OTTAWA, ONTARIO
K1Y 0Y2
t:613.729.2402

ISACHSEN HIGH ARCTIC WEATHER STATION
ELLIF RINGNESS ISLAND, NUNAVUT
TANK LOCATIONS

OUTCOME PROJECT NUMBER:	DRAWN BY:	SCALE:
P2023-16	J.MILLS	VARIES
CLIENT PROJECT NUMBER:	CHECKED BY:	PUBLISH DATE:
------	E.GRIMMINCK	2025-01-14
DRAWING NAME:	SHEET NUMBER:	REV:
P2023-16 ISACHSEN TANK LOCATIONS.dwg	01 OF 01	00

Appendix B

Fuel Inventory, Product Sampling Results and Laboratory Analytical Reports

Table B1 Product Summary Volume (L)
Isachsen HAWS, Nunavut

		Product Summary Volume (L)									
		Total	**Jet B**	**Jet A**	**Jet N/A**	**Gasoline**	**Kerosene**	**Diesel**	**Oil**	**Unknown**	**Oily (waste) Water**
Location	Drums (not including waste water)	20,795	8,310	2,905	2,180	4,665	1,055	490	955	235	1,655
	Runway Tanks	45,818	0	0	0	0	0	45,818	0	0	0
	Middle and Lower Tank Farm	965	0	0	0	0	0	965	0	0	0
	Other AST's	8,598	0	0	0	0	0	4,951	0	0	3,647
	Total	76,176	8,310	2,905	2,180	4,665	1,055	52,224	955	235	5,302

Location	Sample Group (Location)	Assumed Fuel Type	Barrel Description (Colour: Top To Bottom)	Seal Condition	Drum ID	Volume (L) of Product	Sample ID	DUP Sample ID	Date Sampled	Notes
Consolidated North of The Runway Tank Farm	A	Jet B (AIA)	Blue, Yellow, Blue	Sealed	A1	50	DR23-A1		2023-07-14	
					A2	30				
					A3	10				
					A4	200				
					A5	50				
					A6	<10				
	B	Jet Turbo Fuel B (AIA)	Grey, Creamy White, Grey	Sealed	B1	200	DR23-B1		2023-07-14	
					B2	<10				
	C	Jet B (DI)	Blue	Sealed	C1	50				
					C2	180	DR23-C2		2023-07-14	
					C3	200				
	D	Jet N/A	Rose	Sealed	D1	30				
					D2	200	DR23-D2		2023-07-14	
					D3	200				
	E	Jet B (AIA)	Blue, White Cream, Blue	Sealed	E1	<10	DR23-E1		2023-07-14	97..8% water
					E2	<10				
	F	Jet B	Black,Yellow, Black	Sealed	F1	180	DR23-F1		2023-07-14	
					F2	200				
	G	Diesel	Black	Sealed	G1	<10	DR23-G1		2023-07-14	
	H	Kerosene Aviation	Rose, Black, Rose	Sealed	H1	<10	DR23-H1		2023-07-14	
					H2	<10				
					H3	<10				
	I	Jet B	Black,Yellow, Black	Sealed	I1	<10				
					I2	<10				
					I3	25				
					I4	<10				
					I5	50	DR23-I5		2023-07-14	
					I6	<10				
	J	Jet N/A	Yellow	Sealed	J1	0				
					J10	75				Aside south 110m
					J2	50				
					J3	200				
					J4	200				
					J5	0				
					J6	20				
					J7	40	DR23-J7		2023-07-14	93% water
					J8	200				
					J9	0				
					J11	<10				
					J12	<10				
					J13	175				
	K	Gasoline (Unleaded)	Rose under Blue Patina	Sealed	K1	180	DR23-K1		2023-07-14	54% water
					K2	200				
					K3	200				
					K4	200				
					K5	200				
					K6	200				
					K7	200				
					K8	175				
					K9	175				Aside from others
					K10	200				Aside from others
					K11	200				Aside from others
					K12	<10				
					K13	<10				
					K14	<10				
					K15	<10				
					K16	0				
					K17	<10				
					K18	200				
					K19	<10				
					K20	<10				Aside with Q's
					K21	25				
					K22	175				
					K23	200				

Location	Sample Group (Location)	Assumed Fuel Type	Barrel Description (Colour: Top To Bottom)	Seal Condition	Drum ID	Volume (L) of Product	Sample ID	DUP Sample ID	Date Sampled	Notes
Consolidated North of The Runway Tank Farm	L	Kerosene Clear	Blue	Sealed	L1		DR23-L1	DUP-C	2023-07-14	Used for test burn
					L2	200				
					L3	200				
					L4	200				
					L5	200				
					L6	<10				
					L7	<10				
					L8	200				
					L9	<10				Hole in top 50m North West
	M	Diesel	Grey, Creamy White, Grey (Green D) spray painted on	Sealed	M1	125	DR23-M1		2023-07-15	
				Sealed (Water Filled)	M2	80				
				Sealed	M3	<10				
					M4					Used for camp heating and incinerator test burn
					M5	<10				Used for camp heating
					M6	<10				Used for camp heating
					M7	<10				Aside from others in the center of the drum cache, Large cuts in the top and lower side, wasn't moved
					M8	<10				
					M9	200				Aside 10 meters south
	N	Gasoline (Unleaded)	Rose under Blue Patina	Sealed	N1	100	DR23-N1		2023-07-15	
					N2	200				
					N3	200				
					N4	200				
					N5	175				
	O	Gasoline	Red	Sealed	O1	<10	DR23-O1		2023-07-15	
					O2	<10				
					O3	200				Aside south 12m
					O4	<10				
	P	Jet A1 (AIA)	Blue ,Yellow, Blue	Sealed	P1	175	DR23-P1		2023-07-15	96.66% water
					P2	25				
					P3	<10				
	Q	Jet B (AIA)	Blue, White Cream, Blue	Sealed	Q1	20				
					Q2	50				
					Q3	20				Aside South 12m
					Q4	50				
					Q5	50	DR23-Q5		2023-07-15	
					Q6	<10				
					Q7	<10				
					Q8	<10				
					Q9	<10				
					Q10	0				
					Q11	25				
					Q12	<10				
					Q13	<10				
					Q14	25L				
					Q15	25L				
					Q16	25L				
					Q17	25L				
					Q18	200				
	R	Jet Turbo Fuel B (AIA)	Grey, Creamy White, Grey	Sealed	R1	25	DR23-R1		2023-07-15	
					R2	<10				
	S	Jet N/A	Red, Yellow, Red	Sealed	S1	<10	DR23-S1		2023-07-15	
					S2	50				
	T	Unknown	Red, Black, Red	Sealed	T1	<10	DR23-T1		2023-07-15	
	U	Jet N/A	Grey, Creamy White, Grey	Sealed	U1	<10				
					U2	<10				
					U3	<10				
					U4	<10	DR23-U4		2023-07-15	
					U5	<10				
					U6	200				
					U7	200				
	V	Jet N/A	Red, Yellow, Red	Sealed	V1	200	DR23-V1		2023-07-15	

Location	Sample Group (Location)	Assumed Fuel Type	Barrel Description (Colour: Top To Bottom)	Seal Condition	Drum ID	Volume (L) of Product	Sample ID	DUP Sample ID	Date Sampled	Notes
Consolidated South of the Runway Tank Farm	W	Emptied Jet N/A	Red, Yellow Top/Bottom	Open (Water Filled)	W1	N/A				Open likely water
					W2	N/A				Open likely water
					W3	N/A				Open likely water
					W4	N/A				Open likely water
					W5	N/A				Open likely water
					W6	N/A				Open likely water
					W7	N/A				Open likely water
					W8	N/A				Open likely water
					W9	N/A				Open likely water
					W10	N/A				Open likely water
					W11	N/A				Open likely water
					W12	N/A	DR23-W12		2023-07-15	94.85% water
					W13	N/A				Open likely water
					W14	N/A				Open likely water
					W15	N/A				Open likely water
					W16	N/A				Open likely water
	X	Emptied AV Gas	Red, White Top	Open (Water Filled)	X1	N/A				Open likely water
					X10	N/A				Open likely water
					X11	N/A				Open likely water
					X12	N/A				Open likely water
					X2	N/A				Open likely water
					X3	N/A				Open likely water
					X4	N/A				Open likely water
					X5	N/A				Open likely water
					X6	N/A				Open likely water
					X7	N/A	DR23-X7		2023-07-15	96.88% water
					X8	N/A				Open likely water
					X9	N/A				Open likely water
					X13	N/A				Open likely water
	Y	Emptied AV Gas	Red, Blue, Red, White Top	Open (Water Filled)	Y1	N/A				Open likely water
					Y2	N/A	DR23-Y2		2023-07-15	95.68% water
	Z	Emptied Jet N/A	Green, Yellow, Green	Open (Water Filled)	Z1	N/A				Open likely water
					Z2	N/A				Open likely water
					Z3	N/A	DR23-Z3		2023-07-15	Open likely water
	AA	Emptied Unknown	Blue, Red, Blue	Open (Water Filled)	AA1	N/A	DR23-AA1		2023-07-15	80.16% water
					AA2	N/A				Open likely water
					AA3	N/A				Open likely water
	AB	Emptied Unknown	Navy Blue Rusted	Open (Water Filled)	AB1	75	DR23-AB1		2023-07-15	85.82% water
South of Kenn Borek Trailers	AC	Diesel	Grey, Creamy White, Grey	Sealed	AC1	200				On a sled south of Kenn Borek Trailers (used for camp heaters) Says Jet but Found to be Diesel in reused Drums
					AC10	0				
					AC11	0				
					AC2	200				
					AC3	200				
In drum Racks at Camp location					AC4	0				
					AC5	50				
					AC6	50				
South of Kenn Borek Trailers					AC7	0	DR23-AC7	DUP-A	2023-07-15	
					AC8	0				
					AC9	0				
South of Kenn Borek Trailers	AD	Diesel	Light Brown	Sealed	AD1	0	DR23-AD1		2023-07-15	On a sled south of Kenn Borek Trailers (used for camp heaters)
	AE	Jet A1	White	Sealed	AE1	150	DR23-AE1		2023-07-15	Under the southern lip of Kenn Borek Trailers
					AE2	200				
					AE3	200				
	AF	Unknown (suspected gasoline)	Red, Blue, Red	Sealed	AF1	100	DR-AF1	DUP-B	2023-07-15	91.42% water Under the western lip of Kenn Borek Trailers
Consolidated East Northeast of the Runway Tank Farm	AG	Diesel	Black	Sealed	AG1	25	DR-AG1		2023-07-15	
	AH	Jet Fuel N/A	?	Open (Water Filled)	AH1	25				
				Sealed	AH2	75	DR23-AH2		2023-07-15	96.44% water
	AI	Jet Turbo Fuel B (AIA)	Grey, Creamy White, Grey	Sealed	AI1	200	DR23-AI1		2023-07-15	
					AI2	200				
					AI3	200				
	AJ	Jet A	Rose, Blue, Rose	Sealed	AJ1		DR23-AJ1		2023-07-15	Used for incinerator test burn
					AJ2	200				
					AJ3	200				
					AJ4	200				
					AJ5	0				
	AK	Jet B (DI)	Blue, White Cream, Blue	Sealed	AK1		DR23-AK1		2023-07-15	Used for incinerator test burn
					AK2	75				
	AL	Diesel	Teal, White, Teal	Sealed	AL1	25	DR23-AL1		2023-07-15	

