HOPE BAY PROJECT AIRCRAFT DE-ICING MANAGEMENT PLAN

HOPE BAY, NUNAVUT

MARCH 2019

Hope Bay Project Aircraft De-icing Management Plan

Plain Language Summary:

The Aircraft De-icing Management Plan describes how TMAC will manage and operate the Aircraft De-icing Facility (ADF) and all associated appurtenances. This document describes the de-icing product, operating procedures, and how TMAC will limit any potential environmental impacts associated with its operation.

Hope Bay, Nunavut

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Hope Bay Project
c/o #18 Yellowknife Airport
100 McMillan Drive
Yellowknife, NT X1A 3T2
Phone: 867-873-4767
Fax: 867-766-8667

Revisions

Revision #	Date	Section	Changes Summary	Author	Approver
0	November 2017	Entire Document	Initial Document	TMAC	TMAC
1	January 2019	Module A	Details regarding disposal of glycol to TIA	TMAC	TMAC

Contents

Tables

Glossary

Term	Definition
ADF	Aircraft de-icing facility
NWB	Nunavut Water Board
SDS	Safety Data Sheet
SOP	Standard Operating Procedure
TIA	Tailings Impoundment Area
The Plan	Aircraft De-icing Management Plan
TMAC	TMAC Resources Inc.

1 Introduction

This Hope Bay Hope Bay Project Aircraft De-icing Management Plan (the Plan) for has been prepared by TMAC Resources Inc. (TMAC) in accordance with various water licences held by TMAC associated with developments throughout the Hope Bay region.

The Plan is intended primarily for use by TMAC and its contractors to ensure that best practices for minimizing potential environmental impacts and potential environmental liabilities with respect to aircraft de-icing are followed, and that the conditions of water licences are met.

This Plan is structured in a manner such that one document pertaining to aircraft de-icing is approved and implemented across all TMAC Hope Bay project sites, while still addressing site- and licence-specific needs: the main document outlines TMAC's approach to aircraft de-icing as it pertains to all TMAC Hope Bay developments; subsequent modules provide details for each site and the associated water licence; In the event of a new water licence, or an existing licence amendment, only the specific modules pertaining to that licence and site will need to be revised. This is intended for consistency and efficiency across operations and for compliance management.

1.1 Objectives

The main objective of this Plan is to ensure that all aircraft de-icing activities are conducted in a safe, efficient and environmentally compliant manner.

This Plan provides guidance and acts as an operational resource for operators involved in aircraft de-icing activities. Consitent with TMAC's intent to be a responsible operator, these objectives are described as follows:

- Compliance with Project Certificate and Water License requirements and applicable regulations;
- Protection of public health and safety;
- Protection of the operator(s);
- Protection of surface and groundwater;
- Protection of land, local flora and fauna

1.2 Relevant Legislation and Guidance

Table 1.1. List of federal and territorial regulations governing the Hope Bay Project Aircraft De-icing Management Plan

Regulation	Year	Governing Body	Relevance
Canadian Aviation Regulations (CARs)	2017	Transport Canada	Regulations for aviation and activities relating to aeronautics in Canada
Guideline	**Year**	**Issued by**	**Relevance**
Guideline for Aircraft Ground – Icing Operations	2005	Transport Canada	Provides guidance for aircraft de-icing operations

Aircraft Critical Surface Contamination Training For Aircrew and Ground Crew	2004	Transport Canada	Provides guidance on aircraft de-icing management and procedures

1.3 Related Documents

The documents listed in Table 1.2 are expected to be referenced and utilized in conjunction with the Aircraft De-icing Management Plan.

Table 1.2. List of documents related to the Hope Bay Project Aircraft De-icing Management Plan

Document Title	Year	Relevance
Hazardous Waste Management Plan	2017	Describes management and disposal of glycol
Spill Contingency Plan	2017	Describes response procedures in the event of a spill

1.4 Plan Management

The Chief Operating Officer (COO) has the overall responsibility for implementing this management plan and will provide the on-site resources to operate and maintain the ADF and all aircraft de-icing activities within the Hope Bay Belt.

The Mine General Manager (MGM) is responsible for implementing this plan at the Hope Bay site, and providing on-site support and resources for aircraft de-icing activities. The MGM will ensure that all aircraft de-icing activities are conducted as per the Plan in order to achieve personnel safety and minimize impacts to the environment.

The Site Services Supervisor is responsible for revising this management plan and will conduct regular inspections of the ADF, request maintenance or repairs to equipment and document completion of the request, provide feedback on operational procedures to improve performance, and will supervise all aspects of aircraft de-icing activities, including application and disposal of the waste de-icing fluid.

The Environmental Supervisor is responsible for supporting the Site Services Supervisor for revisions (where required) to this plan, monitoring the performance of Aircraft De-icing activities to ensure all de-icing fluid remains contained to the ADF, and conduct regular inspections of the area.

2 De-icing Management Issues

2.1 De-icing Fluid Contaminated Snow and Water

Snow and water that becomes contaminated with de-icing fluid.

2.1.1 Management Action

All Aircraft de-icing activities are restricted to the ADF, which is a lined area and is equipped with a collection sump. Contaminated snow is scraped up and removed after each application. The collection sump is routinely monitored for accumulation of any liquids and all contaminated materials are disposed of as per the TMAC's existing Hazardous Waste Management Plan.

2.2 Design Capacity of De-icing Pad and Sump

Unusual precipitation events (storms) or larger than average spring melts (freshet) could produce excess water that could exceed the de-icing pad and sump capacities.

2.2.1 Management Action

Storage capacity for the de-icing liner and sump have been determined based on site specific conditions. The facility is designed to have capacity for regular operational use and precipitation vents as well as unusual storm events. Water and de-icing fluid collected within the sump is routinely monitored to ensure that maximum holding capacity is available at all times in order to reduce the potential of an unauthorized release.

3 Monitoring and Evaluation

3.1 Annual Inspections

The ADF will be inspected by the engineer of record during the annual geotechnical inspection.

3.2 Other Inspections

Routine visual inspections will be conducted by site personnel to ensure the facility is operating as per its design and to assess maintenance requirements. Water levels within the collection sump are routinely monitored after each use and after any significant rain events.

3.3 Documentation and Reporting

Annual Geotechnical Inspection Reports are submitted to the NWB where required.

Inspection records are maintained on site and available for review upon request.

4 Contingencies

4.1 Spill Response

The TD-530 Deice Cart has a 600 gallon capacity. The product is applied to the aircraft in an effort to be both effective and conscientious in order to ensure safety and minimize waste. In the event of a spill outside of the lined area, response for containment and cleanup would follow the instructions outlined in the SDS and as per the Spill Contingency Plan (TMAC 2017).

All spills are internally reported, and any meeting the Nunavut and Northwest Territories' spill reporting requirements are reported to the 24 hour spill line and the Inspector and are included in the monthly and annual reports for the water license.

5 References

GOC, TC. 2004. Aircraft Critical Surface Contamination Training For Aircrew and Groundcrew. Available from https://www.tc.gc.ca/Publications/en/tp10643/pdf/hr/tp10643e.pdf

GOC, TC. 2005. Guidelines for Aircraft Ground Icing Operations. Available from https://www.tc.gc.ca/Publications/en/tp14052/pdf/hr/tp14052e.pdf

HOPE BAY PROJECT AIRCRAFT DE-ICING MANAGEMENT PLAN

HOPE BAY, NUNAVUT

Module A: Doris

Contents: Module A

A1 Introduction

A1.1 Background

The Type A Water Licence Amendment No 1 2AM-DOH1323 issued to TMAC by the Nunavut Water Board (NWB) requires the development of a Aircraft De-icing Management Plan in accordance with Part G (Item 35). The Aircraft De-icing Management Plan has been prepared and is being submitted by TMAC to address this requirement, and also includes details on the operational procedures, equipment and de-icing fluid specifications.

The 2AM-DOH1323 Licence area includes the Doris North Camp and the necessary infrastructure to support surface exploration, underground mining and development activities, and ore processing.

A2 Aircraft De-icing Facility

A2.1 SDI Superior TD-530 QuickRise Deice Cart

De-icing at the Doris Camp is accomplished using high-pressure equipment to deliver a heated glycol base solution to the surface of the aircraft. De-icing fluid is applied with the use of an SDI Superior TD-530 QuickRise Deice Cart. This unit is a trailer-mounted cart, has a 15’ platform height and has a 600-gallon fluid capacity.

The technical manual for this unit is located at site for user reference. The technical manual outlines the operational, storage, and maintenance considerations for this unit. De-icing operators will be trained in the safe use of the equipment and proper application as per the developed De-icing platform operation Procedure SOP.

A2.2 DOW UCAR Aircraft De-icing Fluid (ADF) XL 54

DOW UCAR Aircraft De-icing Fluid (ADF) XL 54 will be utilized to remove ice, snow and frost from the exterior of the aircraft. The product is an ethylene glycol-based fluid containing water, corrosion inhibitors, wetting agents, and orange dye. The product contains approximately 54% by weight ethylene glycol.

The SDS information sheet is included in Appendix A of this module. The information sheet provides details on performance, operational and environmental properties, along with storage and handling information.

A2.3 Storage, Handling and Containment

De-icing fluid will be shipped to site in $1m^3$ totes via cargo flights. This inventory is be stored within a designated secondary containment area and is transported to the de-icing pad as required. Handling and use of the de-icing fluid and associated equipment is done so by trained personnel.

The majority of the de-icing fluid that is applied to the wings of the aircraft drains onto the designated de-icing and refuelling pad, which is a lined area and is equipped with a collection sump. The location of the Doris de-icing facility is shown in Appendix B of this plan and as-built drawings DN-AE-00 Rev AB

have been submitted. This operation and design will prevent any fluid from entering the surrounding environment. All glycol contaminated snow and sump water will be transported to the TIA in accordance with the below:

- All glycol must be discharged to the TIA pond at least 300 m away from any dams and as far from the shoreline as practical.
- The maximum discharge of propylene glycol is 30m^3 per 6 months.
- All product disposal into the TIA must be recorded with the product details, disposal volume, location of discharge and date.