Location	Sample Group (Location)	Assumed Fuel Type	Barrel Description (Colour: Top To Bottom)	Seal Condition	Drum ID	Volume (L) of Product	Sample ID	DUP Sample ID	Date Sampled	Notes
Barrel Consolidation at Eastern Runway (AEC 4)	AM	Jet B	Black,Yellow, Black	Sealed	AM1	<10				
					AM10	10				
					AM11	10				
					AM2	<10				
					AM3	200				
					AM4	0				
					AM5	200	DR23-AM5		2023-07-15	
					AM6	25				
					AM7	25				
					AM8	10				
					AM9	10				
					AM12	<10				
					AM13	<10				
	AN	Jet B	Black,Yellow, Black	Sealed	AN1	200	DR23-AN1		2023-07-15	
					AN10	200				
					AN11	200				
					AN12	200				
					AN13	200				
					AN14	200				
					AN15	200				
					AN16	200				
					AN17	200				
					AN18	200				
					AN19	200				
					AN2	<10				
					AN20	200				
					AN21	200				
					AN22		DR23-AN22		2023-07-15	Used as camp heating fuel after sampling
					AN23	200				
					AN24	200				
					AN25	<10				
					AN26	0				
					AN27	<10				
					AN28	0				
					AN29	0				
					AN3	<10				
					AN30	25				
					AN31	25				
					AN32	<10				
					AN33	<10				
					AN34	<10				
					AN35	<10				
					AN36	<10				
					AN37	<10				
					AN38	75				
					AN39	<10				
					AN4	<10				
					AN40	<10				
					AN5	<10				
					AN6	<10				
					AN7	200				
					AN8	200				
					AN9	200				

Location	Sample Group (Location)	Assumed Fuel Type	Barrel Description (Colour: Top To Bottom)	Seal Condition	Drum ID	Volume (L) of Product	Sample ID	DUP Sample ID	Date Sampled	Notes
Barrel Consolidation at Eastern Runway (AEC 4)	AO	Jet A1 (AIA)	Grey	Sealed	AO1	200	DR23-AO1		2023-07-15	
					AO2	200				
					AO3	200				
	AP	Jet B (DI)	Blue, White Cream, Blue	Sealed	AP1	10				
					AP2	200	DR23-AP2	DUP-D	2023-07-15	
	AQ	Jet B	Yellow	Sealed	AQ1	75	DR23-AQ1		2023-07-15	
					AQ2	<10				
					AQ3	100				
	AR	Bronze Gasoline	Light Brown	Sealed	AR1	75				
					AR10	0				
					AR11	0				
					AR12	0				
					AR13	0				
					AR14	0				
					AR15	?				
				Open (Water Filled)	AR16	175				Suspected water
				Sealed	AR17	<10				
					AR18	25				
					AR19	<10				
					AR2	<10				
					AR20	<10				
					AR21	<10				
					AR22	0				
					AR3	<10				
					AR4	<10				
					AR5	0				
					AR6	75	DR23-AR6	DUP-E	2023-07-15	99.48% water
					AR7	50				
					AR8	10				
					AR9	0				
	AS	Unknown	White Rusted	Sealed	AS1	50	DR23-AS1		2023-07-15	99.61% water
					AS2	<10				
					AS3	0				
	AT	Oil	Red Rusted Yellow Top	Open (Water Filled)	AT1	75				Were not sampled due to inadequate oil volume remaining
				Sealed	AT2	0				
					AT3	0				
	AU	Oil	Blue, Orange, Blue	Sealed	AU1	25	DR23-AU1		2023-07-15	99.78% water
				Open (Water Filled)	AU2	150				
	AV	Jet B	Grey, Creamy White, Grey	Sealed	AV1	25				
					AV2	50	DR23-AV2		2023-07-15	99.78% water
Consolidated North of The Runway Tank Farm	AW	Piston Oil	Beige	Sealed	AW1	75	DR23-AW1		2023-07-16	
					AW2	75				Not to be incinerated, lead content exceedes guideline.
					AW3	50				
					AW4	<10				
In Drum Racks at Camp Location	AX	Diesel	Various Colours	Sealed	AX1	0				Mostly Empty used as Camp fuel and Can be finished for tent heating next year
					AX2	0				
					AX3	0				
	AY	Usable Gasoline	Blue, Yellow, Blue	Sealed	AY1	175				New Gasoline used for ATV and Camp Generators
Consolidated South of the Runway Tank Farm	AZ	Bad Gasoline supplied	Grey, Orange, Grey	Sealed	AZ1	190				Consolidated South of the Runway Tank Farm So that it is not used by accident south east of battery box
Barrel Consolidation at Eastern Runway (AEC 4)	BA	Jet A	Green	Sealed	BA1	200				New Barrels Stashed by Polar Shelf maybe?
					BA2	200				
					BA3	200				
					BA4	200				
In New Garage	BB	Usable New Motor Oil	Grey	Sealed	BB1	75				New and Waste drums to be used by the onsite Mechanic
	BC	Usable Clean Hydraulic Oil	Black	Sealed	BC1	75				
	BD	Waste Oil	Black, Yellow, Black	Sealed	BD1	175				
	BE	Oil	Blue, Orange, Blue	Sealed	BE1	175				
	BF	Waste Antifreeze	Blue, Yellow, Blue	Sealed	BF1	40				

Total Groups

58

Table B3 Tank Inventory
Isachsen HAWS, Nunavut

Location	Sample Group (Location)	Assumed Fuel Type	Volume (L) of Product	Sample ID	Date Sampled	Notes
Runway Tanks	Tank 00001914	Diesel	21,221	TA23-00001914	2024-07-26	Product column ~2.2m
	Tank 00001920	Diesel	17,170	TA23-00001920	2024-07-26	Product column ~1.78m
	Tank 00001923	Diesel	7,427	TA23-00001923	2024-07-26	Product column ~0.77m
	Tank 30	n/a	0			
Middle and Lower Tank Farm	Tank 00001915	n/a	0			
	Tank 00001916	Diesel	NA			Assumed empty. Damaged ladder unable to verify.
	Tank 00001917	n/a	0			
	Tank 00001918	Diesel	965	TA24-00001918	2024-07-07	
	Tank 00001921	n/a	0			
	Tank 00001922	n/a	0			Only remaining tank at the Middle Tank Farm
Other AST's	Tank 1	n/a	0			
	Tank 2	n/a	0			
	Tank 3	n/a	0			
	Tank 4	Diesel	25			Residual Product
	Tank 5	n/a	0			
	Tank 6	n/a	0			
	Tank 7	n/a	0			
	Tank 8	n/a	0			
	Tank 9	n/a	0			
	Tank 10	Diesel	840	TA24-10	2024-07-07	99.9% Water
	Tank 11	Diesel	160	TA24-11	2024-07-07	99.9% Water
	Tank 12	n/a	0			
	Tank 13	n/a	0			
	Tank 14	Diesel	50	TA24-14	2024-07-07	33.7% Water
	Tank 15	Diesel	3,328	TA24-15	2024-07-07	Product Column ~0.99m
	Tank 16	n/a	0			
	Tank 17	n/a	0			
	Tank 18	n/a	0			
	Tank 19	n/a	0			
	Tank 20	Diesel	25			Residual Product
	Tank 21	Diesel	1,130	TA24-21	2024-07-06	Product Column ~0.2m 99.9% Water
	Tank 22	Diesel	1,390	TA24-22	2024-07-06	Product Column ~0.23m 99.9% Water
	Tank 23	Diesel	200	TA24-23	2024-07-06	55% water
	Tank 24	n/a	0			
	Tank 25	n/a	0			
	Tank 26	n/a	0			
	Tank 27	Diesel	600	TA24-27	2024-07-08	Product Column ~0.5m
	Tank 28	n/a	0			
	Tank 29	n/a	0			
	Tank 31	Diesel	850	TA24-31	2024-07-08	Mostly full

Table B4 Tank and Drum Product Results (2023)
Isachsen HAWS, Nunavut
Fuel Analysis

		Isachsen HAWS 2023								
		Runway Tanks			Drums (North of Runway Tanks)					
Sample ID		**TA23-00001914**	**TA23-00001920**	**TA23-00001923**	**DR23-A1**	**DR23-B1**	**DR23-C2**	**DR23-D2**	**DR23-E1**	**DR23-F1**
Laboratory ID	**Guidelines (1)**	**3514-1**	**3514-2**	**3514-3**	**3492-27**	**3492-28**	**3492-29**	**3492-30**	**3492-31**	**3492-32**
Sampling Date		**July 26,2023**	**July 26,2023**	**July 26,2023**	**July 14, 2023**	**July 14, 2023**	**July 14, 2023**	**July 14, 2023**	**July 14, 2023**	**July 14, 2023**
PARAMETERS										
Flash Point (^{o}C)	<25 or >225	86	86	86	30	47	30	32	No Flash	42
PCBs (ppm)	2	<1	<1	<1	-	-	-	-	-	-
Total Chlorine (ppm)	1000	157	173	152	73	95	26	18	8	27
Appearance (Visual)	NV	Clear light fuel	Clear light fuel	Clear light fuel	-	-	-	-	-	-
Specific Gravity	NV	0.8197	0.8308	0.8234	0.754	0.814	0.752	0.678	1	0.812
Viscosity in cst @ 40^{o}C	NV	1.72	1.90	1.84	0.89	1.67	1.17	0.86	0.84	1.53
Infra FTIR scan Identification	NV	Diesel or Jet Fuel	Diesel or Jet Fuel	Diesel or Jet Fuel	-	-	-	-	-	-
Cadmium (ppm)	2	0	0	0	0	0	0	0	0	0
Lead (ppm)	100	0	0	0	0	0	0	0	0	0
Chromium (ppm)	10	0	0	0	0	0	0	0	0	0
Water % volume	NV	0	0	0	0.01	0.01	0.01	0.01	97.8	0.01
Precieved Contents	NV	Jet Fuel or Diesel	Jet Fuel or Diesel	Diesel or Jet Fuel	Jet B (AIA)	Jet B (AIA)	Jet B (DI)	Jet	Jet B (AIA)	Jet B

Guideline Exceedance
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Notes:

NV - No Value

RDL - Reportable detection limit

RPD - Relative percent difference calculated as (abs(C1-C2)/average(C1+C2))*100

"-" Indicates RPD not calculated. RPD cannot be calculated
if one or more of the analytical results are less than

BOLD - RPD value greater than 40% (for general comparison)

Table B4 Tank and Drum Product Results (2023)
Isachsen HAWS, Nunavut
Fuel Analysis