A significant environmental concern is associated with runoff into receiving surface waters. Glycol has a high biological oxygen demand (BOD), and the introduction into surrounding surface waters may present a potential hazard to aquatic life by depleting the level of dissolved oxygen in the water. In extreme cases this can lead to potential fish kills. Organic based chemicals such as de-icing fluids provide nutrients to micro-organisms in an aquatic environment, which can lead to elevated levels in BOD.

In the event of a potential spill or release, TMAC have an existing Spill Contingency Plan which is utilized to safeguard against accidental spills of harmful substances that may negatively affect the environment. All spills are internally reported, and any meeting the Nunavut and Northwest Territories' spill reporting requirements are reported to the 24 hour spill line and the Inspector and are included in the monthly and annual reports for the water license.

A3 Monitoring and Evaluation

Records will be maintained on site to track glycol usage for each de-icing operation as per De-icing platform operation Procedure SOP.

HOPE BAY PROJECT AIRCRAFT DE-ICING MANAGEMENT PLAN

HOPE BAY, NUNAVUT

Module A: Appendix A SDS Sheet

Product Safety Assessment

UCAR™ Ethylene Glycol Aircraft Deicing & Anti-Icing Fluids

Select a Topic:

Names

- CAS No. 107-21-1
- Ethylene glycol
- UCAR™ Aircraft Deicing Fluid Concentrate SAE/ISO Type 1
- UCAR Aircraft Deicing Fluid XL 54 SAE/ISO Type 1
- UCAR Aircraft Deicing Fluid "50/50" SAE/ISO Type 1
- UCAR Endurance EG106 Aircraft Deicing/Anti-icing Fluid SAE Type IV

Back to top

Product Overview

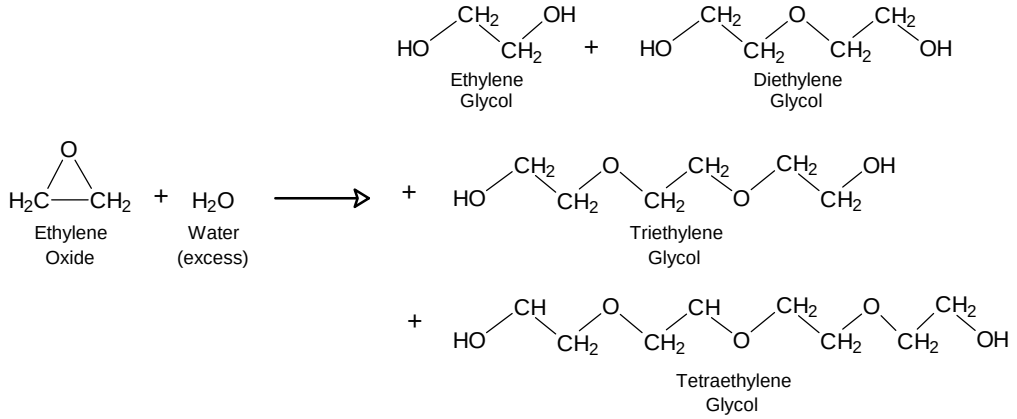
- Dow manufactures a series of ethylene-glycol (EG) -based aircraft deicing and anti-icing fluids under the trade name UCAR™ deicing and anti-icing fluids. They are mixtures of ethylene glycol with water, corrosion inhibitors, wetting agents, and dyes. For further details, see Product Description.
- UCAR EG-based aircraft deicing fluids (ADF) are used for the removal of snow, ice, and frost from the exterior surfaces of aircraft.[1] UCAR EG-based aircraft anti-icing fluids (AAF) are applied following aircraft deicing or during active precipitation to prevent additional snow or ice build-up over an extended period of time. AAF can also be used as a preventive by applying to dry aircraft when overnight frost is forecast.[2] For further details, see Product Uses.
- Worker exposure to UCAR EG-based aircraft deicing and anti-icing fluids is possible during product formulation or during aircraft deicing or anti-icing operations.[3] These fluids are commercial-grade products and are not available for home use. For further details, see Exposure Potential.
- Eye contact with these fluids may cause slight, temporary irritation, although corneal injury is unlikely. Prolonged skin contact is essentially nonirritating. Repeated contact may cause flaking and softening of the skin. According to generally accepted guidelines, ethylene glycol has moderate toxicity if ingested. At room temperature, exposure to vapor is minimal, however, vapor from heated material may cause respiratory irritation and other effects.[3] For further details, see Health Information.
- Ethylene glycol, the main component of UCAR EG-based aircraft deicing and anti-icing fluids, is readily biodegradable, is unlikely to bioaccumulate in the food chain, and is practically nontoxic to fish and aquatic organisms.[3,4] For further details, see Environmental Information.
- UCAR™ EG-based aircraft deicing and anti-icing fluids are thermally stable at typical storage and use temperatures. Some components of these products can decompose at elevated

temperatures, causing pressure build-up in closed systems. Avoid contact with strong acids, strong bases, and strong oxidizers. Areas sprayed with these fluids (such as the tarmac) may become slippery.[3,5] For further details, see Physical Hazard Information.

Back to top

Manufacture of Product

- **Capacity**[6] **–** Total global production capacity of ethylene glycol was reported to be 19.6 million metric tons (43 billion pounds) in 2006. Actual consumption in 2006 was reported to be 17.0 million metric tons (37.5 billion pounds). Dow production facilities are located in St. Charles, Louisiana; Seadrift, Texas; Wilton, United Kingdom; and Terneuzen, The Netherlands. Additional production facilities of MEGlobal (a joint venture between Petrochemical Industries Company (PIC) of Kuwait and The Dow Chemical Company) are located at Fort Saskatchewan and Red Deer, Alberta, Canada.
- **Process**[7] **–** Ethylene glycol is manufactured by a closed, single-reactor process using a catalyzed condensation reaction between ethylene oxide and a controlled amount of water as shown below. Higher glycols (di-, tri-, and tetraethylene glycol) are by-products. Ethylene glycol is then separated and purified by distillation.



Back to top

Product Description[1,3, 8]

Ethylene glycol (EG) is a colorless, odorless liquid. It is soluble to some extent in a wide range of organic materials and is completely soluble in water. UCAR™ EG-based aircraft deicing and anti-icing fluids are mixtures of ethylene glycol with water, corrosion inhibitors, wetting agents, and dyes. Some products also contain thickeners. The dye is intended to indicate which parts of the aircraft have been treated and to differentiate between fluids (Type I fluids are orange, Type IV fluids are green).

Dow manufactures the EG-based aircraft deicing and anti-icing fluids listed below:

- **UCAR Aircraft Deicing Fluid Concentrate** SAE/ISO Type I – an orange-colored mixture of approximately 92% EG intended to be diluted with water prior to application.
- **UCAR Aircraft Deicing Fluid XL 54** SAE/ISO Type I – an orange-colored mixture of approximately 54% EG intended to be used undiluted. It is only available in Canada.
- **UCAR Aircraft Deicing Fluid "50/50"** SAE/ISO Type I – an orange-colored mixture of approximately 48% EG intended to be used undiluted.
- **UCAR Endurance EG106 Aircraft Deicing/Anti-icing Fluid** SAE Type IV – a green-colored mixture of approximately 50% EG intended to be used undiluted.

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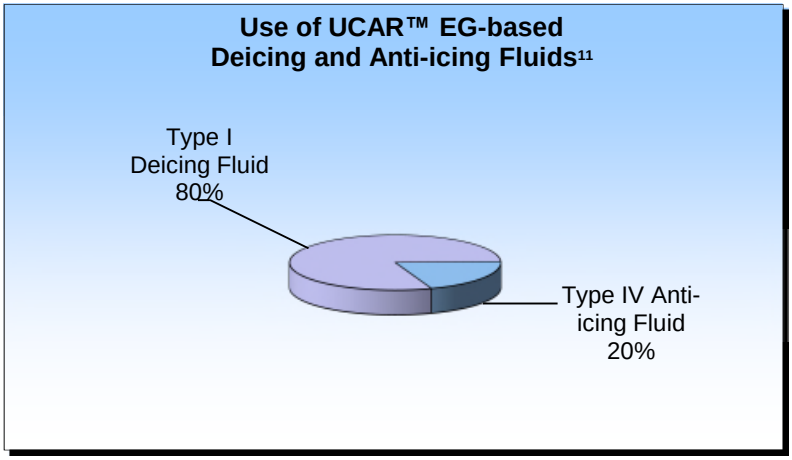
These products conform to Aerospace Material Specifications 1424D, 1428D, and 1428E set by the Society of Automotive Engineers (SAE) International, as well as standards established by airframe manufacturers.[9]

Back to top

Product Uses[1,10,11]



UCAR™ EG-based aircraft deicing fluids (ADF) – ADFs are used for removal of snow, ice, and frost from the exterior surfaces of aircraft. ADFs are normally applied hot and sprayed directly onto aircraft surfaces, especially wings and other control surfaces, immediately preceding takeoff.

UCAR EG-based aircraft anti-icing fluid (AAF) – During periods of active precipitation (snow, sleet, freezing rain), AAF is applied following the ADF operation. In addition to deicing functionality, it provides protection against the build-up of new snow or ice. It is generally applied to the leading edge and upper surface of the wing and to the horizontal stabilizer (tail section). The fluid forms a layer that absorbs snow or freezing rain. It prevents absorbed precipitation from refreezing. During takeoff, the AAF flows off the aircraft exterior. AAF can also be applied to dry aircraft as a preventive if overnight frost is expected.