		Isachsen HAWS 2023								
		Drums (North of Runway Tanks)								
							Duplicates			
Sample ID Laboratory ID Sampling Date	Guidelines (1)	DR23-G1 3492-33 July 14, 2023	DR23-H1 3492-34 July 14, 2023	DR23-I5 3492-35 July 14, 2023	DR23-J7 3492-36 July 14, 2023	DR23-K1 3492-37 July 14, 2023	DR23-L1 3492-38 July 14, 2023	DUP C 3492-53 July 15, 2023	RPD %	DR23-M1 3492-39 July 15, 2023
PARAMETERS										
Flash Point (^{o}C)	<25 or >225	43	39	27	No Flash	30	41	40	1	26
PCBs (ppm)	2	-	-	-	-	-	-	-	-	-
Total Chlorine (ppm)	1000	23	19	84	6	40	25	13	32	12
Appearance (Visual)	NV	-	-	-	-	-	-	-	-	-
Specific Gravity	NV	0.804	0.816	0.768	0.995	0.726	0.806	0.807	0	0.776
Viscosity in cst @ 40^{o}C	NV	1.75	1.53	1.22	0.84	0.74	1.32	1.44	4	0.91
Infra FTIR scan Identification	NV	-	-	-	-	-	-	-	-	-
Cadmium (ppm)	2	0	0	0	0	0	0.3	0.2	20	0
Lead (ppm)	100	0	0	0	0	0	0	0	-	0
Chromium (ppm)	10	0	0	0	0	0	0	0	-	0
Water % volume	NV	0.01	0.01	0.01	93.85	54.82	0.01	0.01	0	0.01
Precieved Contents	NV	Diesel	Kerosene Aviation	Jet B	Jet	Gasoline (Unleaded)	Kerosene	Kerosene		Diesel

Guideline Exceeda

Guideline 1 Abandoned Military Site Remediation Protocol Vol 1 - Main Report (2008)

Notes:

NV - No Value

RDL - Reportable detection limit

RPD - Relative percent difference calculated as (abs(C1-C2)/

"-" Indicates RPD not calculated. RPD cannot be calculated if one or more of the analytical results are less than

BOLD - RPD value greater than 40% (for general comparisor

Table B4 Tank and Drum Product Results (2023)
Isachsen HAWS, Nunavut
Fuel Analysis

		Isachsen HAWS 2023								
		Drums (North of Runway Tanks)								
Sample ID	**Guidelines (1)**	**DR23-N1**	**DR23-O1**	**DR23-P1**	**DR23-Q5**	**DR23-R1**	**DR23-S1**	**DR23-T1**	**DR23-U4**	**DR23-V1**
Laboratory ID		**3492-40**	**3492-41**	**3492-42**	**3492-43**	**3492-44**	**3492-45**	**3492-46**	**3492-47**	**3492-48**
Sampling Date		**July 15, 2023**	**July 15, 2023**	**July 15, 2023**	**July 15, 2023**	**July 15, 2023**	**July 15, 2023**	**July 15, 2023**	**July 15, 2023**	**July 15, 2023**
PARAMETERS										
Flash Point (^{o}C)	<25 or >225	30	32	No Flash	32	36	47	46	53	48
PCBs (ppm)	2	-	-	-	-	-	-	-	-	-
Total Chlorine (ppm)	1000	25	26	8	44	21	55	41	36	31
Appearance (Visual)	NV	-	-	-	-	-	-	-	-	-
Specific Gravity	NV	0.729	0.749	0.997	0.758	0.823	0.819	0.811	0.818	0.824
Viscosity in cst @ 40^{o}C	NV	0.72	0.75	0.84	0.86	1.77	1.71	1.54	1.85	1.84
Infra FTIR scan Identification	NV	-	-	-	-	-	-	-	-	-
Cadmium (ppm)	2	0.1	0.7	0.5	0	0	0	0	0	0
Lead (ppm)	100	0	0	0	0	0	0	0	0	0
Chromium (ppm)	10	0	0	0	0	0	0	0	0	0
Water % volume	NV	0.01	0.02	96.66	0.01	0.01	0.01	0.01	0.01	0.01
Precieved Contents	NV	Gasoline (Unleaded)	Gasoline (Unleaded)	Jet A1 (AIA)	Jet B (AIA)	Jet Turbo B (AIA)	Jet	Unknown	Jet	Jet

Guideline Exceeda

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Notes:

NV - No Value

RDL - Reportable detection limit

RPD - Relative percent difference calculated as (abs(C1-C2)/

"-" Indicates RPD not calculated. RPD cannot be calculated if one or more of the analytical results are less than

BOLD - RPD value greater than 40% (for general comparisor

Table B4 Tank and Drum Product Results (2023)
Isachsen HAWS, Nunavut
Fuel Analysis

		Isachsen HAWS 2023					
		Drums (South of Runway Tanks)					
Sample ID		**DR23-W12**	**DR23-X7**	**DR23-Y1**	**DR23-Z3**	**DR23-AA1**	**DR23-AB1**
Laboratory ID	**Guidelines (1)**	**3492-49**	**3492-50**	**3492-51**	**3492-52**	**3492-1**	**3492-2**
Sampling Date		**July 15, 2023**	**July 15, 2023**	**July 15, 2023**	**July 15, 2023**	**July 15, 2023**	**July 15, 2023**
PARAMETERS							
Flash Point (^{o}C)	<25 or >225	No Flash	No Flash	No Flash	No Flash	No Flash	No Flash
PCBs (ppm)	2	-	-	-	-	-	-
Total Chlorine (ppm)	1000	18	5	6	5	51	31
Appearance (Visual)	NV	-	-	-	-	-	-
Specific Gravity	NV	0.999	1	0.995	0.993	0.993	1.011
Viscosity in cst @ 40^{o}C	NV	0.84	0.84	0.84	0.84	0.84	0.84
Infra FTIR scan Identification	NV	-	-	-	-	-	-
Cadmium (ppm)	2	0	0.1	0.2	0.2	0.4	0.1
Lead (ppm)	100	0	0	0	0	0	0
Chromium (ppm)	10	0	0	0	0	0	0
Water % volume	NV	94.85	96.88	95.65	95.68	80.16	85.82
Precieved Contents	NV	Water filled empty Jet	Water filled empty aviation gas	Water filled empty aviation gas	Water filled empty Jet	Water filled empty unknown	Water filled empty unknown

Guideline Exceeda

Guideline 1 Abandoned Military Site Remediation Protocol Vol 1 - Main Report (2008)

Notes:

NV - No Value

RDL - Reportable detection limit

RPD - Relative percent difference calculated as (abs(C1-C2)/

"-" Indicates RPD not calculated. RPD cannot be calculated if one or more of the analytical results are less than

BOLD - RPD value greater than 40% (for general comparisor

Table B4 Tank and Drum Product Results (2023)
Isachsen HAWS, Nunavut
Fuel Analysis

		Isachsen HAWS 2023							
		Drums (South of Kenn Borek Trailers)							
		Duplicates					Duplicates		
Sample ID	Guidelines (1)	DR23-AC7	DUP A	RPD %	DR23-AD1	DR23-AE1	DR23-AF1	DUP B	RPD %
Laboratory ID		3492-3	3492-23		3492-4	3492-5	3492-6	3492-24	
Sampling Date		July 15, 2023	July 15, 2023		July 15, 2023	July 15, 2023	July 15, 2023	July 15, 2023	
PARAMETERS									
Flash Point (^{o}C)	<25 or >225	37	33	6	53	46	No Flash	No Flash	-
PCBs (ppm)	2	-	-	-	-	-	-	-	-
Total Chlorine (ppm)	1000	76	8	**81**	43	82	45	5	**80**
Appearance (Visual)	NV	-	-	-	-	-	-	-	-
Specific Gravity	NV	0.819	0.82	0	0.821	0.793	0.814	1	10
Viscosity in cst @ 40^{o}C	NV	1.51	1.54	1	1.57	1.3	0.83	0.84	1
Infra FTIR scan Identification	NV	-	-	-	-	-	-	-	-
Cadmium (ppm)	2	0.7	0	-	0	0	0	0	-
Lead (ppm)	100	0	0	-	0	0	0	0	-
Chromium (ppm)	10	0	0	-	0	0	0	0	-
Water % volume	NV	0.03	0.01	**50**	0.01	0.01	91.42	97.39	3
Precieved Contents	NV	Jet Turbo Fuel B (AIA)	Jet Turbo Fuel B (AIA)		Diesel	Jet A1	Unknown (suspected gasoline)	Unknown (suspected gasoline)	

Guideline Exceeda

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Notes:

NV - No Value

RDL - Reportable detection limit

RPD - Relative percent difference calculated as (abs(C1-C2)/

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BOLD - RPD value greater than 40% (for general comparisor

Table B4 Tank and Drum Product Results (2023)
Isachsen HAWS, Nunavut
Fuel Analysis

		Isachsen HAWS 2023					
		Drums (ENE of Runway Tanks)					
Sample ID		**DR23-AG1**	**DR23-AH2**	**DR23-AI 1**	**DR23-AJ 1**	**DR23-AK1**	**DR23-AL1**
Laboratory ID	**Guidelines (1)**	**3492-7**	**3492-8**	**3492-9**	**3492-10**	**3492-11**	**3492-12**
Sampling Date		**July 15, 2023**	**July 15, 2023**	**July 15, 2023**	**July 15, 2023**	**July 15, 2023**	**July 15, 2023**
PARAMETERS							
Flash Point (^{o}C)	<25 or >225	50	No Flash	52	54	31	58
PCBs (ppm)	2	-	-	-	-	-	-
Total Chlorine (ppm)	1000	66	11	43	65	75	80
Appearance (Visual)	NV	-	-	-	-	-	-
Specific Gravity	NV	0.796	1.001	0.812	0.797	0.759	0.804
Viscosity in cst @ 40^{o}C	NV	1.45	0.84	1.41	1.72	1.05	1.58
Infra FTIR scan Identification	NV	-	-	-	-	-	-
Cadmium (ppm)	2	0	0	0	0	0	0
Lead (ppm)	100	0	0	0	0	0	0
Chromium (ppm)	10	0	0	0	0	0	0
Water % volume	NV	0.01	96.44	0.02	0.01	0.01	0.01
Precieved Contents	NV	Diesel	Jet	Jet Turbo B (AIA)	Jet A	Jet B (DI)	Diesel

Guideline Exceeda

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Notes:

NV - No Value

RDL - Reportable detection limit

RPD - Relative percent difference calculated as (abs(C1-C2)/

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BOLD - RPD value greater than 40% (for general comparisor

Table B4 Tank and Drum Product Results (2023)
Isachsen HAWS, Nunavut
Fuel Analysis

		Isachsen HAWS 2023						
		Drums at AEC 28: East Barrel Collection and Processing Area						
					Duplicates			
Sample ID	**Guidelines (1)**	**DR23-AM5**	**DR23-AN22**	**DR23-AO1**	**DR23-AP2**	**DUP D**	**RPD %**	**DR23-AQ1**
Laboratory ID		**3492-13**	**3492-14**	**3492-15**	**3492-16**	**3492-25**		**3492-17**
Sampling Date		**July 15, 2023**	**July 15, 2023**	**July 15, 2023**	**July 15, 2023**	**July 15, 2023**		**July 15, 2023**
PARAMETERS								
Flash Point (^{o}C)	<25 or >225	48	28	46	27	25	4	28
PCBs (ppm)	2	-	-	-	-	-	-	-
Total Chlorine (ppm)	1000	42	9	54	8	5	23	69
Appearance (Visual)	NV	-	-	-	-	-	-	-
Specific Gravity	NV	0.798	0.762	0.79	0.758	0.758	0	0.762
Viscosity in cst @ 40^{o}C	NV	1.57	1.15	1.64	0.91	0.88	2	0.94
Infra FTIR scan Identification	NV	-	-	-	-	-	-	-
Cadmium (ppm)	2	0	0	0	0	0	-	0
Lead (ppm)	100	0	0	0	0	0	-	0
Chromium (ppm)	10	0	0	0	0	0	-	0
Water % volume	NV	0.01	0.01	0.01	0.01	0.01	0	0.01
Precieved Contents	NV	Jet B	Jet B	Jet A1 (AIA)	Jet B (DI)	Jet B (DI)		Jet B