Back to top

Exposure Potential

Based on the uses for UCAR™ EG-based aircraft deicing and anti-icing fluids, the public could be exposed through:

- **Workplace exposure**[3] – Exposure can occur at a manufacturing site. Those working with these products in production facilities could be exposed during maintenance, sampling, testing, or other procedures. Airfield personnel can be exposed during aircraft deicing and anti-icing operations. The potential for exposure is reduced by engineering controls and personal protective equipment. Facilities that manufacture or use these fluids should have a thorough training program for employees and appropriate work processes and safety equipment in place to limit unnecessary exposure. See Health Information.
- **Consumer exposure to UCAR EG-based aircraft deicing and anti-icing fluids** – Dow does not sell these products for consumer use. Under normal conditions of use, airline passengers and flight crews would not be expected to have any significant exposure to these fluids, and any odor detected by these individuals while the materials are being properly applied would be at an exposure level that is considered safe for humans. See Health Information.
- **Environmental releases**[3] – Ethylene glycol may slowly evaporate from these products. Ethylene glycol is very soluble in water, and when introduced to water, will have a tendency to remain there. Because ethylene glycol is readily biodegradable, it will be removed from water and soil environments, including wastewater-treatment facilities. In the event of a spill, the focus is on containing the spill to prevent contamination of soil, ditches, sewers, waterways, or groundwater. For small spills, absorb the material with materials such as cat litter, sawdust, vermiculite, or Zorball. Collect the material in suitable and properly labeled

containers. These materials are not classified as dangerous to aquatic organisms. See Environmental, Health, and Physical Hazard Information.

- **Large release** – Industrial spills or releases are infrequent and generally contained. If a large spill does occur, dike the area to contain the spill. The material should be captured, collected, and reprocessed or disposed of according to applicable governmental requirements. Isolate the area and keep unnecessary or unprotected personnel from entering the area. Follow emergency procedures carefully. Excessive product accumulation on the tarmac during deicing or anti-icing operations should be removed by mechanical means (e.g., vacuum truck).[5] See Environmental and Physical Hazard Information.
- **In case of fire** – Keep people away and deny unnecessary entry. Firefighters should wear positive-pressure, self-contained breathing apparatus (SCBA) and protective firefighting clothing or fight the fire from a safe distance. Use water fog or fine spray, dry-chemical or carbon-dioxide fire extinguishers, or foam. ***Do not use*** a direct water stream as it may spread the fire. Follow emergency procedures carefully.[3] See Health and Physical Hazard Information.

For more information, see the relevant Safety Data Sheet.

Back to top

Health Information[3]

The primary ingredient in UCAR™ EG-based aircraft deicing and anti-icing fluids is ethylene glycol. The U.S. Agency for Toxic Substances and Disease Registry (ATSDR) has stated, "Your health is not likely to be seriously affected by the very small amounts of ethylene glycol that could be tasted or otherwise accidentally eaten (for example, by putting your fingers in your mouth after getting them wet with antifreeze). Accidental or intentional ingestion of larger amounts of ethylene glycol can cause serious illness or death."

Eye and Skin Contact – Eye contact with liquid, vapor, or mist may cause slight irritation but corneal injury is unlikely. Brief skin contact is essentially nonirritating. Prolonged or repeated skin contact may cause slight irritation with local redness. Repeated or prolonged skin exposure to large quantities of ethylene glycol may result in absorption of harmful amounts. Massive contact with damaged skin or with material hot enough to burn the skin may result in absorption of potentially lethal amounts.

Inhalation – At room temperature, exposure to vapor is minimal due to the low volatility of the material. With good ventilation, a single exposure is not expected to cause adverse effects. If the material is heated or areas are poorly ventilated, vapor or mist may accumulate and cause respiratory irritation and symptoms such as headache and nausea.

Ingestion – The oral toxicity is expected to be moderate due to the presence of ethylene glycol. Small amounts swallowed incidental to normal handling operations are not likely to cause injury; however, swallowing large amounts of ethylene glycol may cause nausea, vomiting, abdominal discomfort, diarrhea, and/or serious injury, even death. Excessive exposure may result in central nervous system effects, cardiopulmonary effects, and kidney failure.

Repeated exposure – Repeated excessive exposure in animals has been reported to cause kidney and liver effects. In humans, effects have been reported on the central nervous system, (for example, headache) and excessive repeated exposure to vapor or mist may cause irritation of the upper respiratory tract.

Other effects – Ethylene glycol did not cause cancer in long-term animal studies. Based on animal studies, ingestion of very large amounts of ethylene glycol appears to be the major and

possibly only route of exposure to produce birth defects. Ingested in large amounts, ethylene glycol has also been shown to interfere with reproduction in animals. *In vitro* and animal genetic toxicity studies were negative.

For more information, see the relevant Safety Data Sheet.

Back to top

Environmental Information[3,4]

Ethylene glycol, the main component in UCAR™ EG-based aircraft deicing and anti-icing fluids, has a low volatility and may slowly evaporate from products containing it. The substance is very soluble in water, and when introduced, will have a tendency to remain in water. It has minimal tendency to bind to soil or sediment.

Ethylene glycol is unlikely to persist in the environment. The substance is readily biodegradable, which suggests the chemical will be removed from water and soil environments, including biological wastewater-treatment facilities.

Ethylene glycol is not likely to accumulate in the food chain (bioconcentration potential is low) and is practically nontoxic to fish and other aquatic organisms on an acute basis.

Environment Canada reviewed ethylene glycol and finalized the results in a Priority Substance List, State of the Science Report (2000). The assessment included the analysis of environmental exposures and effects from use in deicing/anti-icing operations. The report concluded that releases of ethylene glycol from current practices are unlikely to result in adverse effects when consideration is given to the seasonal nature and duration of the releases. The Organisation for Economic Co-operation and Development (OECD) Screening Information Data Set (SIDS) Initial Assessment Profile for ethylene glycol concluded that, based on the known properties and exposure patterns, the chemical is currently of low priority for further work due to its low hazard profile. (Link: http://cs3-hq.oecd.org/scripts/hpv/Index2.asp?CASNUM=107211)

For more information, see the relevant Safety Data Sheet.

Back to top

Physical Hazard Information[3,12]

Ethylene glycol is thermally stable at recommended storage and use temperatures. However, exposure to elevated temperatures can cause decomposition. Gas generated during decomposition can cause pressure build-up in closed systems. The decomposition products of ethylene glycol depend upon temperature, air supply, and the presence of other materials and may include aldehydes, alcohols, and ethers.

Ethylene glycol is incompatible with strong acids, strong bases, and strong oxidizers. Avoid contact with these materials.

For more information, see the relevant Safety Data Sheet.

Back to top

Regulatory Information

Regulations may exist that govern the manufacture, sale, transportation, use, and/or disposal of UCAR™ EG-based aircraft deicing and anti-icing fluids. These regulations may vary by city, state, country, or geographic region. Information may be found by consulting the relevant Safety Data Sheet, Technical Data Sheet, or Contact Us.

Back to top

Additional Information

- Safety Data Sheets (http://www.dow.com/webapps/msds/msdssearch.aspx)
- Contact Us (http://www.dow.com/aircraft/contact/index.htm)
- *UCAR Aircraft Deicing Fluids: Concentrate, XL 54, "50-50",* Product Information Bulletin, The Dow Chemical Company, Form No. 183-00021-0709 AMS, July 2009 (http://msdssearch.dow.com/PublishedLiteratureDOWCOM/dh_08e5/0901b803808e501a.pdf?filepath=aircraft/pdfs/noreg/183-00021.pdf&fromPage=GetDoc)
- *UCAR Endurance EG106: Ethylene Glycol Type IV Aircraft Deicing/Anti-icing Fluid*, Product Information, The Dow Chemical Company, Form No. 183-00101-0713 AMS, July 2013(http://msdssearch.dow.com/PublishedLiteratureDOWCOM/dh_08e0/0901b803808e0a22.pdf?filepath=aircraft/pdfs/noreg/183-00101.pdf&fromPage=GetDoc)
- *Draft Toxicological Profile for Ethylene Glycol*, U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, September 2007 (ATSDR—Toxicological Profile: Ethylene Glycol—Draft for Public Comment)
- "Marketing Research Report: Mono-, Di- and Triethylene Glycols," *Chemical Economics Handbook*, Stanford Research Institute (SRI) Consulting, February, 2007
- *SIAR Ethylene Glycols,* SIDS Initial Assessment Report for SIAM 18, Organisation for Economic Co-operation and Development (OECD), United Nations Environment Programme (UNEP), Paris, France, April 20–23, 2004 (revised January 26, 2007) (http://cs3-hq.oecd.org/scripts/hpv/Status/DownloadFile.ASP?CASNUM=107211&StatusCode=SIARC&DataNo=1)

For more business information about UCAR EG-based aircraft deicing and anti-icing fluids, visit Dow's Aircraft Deicing and Anti-icing Fluids website at http://www.dow.com/en-us/aircraft/products.

Back to top

References

[1] *UCAR™ Aircraft Deicing Fluids: Concentrate, XL 54, "50-50",* Product Information, The Dow Chemical Company, Form No. 183-00021-0709 AMS, July 2009, page 6.
[2] *UCAR Endurance EG106: Ethylene Glycol Type IV Aircraft Deicing/Anti-icing Fluid*, Product Information, The Dow Chemical Company, Form No. 183-00101-0713 AMS, July 2013, page 6.
[3] *UCAR Aircraft Deicing Fluid Concentrate SAE/ISO Type I Material Safety Data Sheet,* The Dow Chemical Company
[4] *UCAR Aircraft Deicing Fluids: Concentrate, XL 54, "50-50",* Product Information Bulletin, The Dow Chemical Company, Form No. 183-0021-0709 AMS, July 2009, pages 20–22.
[5] *UCAR Aircraft Deicing Fluids: Concentrate, XL 54, "50-50",* Product Information Bulletin, The Dow Chemical Company, Form No. 183-00021-0709 AMS, July 2009, page 28.
[6] "Marketing Research Report: Mono-, Di- and Triethylene Glycols," *Chemical Economics Handbook*, Stanford Research Institute (SRI) Consulting, February, 2007, Supply Demand Overview.