Guideline Exceeda

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Notes:

NV - No Value

RDL - Reportable detection limit

RPD - Relative percent difference calculated as (abs(C1-C2)/

"-" Indicates RPD not calculated. RPD cannot be calculated if one or more of the analytical results are less than

BOLD - RPD value greater than 40% (for general comparisor

Table B4 Tank and Drum Product Results (2023)
Isachsen HAWS, Nunavut
Fuel Analysis

		Isachsen HAWS 2023						
		Drums at AEC 28: East Barrel Collection and Processing Area						Drums (N of Runway Tanks)
		Duplicates						
Sample ID		DR23-AR6	DUP E		DR23-AS1	DR23-AU1	DR23-AV2	DR23-AW1
Laboratory ID	Guidelines (1)	3492-18	3492-26	RPD %	3492-19	3492-20	3492-21	3492-22
Sampling Date		July 15, 2023	July 15, 2023		July 15, 2023	July 15, 2023	July 15, 2023	July 16, 2023
PARAMETERS								
Flash Point (°C)	<25 or >225	No Flash	No Flash	-	No Flash	No Flash	No Flash	28
PCBs (ppm)	2	-	-	-	-	-	-	-
Total Chlorine (ppm)	1000	20	6	**54**	21	26	9	190
Appearance (Visual)	NV	-	-	-	-	-	-	-
Specific Gravity	NV	1.001	1	0	1.001	1	1	0.698
Viscosity in cst @ 40°C	NV	0.84	0.84	0	0.84	0.84	0.84	0.72
Infra FTIR scan Identification	NV	-	-	-	-	-	-	-
Cadmium (ppm)	2	0	0	-	0	0	0	0
Lead (ppm)	100	0	0	-	0	0	0	**469.3**
Chromium (ppm)	10	0	0	-	0	0	0	0
Water % volume	NV	99.48	93.41	3	99.61	99.78	98.37	0.02
Precieved Contents	NV	Bronze Gasoline	Bronze Gasoline		Unknown	Oil	Jet B	Piston Oil

Guideline Exceeda

Guideline 1 Abandoned Military Site Remediation Protocol Vol 1 - Main Report (2008)

Notes:

NV - No Value

RDL - Reportable detection limit

RPD - Relative percent difference calculated as (abs(C1-C2)/

"-" Indicates RPD not calculated. RPD cannot be calculated if one or more of the analytical results are less than

BOLD - RPD value greater than 40% (for general comparisor

Table B5 Tank Product Results (2024)
Isachsen HAWS, Nunavut
Fuel Analysis

		Isachsen HAWS 2024											
		AEC 18: Lower Tank Farm	AEC 13: New Garage				Operations Building	AEC 7: Hydrogen Building	AEC 16: Strip Tanks		Kenn Borek Trailers		AEC 12: Maintenance Garage
			Duplicates										
Sample ID		**TA24-00001918**	**TA24-10**	**DUP A**		**TA24-11**	**TA24-14**	**TA24-15**	**TA24-21**	**TA24-22**	**TA24-23**	**TA24-27**	**TA24-31**
Laboratory ID	**Guidelines (1)**	**7371-1**	**7371-11**	**7371-10**	**RPD %**	**7371-9**	**7371-8**	**7371-7**	**7371-5**	**7371-4**	**7371-6**	**7371-3**	**7371-2**
Sampling Date		**July 7, 2024**	**July 7, 2023**	**July 7, 2023**		**July 7, 2023**	**July 7, 2023**	**July 7, 2023**	**July 6, 2023**	**July 6, 2023**	**July 6, 2023**	**July 8,2023**	**July 13,2023**
PARAMETERS													
Flash Point (^{o}C)	<25 or >225	90	*1	*1	-	*1	91	-5	*1	*1	59	78	55
PCBs (ppm)	2	<1	<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<1
Total Chlorine (ppm)	1,000	120	2	5	**43**	95	157	205	2	5	126	135	151
Appearance (Visual)	NV	Clear fuel +sediment	Clear water	Clear water	-	Dark water	10% fuel	Dark fuel	Aqueous solution	Aqueous solution	50/50 fuel & water	Clear fuel	Clear fuel
Specific Gravity	NV	0.8211	1.0005	1.0021	0	1.0051	0.8259	0.8081	0.9999	0.9997	0.812	0.823	0.8087
Viscosity in cst @ 40^{o}C	NV	1.97	0.85	0.81	2	1.31	2.03	1.54	1.26	1.07	1.49	1.89	1.47
Infra FTIR scan Identification	NV	Fuel	Water	Water	-	Water	Some fuel	Some fuel	Water	Water	Some fuel	Fuel	Fuel
Cadmium (ppm)	2	0	0	0	-	0	0	0	0	0	0	0	0
Lead (ppm)	100	0	0	0	-	0	0	18.3	0	0	0.2	0	0
Chromium (ppm)	10	0	0	0	-	0	0	0	0	0	0	0	0
Water % volume	NV	0.02	99.9	99.9	-	99.9	33.7	0.07	99.9	99.8	55.5	0.02	0.02

Guideline Exceedance

Guideline 1 Abandoned Military Site Remediation
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Notes:

*1 - No flashpoint, Steam coming off at 100^{o}C

NV - No Value

RDL - Reportable detection limit

RPD - Relative percent difference calculated as (abs(C1-C2)/average(C1+C2))*100

"-" Indicates RPD not calculated. RPD cannot be calculated
if one or more of the analytical results are less than

BOLD - RPD value greater than 40% (for general comparison)

Table B6 Runway Tanks Diesel Specification Results (2024)
Isachsen HAWS, Nunavut
Fuel Analysis

				Isachsen HAWS 2024					
				Runway Tanks					
				TA24-00001914		TA24-00001920		TA24-00001923	
Sample ID	Specification (1)		Units	TA24-00001914	TA24-00001914 (filtered)	TA24-00001920	TA24-00001920 (filtered)	TA24-00001923	TA24-00001923 (filtered)
Laboratory ID	Minium	Maximum		FL24_1455-005	FL24_1455-006	FL24_1455-001	FL24_1455-002	FL24_1455-003	FL24_1455-004
Sampling Date				July 7, 2023	July 7, 2024	July 6, 2023	July 6, 2023	July 7, 2023	July 7, 2023
PARAMETERS									
Copper Corrosion - Classification		No. 1		1a	1a	1a	1a	1a	1a
Water and Sediment		0.02	% (v/v)	<0.005 (2)	<0.005 (2)	<0.005 (2)	<0.005 (2)	**0.06** (2)	<0.005 (2)
Electrical Conductivity	25		pS/m	86	91	139	115	138	117
Ash Content		0.01	Mass %	<0.001	<0.001	<0.001	<0.001	0.003	<0.001
Carbon Residue, 10% Bottoms		0.1	%	0.08	0.1	0.07	0.09	0.09	0.09
Cetane Number	40			42.2	42.2	41.8	42	42.2	42.2
Total Sulfur		15	mg/kg	**812** (3)	**809** (3)	**1030** (3)	**1040** (3)	**926** (3)	**934** (3)
Kinematic Viscosity @ 40°C (Bias-corrected)	1.3	3.6	mm2/s (cSt)	1.549	1.551	1.771	1.773	1.66	1.66
Wear Scar Diameter		460	um	**630** (4)	**660** (4)	**540** (4)	**550** (4)	**570** (4)	**580** (4)
Distillation 90% Recovered (corr)		290	°C	249.8	248.8	260.3	260.3	254.8	253.7
Corrected Flash Point	40		°C	70	70	74	74	74	73
Acid Number		0.1	mg KOH/g	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Guideline Exceedance

Specification 1 - CAN/CGSB-3.517-2020 A

Notes:

(1) The results obtained on your sample except for ASTM D7039 and ASTM D7688 comply with the specified limiting values of the Canadian General Standards Board (CGSB) specification for Diesel Fuel (CAN/CGSB-3.517-2020 Type A) for areas of Canada which do not require lower flow properties than that displayed by the cloud point result.

(2) CAN/CGSB-3.517-2020 states that the referee test method for water and sediment shall be ASTM D1796 (modified). The test is modified by substituting the centrifuge tube specified in ASTM D2273 for the centrifuge tube in ASTM D1796.

(3) As per ASTM D7039 Sections 5.1 and 5.2, fuels containing large quantities of oxygenates, such as biodiesel, biodiesel blends, and gasoline-ethanol blends, can have a high oxygen content leading to significant absorption of sulfur Ka radiation and low sulfur % have correction factors outside the range of 0.98 to 1.04 and should be corrected for oxygen. The oxygen content of the sample is unknown; therefore, a matrix correction factor has not been applied to the reported sulfur result.results. For general analytical purposes, the matrices of test samples and the calibrants are considered to be matched when the calculated correction factor (C) is within 0.98 to 1.04. No matrix correction is required when the value of C is outside the range of 0.98 to 1.04. Biodiesel and biodiesel blends with >2 wt% oxygen and gasoline-ethanol blends >8 wt% have correction factors outside the range of 0.98 to 1.04 and should be corrected for oxygen. The oxygen content of the sample is unknown; therefore, a matrix correction factor has not been applied to the reported sulfur result.

(4) The High Frequency Reciprocating Rig (HFRR) analysis can be used as an indicator of base fuel lubricity. The Canadian General Standards Board (C.G.S.B.) specification for Diesel Fuel CAN/CGSB-3.517-2020 states that an acceptable test result is defined as a wear scar diameter of less than or equal to 460 µm at 60°C.