[7] *Screening Information Data Set (SIDS) Initial Assessment Report for SIAM 18: Ethylene Glycols,* Organisation for Economic Co-operation and Development (OECD), United Nations Environment Programme (UNEP): Paris, France, January 26, 2007, page 11.
[8] *UCAR Endurance EG106: Ethylene Glycol Type IV Aircraft Deicing/Anti-icing Fluid*, Product Information, The Dow Chemical Company, Form No. 183-00101-0713 AMS, July 2013, pages 6, 8, and 17-19.
[9] Dow Aircraft Deicing and Anti-icing website: Products (http://www.dow.com/aircraft/products/index.htm).
[10] *UCAR™ Endurance EG106: Ethylene Glycol Type IV Aircraft Deicing/Anti-icing Fluid*, Product Information, The Dow Chemical Company, Form No. 183-00101-0713 AMS, July 2013, pages 22-24.
[11] Estimates by The Dow Chemical Company.
[12] *UCAR Aircraft Deicing Fluids: Concentrate, XL 54, "50-50",* Product Information Bulletin, The Dow Chemical Company, Form No. 183-00021-0709 AMS, July 2009, pages 23 and 28.

Back to top

NOTICES:

As part of its 2015 Sustainability Goals, Dow has committed to make publicly available safety assessments for its products globally. This product safety assessment is intended to give general information about the chemical (or categories of chemicals) addressed. It is not intended to provide an in-depth discussion of health and safety information. Additional information is available through the relevant Safety Data Sheet, which should be consulted before use of the chemical. This product safety assessment does not replace required communication documents such as the Safety Data Sheet.

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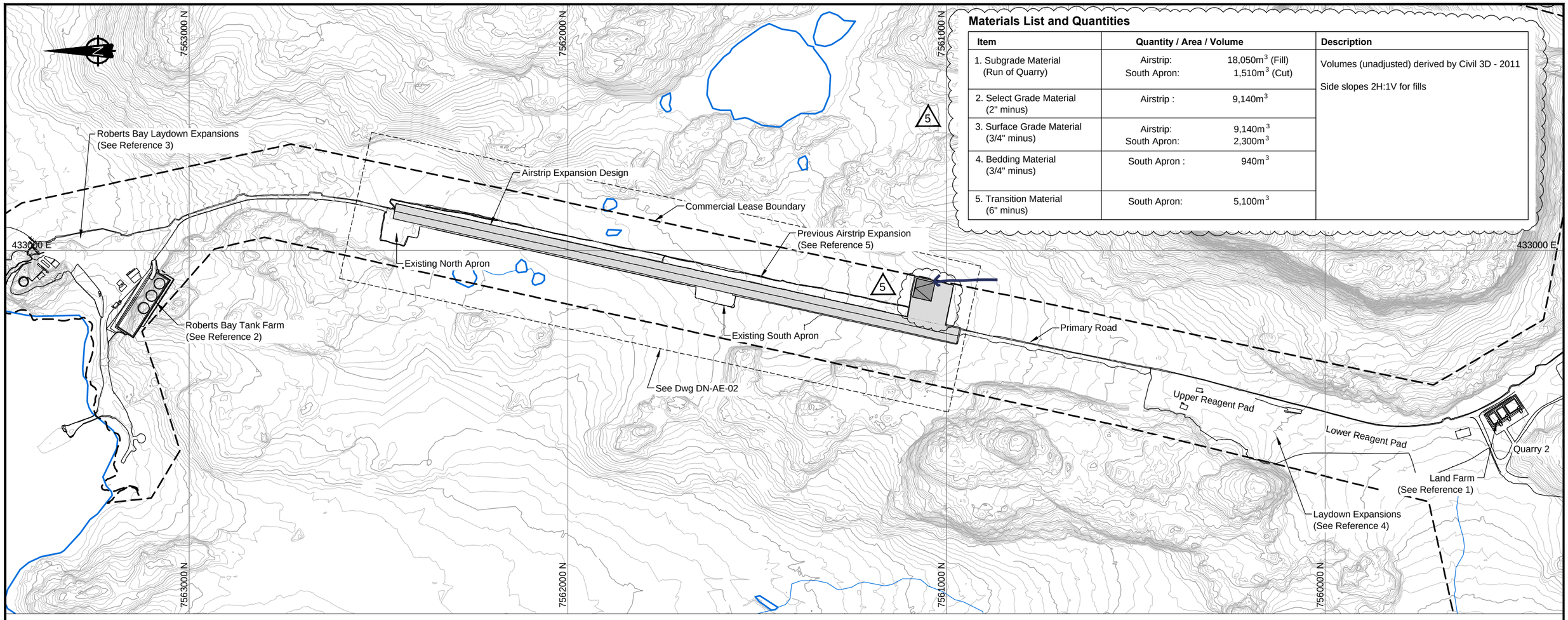
Back to top

Form No. 233-00609-MM-0615X

HOPE BAY PROJECT AIRCRAFT DE-ICING MANAGEMENT PLAN

HOPE BAY, NUNAVUT

Module A: Appendix B Doris Layout



Materials List and Quantities

Item	Quantity / Area / Volume		Description
1. Subgrade Material (Run of Quarry)	Airstrip: South Apron:	18,050m^3 (Fill) 1,510m^3 (Cut)	Volumes (unadjusted) derived by Civil 3D - 2011 Side slopes 2H:1V for fills
2. Select Grade Material (2" minus)	Airstrip :	9,140m^3	
3. Surface Grade Material (3/4" minus)	Airstrip: South Apron:	9,140m^3 2,300m^3	
4. Bedding Material (3/4" minus)	South Apron :	940m^3	
5. Transition Material (6" minus)	South Apron:	5,100m^3	

NOTES

1. The designs are based on the contour information shown on these drawings. It is however the Contractor's responsibility to confirm that the contours are a fair reflection of the ground levels in the vicinity of the works, and to advise the Construction Manager and Engineer of any differences.
2. The co-ordinate system is UTM NAD 83, Zone 13.
3. All dimensions are in metric units, unless specifically mentioned.
4. All drawings are scaled appropriately for D-Size construction drawings. Scales may not be correct if these drawings are reproduced and presented in any other size format.
5. The Engineer will provide the Construction Manager and Contractor with digital design files for setting out the works.
6. The Contractor and Construction Manager shall familiarize themselves with all appropriate Licenses and/or Permits pertaining to execution of the Works. The Engineer will not be responsible for any infringements.
7. The Contractor is to take due care that no wildlife or birds' nest are disturbed during construction. The Construction Manager is to be immediately notified if such sites are found.
8. The Contractor will employ best practices to identify archaelogical sites, and maintain archaelogical site exclusion boundaries of 30m minimum radius from any of these works.
9. These works must be executed in accordance with the standard TMAC health and safety, and enviromental standards and protocols. It is the Contractors responsibility to familiarize himself with these documents.
10. Construction shall be in accordance with the following Technical Specifications: Earthworks and Geotechnical Engineering, Hope Bay project, Nunavut, Canada, revision G -Issue for Construction.
11. The airstrip expansion alignment and dimensions were provided by TMAC are as follows:
    - The Airstrip will have a total length of 5,000 feet (1,524 m) starting at the north end of the existing airstrip.
    - Airstrip will have a total width of 131 feet (40 m) with the west shoulder remaining unchanged from the existing airstrip.
    - The Airstrip will have a minimum fill thickness of 1 m
    - The Airstrip will not be crowned but will be graded at 2% from east to west
    - The Airstrip shoulders will have side slopes of 2H:1V
    - The North Apron remains unchanged
    - The Airstrip will be constructed using Run of Quarry as subgrade material, 2 inch (51 mm) minus as Select Grade Material, and ¾ inch (19 mm) minus as Surfacing Grade Material
12. Notes in this drawing apply to all other active drawings.

REFERENCES

1. SRK Consulting (Canada) Inc., 2012. Engineering Drawings for the Doris North Land Farm, Doris North Project, Nunavut, Canada. Revision AB. As-Built Drawings Prepared for Hope Bay Mining Limited. Project Number 1CH008.033/058. April 20, 2012
2. SRK Consulting (Canada) Inc., 2012. Engineering Drawings for the Roberts Bay Fuel Tank Farm, Doris North Project, Nunavut, Canada. Revision AB. As-Built Drawings Prepared for Hope Bay Mining Limited. Project Number 1CH008.033. April 18, 2012
3. SRK Consulting (Canada) Inc., 2011. Engineering Drawings for the Roberts Bay Laydown Area, Doris North Project, Nunavut, Canada. Revision AB. As-Built Drawings Prepared for Hope Bay Mining Limited. Project Number 1CH008.027/033, December 16, 2011
4. SRK Consulting (Canada) Inc., 2011. Engineering Drawings for the Laydown Expansions, Doris North Project, Nunavut, Canada. Revision AB. As-Built Drawings Prepared for Hope Bay Mining Limited. Project Number 1CH008.027, December 16, 2011
5. SRK Consulting (Canada) Inc., 2011. Engineering Drawings for the Airstrip Expansion & Bypass Road, Doris North Project, Nunavut, Canada. Revision D. Issued for Review Drawings Prepared for Hope Bay Mining Limited. Project Number 1CH008.033, July 26, 2011

LEGEND

- Proposed Airstrip Expansion
- Lease Boundary
- 0+000 Chainage
- Existing Roads and Infrastructure
- Lakes, Ponds or Permanent Water Bodies

0 50 100 150 200 250
Scale in Metres

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS			

NO.	DESCRIPTION	CHK'D	APP'D	DATE
5	SOUTH APRON UPDATES	MMM	EMR	7Oct16
4	SOUTH APRON UPDATES	MMM	EMR	4Oct16
3	SOUTH APRON ADDITION	KK	EMR	24Jun16
2	RUNWAY EXTENDED	EMR	EMR	10Feb16
1	RUNWAY CROWNED	LW	EMR	22Oct15
0	ISSUED FOR CONSTRUCTION	LW	EMR	19Oct15
A	ISSUED FOR DISCUSSION	LW	EMR	17Oct15

REVISIONS

PROFESSIONAL ENGINEERS STAMP

srk consulting

DESIGN:	DRAWN:	REVIEWED:
TMAC	NV	EMR
CHECKED:	APPROVED:	DATE:
EMR	EMR	Oct. 7, 2016

FILE NAME: 1CT022.005.300_ND-AE-01-05 Rev5.dwg

TMAC RESOURCES

DORIS NORTH PROJECT

SRK JOB NO.: 1CH022.005.300

Airstrip Expansion

DRAWING TITLE:

General Arrangement

DRAWING NO.	SHEET	REVISION NO.
DN-AE-01	2 OF 7	5

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