RDL - Reportable detection limit

RPD - Relative percent difference calculated as (abs(C1-C2)/average(C1+C2))*100

"-" Indicates RPD not calculated. RPD cannot be calculated if one or more of the analytical results are less than detection limits or

BOLD - RPD value greater than 40% (for general comparison)

Appendix C

Photograph Logs

Runway Tanks/Berm Inspection Photo Log: Isachsen HAWS

Photo 1: Runway Tanks (from left to right) #00001920 (~17,170 L), #00001923 (~7,427 L) and #00001914 (~21,221 L) containing product, view Southeast. (July 18, 2023)

Photo 2: Measuring steel thickness of tanks using an Ultrasonic Velocity Meter, view South. (July 6, 2024)

Photo 3: Runway Tanks and current condition of the berm, view North. (July 6, 2024)

Photo 4: Condition of the berm liner, note rips and tears in corner, view Northwest. (July 6, 2024)

Photo 5 Tank #00001920, 17,170L, 4.91 mm thick steel, view Southeast. (July 23, 2024)

Photo 6: Tank #00001920 main valve locked out with blocking plate (July 6, 2024)

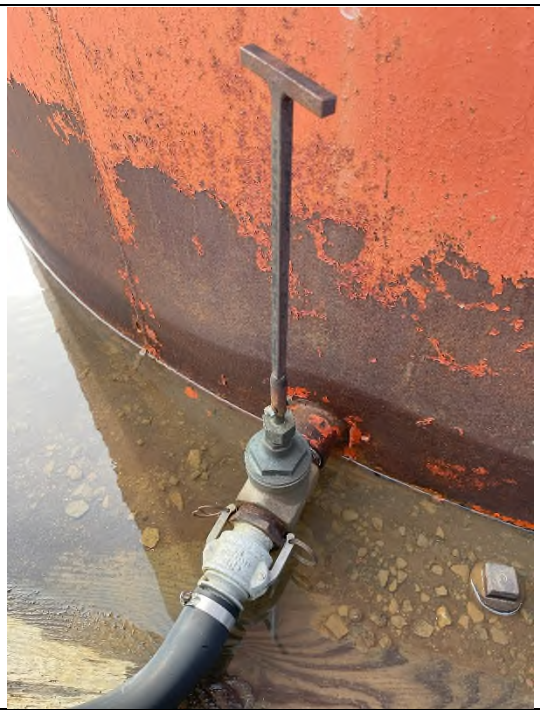


Photo 7: Tank #00001920 small valve at bottom of tank with a T bar handle. Not manipulated for fear of breakage. (July 6, 2024)

Photo 8: Tank #00001920 hose and dispensing nozzle placed over inspection port within berm (July 23, 2024)

Photo 9: Tank #00001923, 7,427 L, 5.13mm thick steel, view Southeast. (July 23, 2024)

Photo 10: Tank #00001923 main valve on backside. Locked out and blocking plate attached (July 23, 2024)

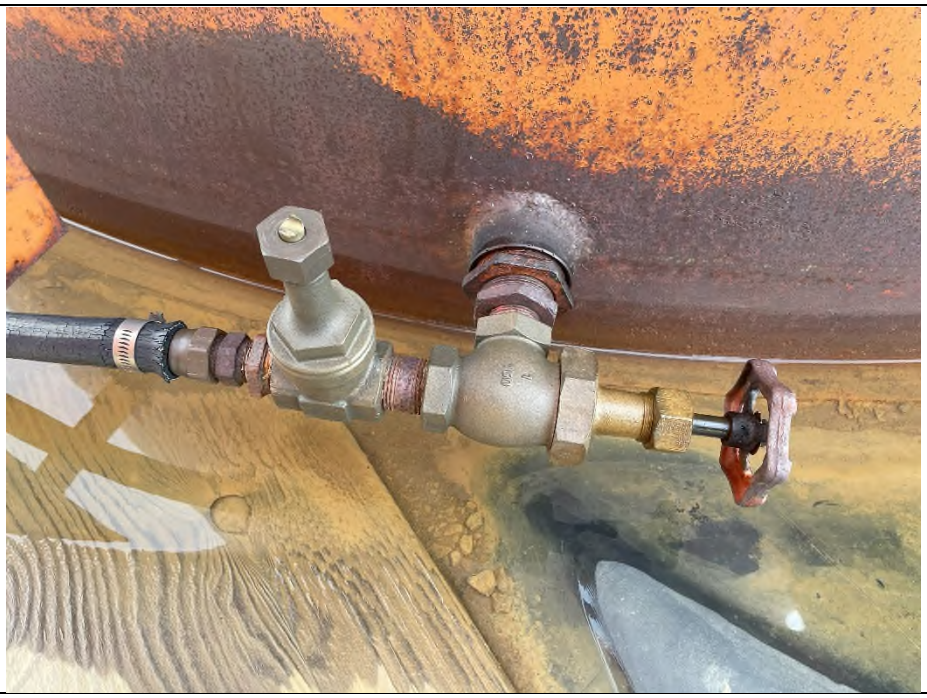


Photo 11: Tank #00001923 small valve at bottom with broken T bar handle connected to black hose. Not manipulated for fear of breakage/leakage. Hose placed within berm. (July 6, 2024)

Photo 12: Tank #00001914, 21,221 L, 4.92mm thick steel and condition of the berm, view Southeast. (July 6, 2024)

Photo 13: Tank #00001914 main valve locked out with blocking plate in place. No smaller valve noted on this tank. (July 23, 2024)

Photo 14: Diesel specification testing of Runway Tanks using fall protection, view Southeast. (July 8, 2024)

Drum Product Inventory Photo Log: Isachsen HAWS

Photo 1: Drum Group A (6 drums, Blue/Yellow/Blue): Jet B Anti Icing Additive (AIA), view Southeast (July 14, 2023)

Photo 2: Drum Group B (2 drums, Grey/Creamy White/Grey): Jet Turbo B AIA, view Southeast (July 14, 2023)

Photo 3: Drum Group C (3 drums, Blue): Jet B De-icer (DI), view Southeast (July 14, 2023)

Photo 4: Drum Group D (2 drums, Rose): Jet B AIA, view Southeast (July 14, 2023)

Photo 5: Drum Group E (2 drums, Blue/White Cream/Blue): Jet B AIA, view Southeast (July 14, 2023)

Photo 6: Drum Group F (2 drums, Black/Yellow/Black): Jet B, view Southeast (July 14, 2023)

Photo 7: Drum Group G (1 drum, Black): Diesel and Drum Group H (3 drums – 2 added after photo, Rose/Black/Rose): Kerosene, view Southeast (July 14, 2023)

Photo 8: Drum Group I (6 drums, Black/Yellow/Black): Jet B, view Southeast (July 14, 2023)

Photo 9: Drum Group J (13 drums – other aside or added later, Yellow): Jet, view Southeast (July 14, 2023)

Photo 10: Drum Group K (23 drums – others aside or added later, Rose over top of Blue): Gasoline (unleaded), view Southeast (July 14, 2023)

Photo 11: Drum Group L (9 drums – one aside, Blue): Kerosene, view South (July 14, 2023)

Photo 12: Drum Group M (9 drums, Grey/Creamy White/Grey with green D spray painted on): Diesel, view Southeast (July 14, 2023)

Photo 13: Drum Group N (5 drums, Rose over top of Blue): Gasoline (unleaded), view South (July 15, 2023)

Photo 14: Drum Group O (4 drums – 1 aside, another added later, Red): Gasoline, view Southwest (July 15, 2023)

Photo 15: Drum Group P (3 drums, Blue/Yellow/Blue): Jet A1 AIA, view Southwest (July 15, 2023)

Photo 16: Drum Group Q (18 drums, Blue/White Cream/Blue): Jet B AIA, view Southwest (July 15, 2023)

Photo 17: Drum Group R (2 drums, Grey/White Cream/Grey): Jet Turbo B AIA, view Southwest (July 15, 2023)

Photo 18: Drum Group S (2 drums, Red/Yellow/Red): Jet, view Southwest (July 15, 2023)

Photo 19: Drum Group T (1 drum, Red/Black/Red): Unknown, view Southwest (July 15, 2023)

Photo 20: Drum Group U (7 drums – others added after photo, Grey/White Cream/Grey): Jet, view Southwest (July 15, 2023)

Photo 21: Drum Group V (1 drum, Red/Yellow/Red): Jet, view Southwest (July 15, 2023)

Photo 22: Drum Group W (16 drums, Red, Yellow Top/Bottom): Former Jet open water filled, view Northwest (July 15, 2023)

Photo 23: Drum Group X (13 drums, Red, White Top): Former Aviation Gas open water filled, view North (July 15, 2023)

Photo 24: Drum Group Y (2 drums, Red, Blue, Red White Top): Former Aviation Gas open water filled, view West (July 15, 2023)

Photo 25: Drum Group Z (3 drums, Green/Yellow/Green): Former Jet open water filled, view North (July 15, 2023)

Photo 26: Drum Group AA (3 drums, Red/Blue/Red): Former Unknown open water filled, view South (July 15, 2023)

Photo 27: Drum Group AB (1 drum, Navy Blue Rusted): Former Unknown open water filled, view North (July 15, 2023)

Photo 28: Drum Group AC (9 drums, Grey/Creamy White/Grey): Jet Turbo B (AIA) and Drum Group AD (1 drum, Light Brown): Diesel, view North (July 15, 2023)

Photo 29: Drum Group AE (3 drums, White): Jet A1, view North (July 15, 2023)

Photo 30: Drum Group AF (1 drum, Red/Blue/Red): Unknown – suspected gasoline, view South (July 15, 2023)

Photo 31: Drum Group AG (1 drum, Black): Diesel, view Southwest (July 15, 2023)

Photo 32: Drum Group AH (2 drums, Rusty Red): Jet, one drum open water filled, view Southwest (July 15, 2023)

Photo 33: Drum Group AI (3 drums, Grey/Creamy White/Grey): Jet Turbo B (AIA), view Southwest (July 15, 2023)

Photo 34: Drum Group AJ (5 drums, Rose/Blue/Rose): Jet A, view Southwest (July 15, 2023)

Photo 35: Drum Group AK (2 drums, Blue/White/Blue): Jet B (DI), view South (July 15, 2023)

Photo 36: Drum Group AL (1 drum, Teal/White/Teal): Diesel, view South (July 15, 2023)

Photo 37: Drum Group AM (13 drums, Black/Yellow/Black): Jet B, view Southwest (July 15, 2023)

Photo 38: Drum Group AN (40 drums, Black/Yellow/Black): Jet B, view Southwest (July 15, 2023)

Photo 39: Drum Group AO (3 drums, Grey): Jet A1 (AIA) view Southwest (July 15, 2023)

Photo 40: Drum Group AP (2 drums, Blue/White/Blue): Jet B (DI), view Southwest (July 15, 2023)

Photo 41: Drum Group AQ (3 drums – 1 aside, Yellow): Jet B, view Southwest (July 15, 2023)

Photo 42: Drum Group AR (22 drums, Light Brown): Gasoline (Bronze), view Southeast (July 15, 2023)

Photo 43: Drum Group AS (3 drums, White Rusted): Unknown, view Southeast (July 15, 2023)

Photo 44: Drum Group AT (3 drums, Red Rusted, Yellow Top): Oil, view Southeast (July 15, 2023)

Photo 45: Drum Group AU (2 drums, Blue/Orange/Blue): Oil, view Northeast (July 15, 2023)

Photo 46: Drum Group AV (2 drums, Grey/White/Grey): Jet B, view East (July 15, 2023).

Drum Group AW (4 drums, Beige: Pistol Oil (not pictured – were rolled out of gullies placed north of Runway Tanks)

Tank Product Inventory Photo Log: Isachsen HAWS

Photo 1: Runway Tanks (from left to right) #00001920 (~17,170 L), #00001923 (~7,427 L) and #00001914 (~21,221 L) containing product, view Southeast. (July 18, 2023)

Photo 2: Tanks #00001916 (assumed empty but ladder broken so unable to verify at time), #00001918 (~965 L) and #00001921 (empty), view Southwest. (July 18, 2023)

Photo 3: Tank #10 (~840 L), view Northwest. (July 18, 2023)

Photo 4: Tank #11 (~160 L), view Northwest. (July 18, 2023)

Photo 5 Tank #14 (~50 L), view Southeast. (July 18, 2023)

Photo 6: Tank #15 (~3,328 L), view Northeast. (July 18, 2023)

Photo 7: Tank #20 (Residual ~25 L), view Southeast. (July 18, 2023)

Photo 8: Tank #21 (~1,130 L) and Tank #22 (~1,390 L), view East. (July 18, 2023)

Photo 9: Tank #23 (~200 L), view East. (July 18, 2023)

Photo 10: Tank #27 (~600L, view North. (July 18, 2023)

Photo 11: Tank #31 (~850 L) inside Maintenance Garage, view Northeast. (July 12, 2024)

Appendix D

Ketek Certificates and Field Report

Incinerator A

KETEK GROUP INC.	Form	Document #:	F247
	INCINERATOR COMMISSIONING FORM	Issued For:	D
		Revision #:	01
		Effective Date:	Jun. 4, 2012

A – All Ketek Group B – All Branches C – Edmonton (Home Office) D – Other (as specified)

This is to confirm that unit number 9570A/CONTROL, CY-20-W.OSYSTEM CY-___-___-A-___ Single/Dual chamber incinerator is commissioned successfully on this day JULY 16 and OUTCOME CONSULTANTS staff is satisfied with its operation.

Unit was commissioned with help from Ketek Manufacturing technician(s)

JEFFREY PRADO / MARC POULIOT.

Following Eric Grimmick (Outcome Consultants Inc) staff was present and was shown how to operate this incinerator.

1. Eric Grimmick
2. _____
3. _____
4. _____
5. _____

Signatures _____ Client Signatures Don Pleasant

Name JEFFREY PRADO Client Name Don Pleasant

Ketek Manufacturing Representative Company Name Outcome Consultants Inc

Prepared By:	See Master Copy For Signature	Administrator	Approved By:	See Master Copy For Signature	General Manager
K:\Library\Forms\F247 Incinerator Commissioning Form.docx					Page 1 of 1

Incinerator B

KETEK GROUP INC.	Form	Document #:	F247
	INCINERATOR COMMISSIONING FORM	Issued For:	D
		Revision #:	01
		Effective Date:	Jun. 4, 2012
A – All Ketek Group B – All Branches C – Edmonton (Home Office) D – Other (as specified)			

This is to confirm that unit number 9570B/CONTROL, CY-20-W.O. SYSTEM CY-__-A-__ Single/Dual chamber incinerator is commissioned successfully on this day JULY 15 and OUTCOME CONSULTANTS staff is satisfied with its operation.

Unit was commissioned with help from Ketek Manufacturing technician(s)

JEFFREY PRADO / MARC POULIOT.

Following Eric Grimminck (Outcome Consultants) staff was present and was shown how to operate this incinerator.

1. Eric Grimminck
2. _____
3. _____
4. _____
5. _____

Signatures _____ Client Signatures Don Plenderleith

Name JEFFREY PRADO Client Name Don Plenderleith

Ketek Manufacturing Representative Company Name Outcome Consultants

KETEK GROUP INC.

SERVICE REPORT

Revision 01	F163
Revised By: BA	Jan. 23, 2014

Home Office: 20204-110 Ave., Edmonton, Alberta, T5S 1X8 | Contact Us: ketek@ketek.ca, 1-855-447-5050, www.ketek.ca

Branch: ☒ Edmonton ☐ Fort McMurray ☐ Grande Prairie ☐ Cold Lake ☐ Fort St. John ☐ Fort Nelson ☐ Other:

Client: OUTCOME CONSULTANTS Rig #: Date: 07/19/24

Location: ISACHSEN NUNAVUT Job Name:

Service Request By: DON PLENDERLEITH Phone #: RO #: 36252

Email: dplenderleith@outcomeinc.ca AFE/PO #:

Status/Description/Information	☐ Equipment Service/Maintenance
TECHNICIAN: JEFFREY PRADO AND MARC MOULIOT.	
- JULY 07, - TRAVEL	↳ CONNECT WASTE OIL CONTROLLER
↳ EDMONTON TO OTTAWA	TO INCINERATOR CHAMBER SN: 9570B
- JULY 08 - TRAVEL	AND TEST RUN UNIT. OK
↳ OTTAWA TO IQALUIT	↳ CONNECT WASTE OIL CONTROLLER
- JULY 09 - TRAVEL	TO INCINERATOR CHAMBER SN: 9570A
↳ IQALUIT TO RESOLUTE	AND TEST RUN UNIT. OK
- JULY 09 - 13 @ RESOLUTE	↳ UH HOOK CONNECTION AND PUT
- JULY 13 - TRAVEL	AWAY PARTS IN SECURED AREA.
↳ RESOLUTE TO ISACHSEN	- JULY 19 - TRAVEL
- JULY 13 - 19 - ONSITE	↳ ISACHSEN TO RESOLUTE
↳ ASSEMBLY OF WASTE OIL	- JULY 19-21 @ RESOLUTE
INCINERATOR SKID PANEL AND	- JULY 21 - TRAVEL RESOLUTE TO YELLOWKNIFE
PUMP SKID. (CONTROLLER)	JULY 22 - TRAVEL YELLOWKNIFE TO EDMONTON

Labour:	hrs @ $ =	Approved By (Printed Client Name and Signature or Stamp):	Don Plenderleith Outcome Consultants July 18 2024
Distance:	km @ $ =		
Unit #:	☐ Trailer Sales Total =		
Completed by: JEFFREY PRADO	Subtotal =	Posted Document Number:	

Taxes will be added when invoiced

Sign-off	Prepared by	Approved by		Document Number
	See Master Copy For Signature	See Master Copy For Signature	See Rationale and Usage Document Before Use	SR 142581
	(INSERT TITLE)	Vice President		

White - Original, Yellow - Office, Pink - Customer, Gold - Report Book

Appendix E

Incinerator Standard Operating Procedure (SOP)

Incinerator Operating Procedure, Isachsen HAWS

NOJV SOP:	Ver: 1	Issue Date: Nov. 27, 2024

Table of Contents

Incinerator Operating Procedure, Isachsen HAWS

List of Figures

Incinerator Operating Procedure, Isachsen HAWS

1.0 SOP Introduction

1.1 Purpose Statement

The purpose of this Standard Operating Procedure (SOP) is to describe the steps required to safely operate the two Ketek incinerators 9570A and 9570B stored at Isachsen HAWS and to provide a reference for setup and disassembly of theses incinerators.

At the end of this SOP, the user will be able to:

1. Setup incinerators 9570A and 9570B
2. Safely operate the incinerators
3. Identify common incineration issues and solutions
4. Properly disassemble and safely store incinerators 9570A and 9570B

1.2 Intended User of this Document

This SOP is intended for any personal tasked with operating or assisting in incinerator operations.

1.3 Who are the Participants

1.3.1 Assignee:

The project manager or field superintendent role will indicate if an employee is required to operate or assist in operation of incinerators. They will direct the employee to read over the SOP. They will also be responsible for selecting the incineration area and empty drum storage locations

1.3.2 Assigned:

The employee assigned to help setup, disassemble, monitor, and or assist in the incineration of fuel via incinerator 9570A or 9570B.

1.4 Applicable Industry Standards or Required Certifications

- No standards are required for the current SOP.
- Understanding the signs of a spill or fuel line leak

1.5 List of Minimum Required Equipment for this Process

- A forklift or fork equipped vehicle
- Waste fuel
- Clean diesel fuel for pilot burner ignition and/or operation
- A fuel storage/mixing tank
- A clear storage tank for oily water fuel separation
- Personal hand radio or communications device for safety and spill reporting

- Portable secondary fuel containment capable of holding 110% volume discharge from the largest fuel storage/mixing tank
- Spill kit(s)
- Min 8000 watt generator: Capable of outputs Voltage: 125/250VAC, Phase: 1PH, Amp: 30, Freq: 60Hz)
- Incinerator components (see attached Incinerator Setup figure at the end of the SOP)

2.0 Incinerator Setup/Disassembly

2.1 Storage Locations of Incinerator Components:

The incinerator components are stored in the following locations:

1. In the New Garage near the back south wall are the main control panels, and waste fuel control panels. To the east of the bay doors, are the pilot burners air intake hoses, portable spill containment berms, fittings, spare chamber cement, and some additional pails (Figure 1 below).

Figure 1: New Garage - Incinerator Components Storage Location

2. To the east of the Runway Tanks are the two incineration chambers (Figure 2 below).
Note: The storage locations may change from year-to-year. Any change in storage locations for the components should be documented at time of disassembly.

Figure 2: Near Runway Tanks - Incineration Chamber Storage Location

3. For future incineration operations, mixing tanks, a spill containment berm, oily water fuel separation totes, generators and clean diesel fuel will be found.

Note: These items have not yet been mobilized to site yet. These components should be stored in the New Garage for long term storage and documented along with the rest of the incinerator parts following incineration operations.

2.2 Setup:

The following steps will detail how to setup the incinerators as per the Incinerator Setup figure provided in **Appendix A** of this SOP.

Note: The use of rig mats to prevent ground rutting is advised as Isachsen can be extremely muddy and repeated vehicle traffic can quickly make the ground condition horrendous.

1. Using a fork-equiped vehicle move all the incinerator parts to the designated incineration area chosen by the project manager or field superintendent. Use rig mats wherever possible to prevent ground rutting as noted above.

   Note: The exact incinerator location may vary but the incineration chambers must have a clear 6 meter radius around due to the high operating temperature.

   The main incinerator components are shown below in Figure 3 for reference.

Figure 3: Main Control Panel with attached blowers (left), Waste Fuel Pump Control Panel, pump attached (middle left), Incineration chamber (middle right) and Pilot Burner (right)

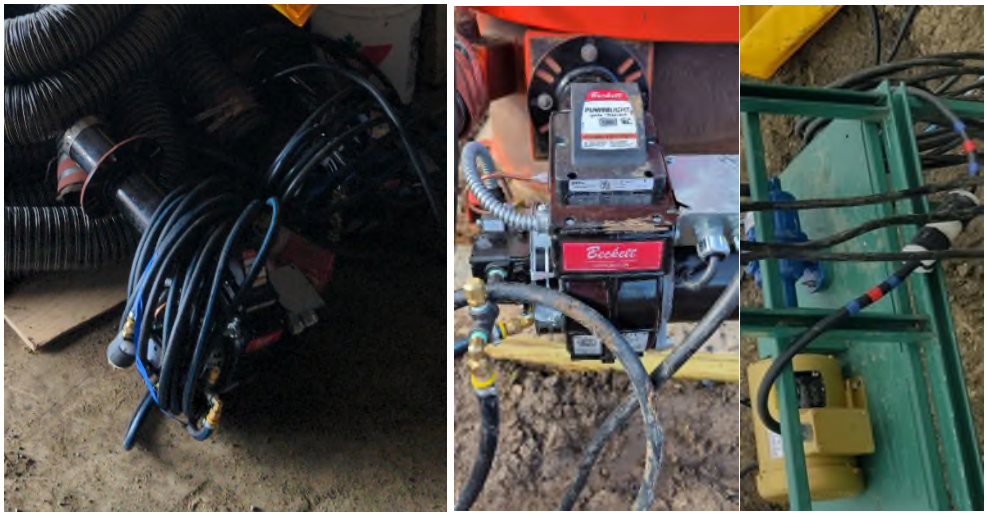
Figure 4: Clean Diesel and waste fuel for pilot burners (left), Proposed Mixing Tank (middle left), proposed oily water fuel separation tote (middle right) and proposed Field Generator (1 required for each incinerator setup) (right)

2. Setup the spill containment berm(s) as needed. Position all the fuel containing tanks/totes inside the berm using the fork-equipped vehicle. The spill containment berm must contain 100% of the volume in the largest mixing tank as well as an additional 10% of the total fuel volume contained within the berm. See **Appendix A** for the Incineration Setup with the spill containment arrangement shown.
3. Arrange the other non-fuel containing control panels and incineration chambers as illustrated with consideration for the incineration chambers to have a 6-meter clear radius.
4. Install the pilot burners on the incineration chambers. First mount the pilot burner to the burn chamber using the bolts found within one of the Canadian Tire 5 G pails used for incineration parts located in the New Garage. The fuel line of the pilot burner should then be connected to a clean diesel source. The power cord from the pilot burner attaches to the main control panel.

Complete this step for both incineration chambers. There is a spare pilot burner within the New Garage in case one pilot burner fails.

Note: The power lines are labelled and colour coated with electrical tape, the ends of the same colour and label should be connected together.

Figure 5: Unattached pilot burner (left), attached pilot burner (middle), Example of colour coated power connections (right)



5. Setup of the waste fuel control panel. The waste fuel panel comes pre-attached with a fuel pump and filter. The intake line of the pump should be submerged/connected to the fuel mixing tank and output connected just left of the pilot light on incineration chamber (Figure 6 below). Use some plumbers tape on the fitting to prevent leakage. Lastly, connect the power line and data line to the main control panel in the same manner as 2.2 Setup Step 4 above.

Figure 6: Waste fuel connection valve on incineration chamber

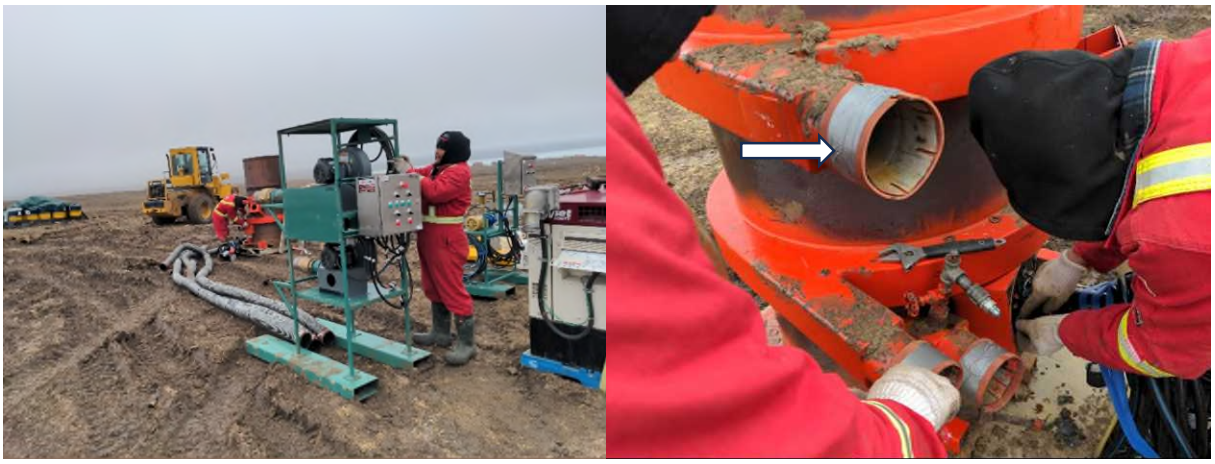
6. Setup of the main control panel. Two blowers come pre-attached to the control panel. There are three air hoses and 12 gaskets and hose clamps (see Figure 7 below) used for operation. The upper blower contains a hose splitter for evenly distributing airflow between two air lines and

these air lines connect to the two top air connections on the incinerator chamber. The air hose from the bottom blower connects to the bottom air connection on the incineration chamber. When connecting the air hoses, place the air hoses over the gaskets then use the padded hose clamps to tighten down the connection.

Note: The air hoses are quite fragile and there and no extra currently on site. Do not over tighten the hose clamps. Just tighten them enough to keep the hose from sliding off the connection port.

7. Lastly connect the remaining power line to the generator. This is the only power cord that is labelled but uncolored.

Figure 7: Main control panel, and uninstalled incineration hoses (left), Air hose gaskets on incineration chambers air connections (right)



At this point everything should be connected as per the Incinerator Setup Diagram provided in **Appendix A.**

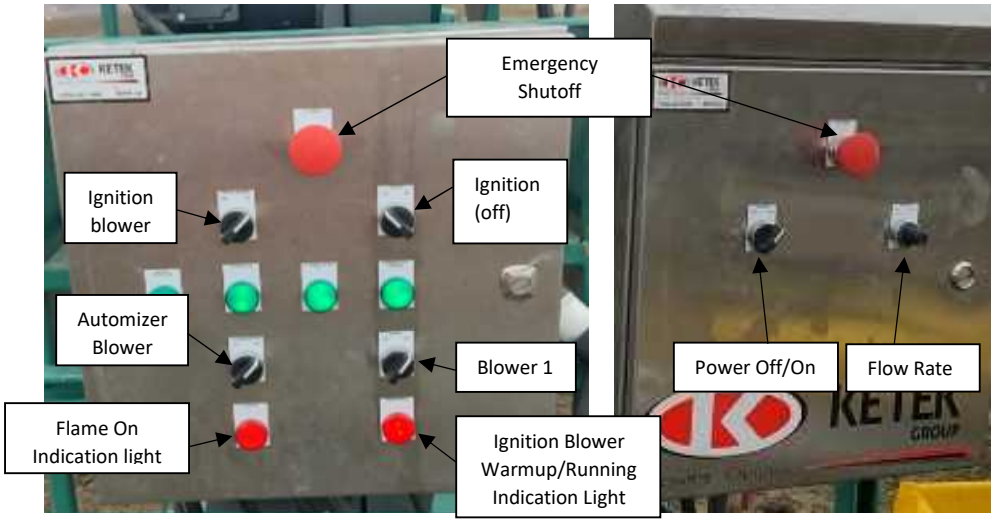
3.0 Incinerator Operation:

3.1 Startup:

The following steps describe how to properly commence the incineration of waste fuels. The incineration rate for waste fuels is 113 Liter per hour and the burn rate for the pilot burner is 16 Liter per hour. See the main control panel figure below for switch reference.

Note: When a switch is pointed to the left it is off. For example, the ignition switch is off in the photo (left) below.

Figure 8: Control Panel Switch Layout. On/Off Indicator Lights in green. Main panel (left) waste fuel panel (Right)



1. Check all fuel, air and electrical lines for damage and ensure all connections are good prior to starting the incineration process.
2. Make sure the generator is topped up with fuel and that the emergency stop buttons on the main control and waste fuel panel are disengaged.
3. Turn the generator on.
4. Turn on the ignition blower switch on the top left of the control panel. This will start the pilot burner by providing a small amount of fuel & turning on the pilot burners built in blower.
5. Wait five minutes for the pilot burner to begin circulating air and fuel within the incineration chamber. During this time check for leaks in the fuel line that may be caused by the pilot burner startup.
6. After five minutes a red light on the bottom right corner will turn on. The ignition switch on the top right can now be switched on this will increase flame output of the pilot burner to an operational state.
7. Confirm that the flame has been lit. You should see hot air rising from the ignition chamber and maybe some steam.
8. Wait for 30 minutes to allow the burn chamber to heat up.
9. Now turn the Blower 1 switch on. Check to make sure the blower is operating properly then immediately turn on the Automizer Blower switch.
10. The waste fuel control panel will now be activated. Go over to the waste fuel panel and turn the switch on. Start at the lowest setting (flow rate) and adjust the fuel flow rate nob until the flame is just barely visible as seen in the Figure 9 photo below. This is the maximum flame height and incineration should be stopped if the flame goes too high above the chamber top while at the lowest flow rate.
11. If the fuel appears to be burning well, the incineration is self-sustaining and the ignition switch on the main control panel can and should be switched off to save burning the 16 liters per hour of clean diesel for the pilot burner.

Note: If turning the ignition switch off causes the flame to go out within the next few minutes it should immediately be turned on again.

Figure 9: Waste fuel pump and control panel and burn chamber with ideal flame height shown

3.2 Shutdown/Cooldown:

The following steps describe the shut down procedure and the mandatory cool down period for the incinerators:

1. Turn the flow rate dial on the waste fuel control panel to the minimum setting.
2. Turn the waste fuel control panel off using the on/off switch.
3. Turn off the ignition on the main control panel. There should now no longer be any flame in the incineration chamber.

4. For the next three hours allow the incineration chamber to cool by keeping the Blower 1, Automizer Blower and the Ignition blower switches on.
5. After three hours look for signs that the ignition chamber has cooled and the turn of all switches.

3.3 Troubleshooting:

Here is a list of some common issues that may occur and steps to rectify them:

Stoppage of Main Incineration Flame:

1. Firstly, always check that all the fuel line are securely connected and the waste fuel and clean diesel tanks and generator fuel supply are filled up. This is always the first thing to check. If any one of these fuel sources runs dry it could cause damage to the system.

2. If the incineration flame goes out while the ignition switch is off, this may be caused by oily water getting in to the waste fuel line or caused by fuel that is not combustible enough.

   Rectify by turning the waste fuel control panel off temporarily and turning the ignition switch back on. Wait until you see the flame again and then start the waste fuel control panel again, try to continue burning with the ignition on for a few minutes before attempting to turn it off again. If the flame goes out again, continue burning with the ignition switch turned on until a point where new waste fuel can be mixed.

3. If the incineration flame goes out while ignition switch is on, this may be caused by oily water getting into the waste fuel line or a damaged pilot light.

   Rectify by first turning off the waste fuel pump on the control panel. Check that the power line is connected to the main control panel. If the flame doesn't reappear within a minute, you may have a pilot burner failure. Cool down the incineration chamber and then install the spare pilot burner. If the flame does come back on, try starting the waste fuel control panel again. If the waste fuel puts out the flame with the ignition burner running, then there is probably a high amount of oily water attempting to be burned. Try putting the waste fuel line into another mixing tank or more known combustible waste fuel product. If this solves the problem, pump the product out of the problematic mixing tank into a oily water separation tank and see if more fuel will decant out of the mixture. Try burning the fuel portion again.

If there is dark smoke coming from the incineration chamber:

1. The waste fuel supply line may need to have the particulate filter replaced or one of the blowers may not be operating properly and providing enough air to the system.

Rectify by first turning off the waste fuel control panel. Check the blower for power and any malfunction. If there is a malfunction, stop incineration until the blower can be fixed or replaced. If the blowers are operating correctly, empty the contents of the filter into a bucket and recirculate it back into the mixing tank. Replace the filter and proceed. If black smoke persists, try decreasing the flow rate and turning the incinerator switch on. If nothing rectifies the issue, try a new fuel mixture and slowly use the problematic fuel to dilute other known pure fuel types. Or dispose of that mixed batch of waste fuel by other means than incineration.

4.0 Fuel Mixing

4.1 Oily Water & Fuel Separation:

The oily water & fuel separation process will be used to aid in the mixing of fuels with the goal to reduce water content making for favorable incineration conditions. The incineration system/process can operate with as much as 10% water content, and as long as a flame can be maintained while the ignition flame is running this shouldn't cause a problem.

To reduce the water, mixed/unknown fuels should be placed in a separate clear plastic tote and given 45 minutes for the fuel to decant from the water. There should be a visible floating phase of fuel above the water in the separation tote. Draw off the floating phase and put it into the incinerator mixing tanks for incineration. Pump the remaining oily water into a storage container. The water fraction will have to be either cleaned / treated on-site and tested to confirm that it meets surface water quality guidelines prior to releasing it on site, or sent off-site for disposal.

Note: Try not to exceed 10% volume of the oily water within the mixing tank. Use the fuel product inventory provided to help determine mixing ratios and avoid incineration down time.

Figure 10: Fuel and Water separation in a glass

4.2 Volatile Fuel (Gasoline) Mixing:

Gasoline is too volatile for direct incineration within the system and will cause the flame to protrude out of the incineration chamber creating unnecessary safety risks. Gasoline should be mixed down to a 5% gasoline mixture with 95% diesel or jet fuel ratio (i.e. 1 part to 19). This ratio of gasoline to diesel/jet can be varied as long as the flame is kept under the maximum height. Use the fuel product inventory to help determine mixing ratios and avoid incineration down time.

Incinerator Operating Procedure, Isachsen HAWS

SOP Author / Date / Version #

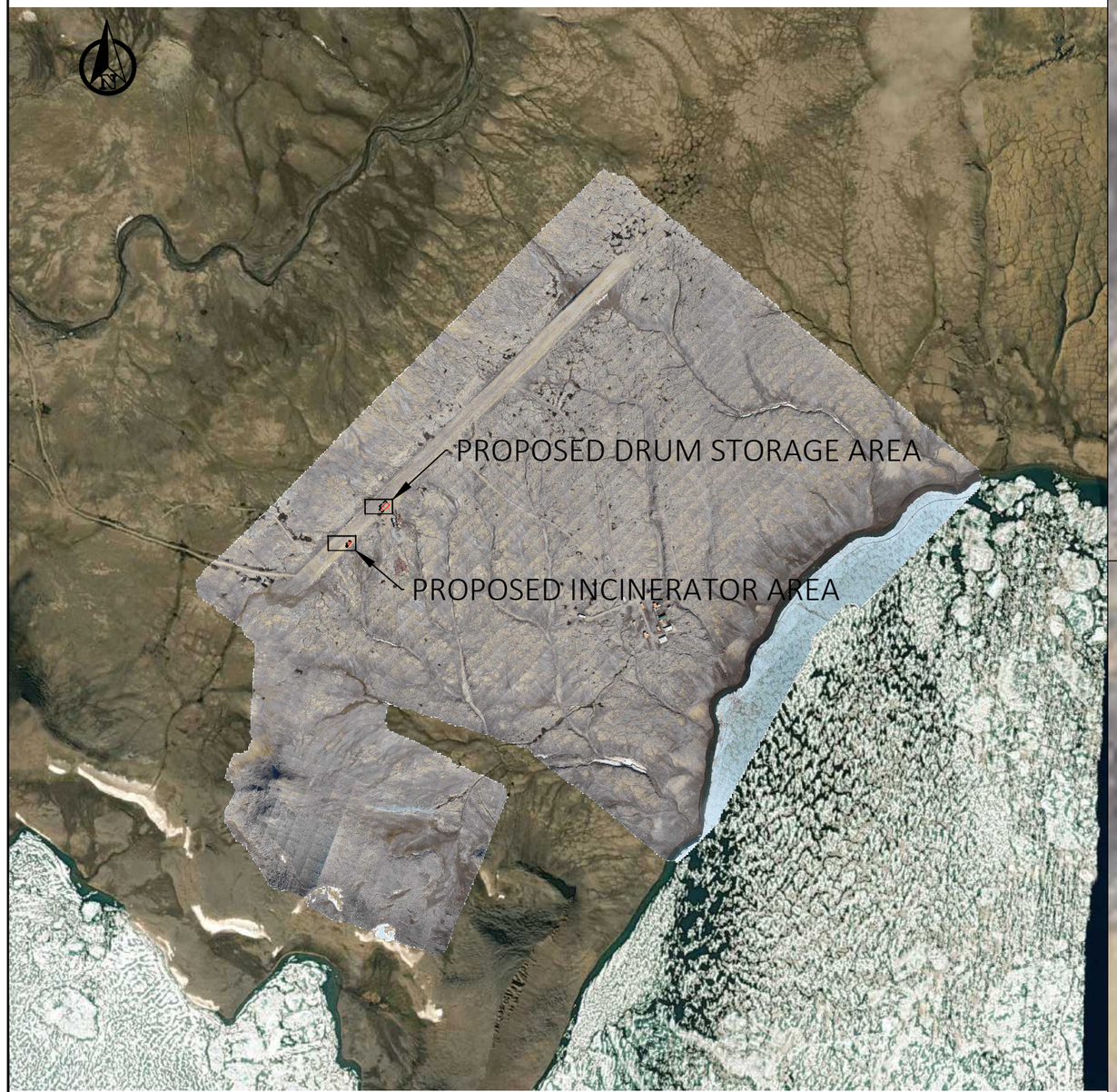
Eric Grimminck/Nov 27 2024/#1

Peer Review / Date / Version #

Don Plenderleith/Nov 27 2024/#1

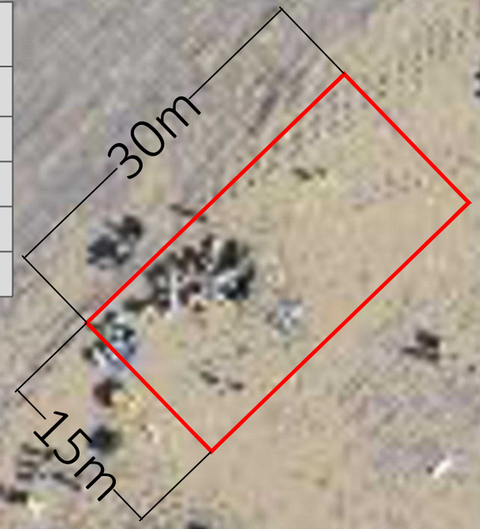
Appendix A: Figures

(Proposed Incineration Location & Incinerator Setup)



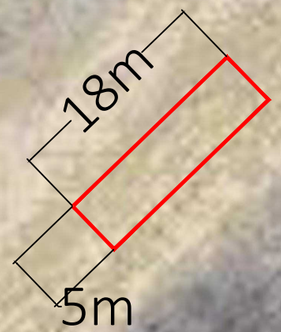
PROPOSED DRUM STORAGE AREA

Point Table				
Point #	Elevation	Northing	Easting	Description
1		8746956.62	531254.65	SE corner
2		8746946.57	531222.65	NW corner
3		8746935.78	531233.07	SW corner
4		8746967.40	531244.23	NE corner



PROPOSED INCINERATOR AREA

Point Table				
Point #	Elevation	Northing	Easting	Description
5		8746818.79	531114.55	SE Corner
6		8746809.88	531098.13	NW Corner
7		8746822.37	531111.08	NE Corner
8		8746806.28	531101.60	SW Corner



GENERAL NOTES

1. ALL MEASUREMENTS IN METRES UNLESS OTHERWISE NOTED
2. COORDINATE SYSTEM IS NAD83 (CSRS) / UTM ZONE 13N

LEGEND

	PROPOSED AREA

outcome CONSULTANTS
151 HOLLAND AVE SUITE 200
OTTAWA, ONTARIO
K1Y 0Y2
t:613.729.2402

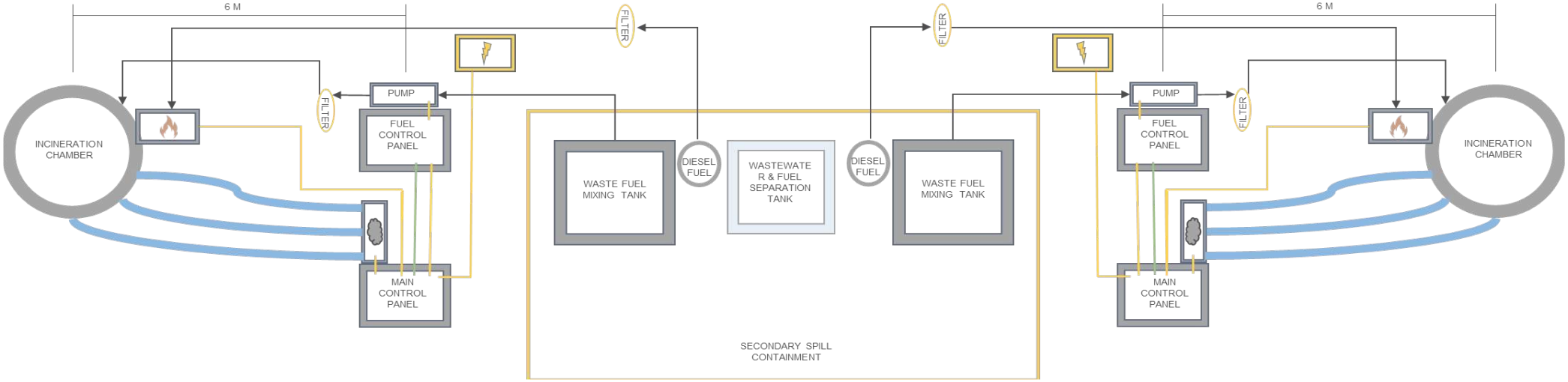
ISACHSEN HIGH ARCTIC WEATHER STATION

ELLIF RINGNESS ISLAND, NUNAVUT

PROPOSED DRUM STORAGE AND INCINERATOR LOCATION

SITE OVERVIEW

OUTCOME PROJECT NUMBER:	DRAWN BY:	SCALE:
P2023-16	J.MILLS	1:20000
CLIENT PROJECT NUMBER:	CHECKED BY:	PUBLISH DATE:
------	E.GRIMMINCK	2024-11-29
DRAWING NAME:	SHEET NUMBER:	REV:
P2023-16 ISACHSEN INCINERATOR SETUP.dwg	01 OF 01	00



GENERAL NOTES

INCINERATOR SETUP BLUEPRINT
APLICABLE FOR INCINERATIORS 9570A & 9570B

LEGEND

- ELECTRICAL LINE
- DATA LINE
- POWER SUPPLY
- BLOWER
- PILOT BURNER
- AIR LINE

151 HOLLAND AVE SUITE 200
OTTAWA, ONTARIO K1Y 0Y2
t:613.729.2402

outcome CONSULTANTS

ISACHSEN HIGH ARCTIC WEATHER STATION
INCINERATION SOP
INCINERATOR 9570A & 9570B SETUP

OUTCOME PROJECT NUMBER:	DRAWN BY:	SCALE:
NP2023-16	E.GRIMMINCK	1:110
CLIENT PROJECT NUMBER:	CHECKED BY:	PUBLISH DATE:
NP2023-16	K.VEITCH	2024-04-08
DRAWING NAME:	SHEET NUMBER:	SHEET NUMBER:
NP2023-16 ISACHSEN INC SETUP.dwg		01 OF 01