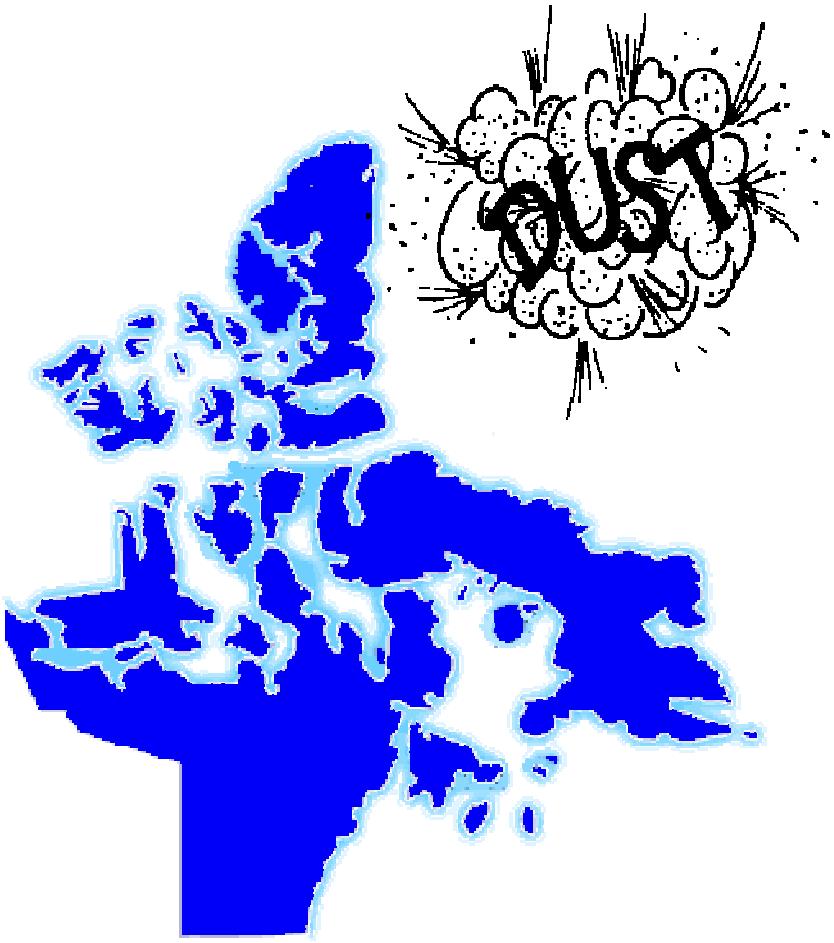
ENVIRONMENTAL GUIDELINE FOR Dust suppression



Department of Sustainable Development
Environmental Protection Service

Nunavut

GUIDELINE: DUST SUPPRESSION

AS AMENDED BY:

USE OF GUIDELINE

A guideline is not law and is therefore not enforceable. It does however, assist an inspector to determine what action(s) may be required of him. Paragraph 2.2(c) of the Environmental Protection Act allows the Minister to develop co-ordinate and administer guidelines. The Act [subsection 5(1)] makes it an offence to discharge a contaminant into the environment, subject to some exceptions [subsection 5(3)]. When a discharge occurs and it is inconsistent with the guideline, the discharge is considered an unacceptable risk. The inspector may then consider issuing an order or laying an Information.

A guideline allows for some leniency in applying the law. A court would probably be inclined to consider the application of a guideline favorably because the public is aware of the standards they are expected to meet.

This Guideline is not law.
It is prepared by Environmental Protection Service,
Department of Sustainable Development
Government of the Nunavut

January, 2002

Guideline for Dust Suppression

January, 2002

GUIDELINE FOR DUST SUPPRESSION

1 Introduction

The purpose of this guideline is to make you aware of the procedures you must follow before applying a dust suppressant in Nunavut. The Department of Sustainable Development, Environmental Protection Service, (EPS) has currently approved three dust suppressants for use in Nunavut. The publication provides guidance for applying these products and a process for approving other dust suppression products.

Section 2.2 of the *Environmental Protection Act* gives the Minister of Sustainable Development the authority to develop, co-ordinate and administer these guidelines (see appendix A).

1.1 Definitions

Approved Product	A product approved by EPS for dust suppression.
Leachate Test	Leachate Extraction Procedure - Canadian General Standards Board (CGSB) #164-GP-1-MP (or as amended) or equivalent.
PCB	Polychlorinated biphenyl.
Roadway	The traveled surface of a road, from shoulder to shoulder; it does not include the side slopes or ditches.
Set	The point at which the product becomes stable, according to the manufacturer's specifications.
Used Oil	Any oil from an industrial or non-industrial source that has become unsuitable for its intended purpose due to the presence of impurities or the loss of original properties.

1.2 Why are dust suppressants used?

Reasons for using dust suppressants include:

Safety	Untreated roads may lead to more accidents. Accident potential is increased due to loss of visibility.
Health	Dust particles may become a health hazard when they become trapped in the lungs.
Vegetation	Large amounts of dust may induce changes in vegetation due to increased heat absorption and decreased transpiration.

Aquatic Resources	High levels of dustfall into aquatic systems may adversely affect aquatic plants and fish that are not adapted to high levels of sedimentation.
Aesthetics	Dust produces an immediate visual impact that may affect residents who live near dust prone roads.
Road Maintenance Costs	Treated roads can lower road maintenance costs by reducing general loss and blading time.

An Ambient Air Quality Guideline established under the Environmental Protection Act sets standards respecting the maximum desirable levels of dust in ambient air in the NWT/Nunavut. Measured as total suspended particulate (TSP), the standards for dust over 24 hours are 120 micrograms per cubic metre (µg/m^3) and averaged over a year are 60 µg/m3. These standards apply to the whole of the NWT/Nunavut. They define the long term goal for air quality to protect unpolluted parts of the Territories and for the continuing development of control options in polluted areas.

1.3 Roles and Responsibilities

Although the *Environmental Protection Act* does not require permits for the application of dust suppressants in Nunavut, all suppressants must first be approved by EPS. While general conditions are provided for approved dust suppressants, additional conditions may be required on a case by case basis.

The responsible party, being the landowner, road authority or municipal authority, must make provisions to notify the public and contact the Department of Sustainable Development before applying suppressants. The responsible party must also verify that the products are approved for use and properly applied by the applicator. If the product migrates from the roadway and is deemed to violate the *Environmental Protection Act*, the person(s) responsible must be prepared to take appropriate remedial measures.

Applicators are also accountable for their actions. Applicators are responsible for ensuring that the product is approved for use in Nunavut, is correctly applied to the designated area and does not migrate off the site. Applicators, manufacturers and retailers must provide information about new products to EPS for approval before their use in Nunavut (Section 3).

> ***It is important to remember that the responsible party (the landowner, road authority or municipal authority) is liable for any activity they authorize. Contamination of the environment and subsequent remediation of the site is ultimately their responsibility. (See Appendix A)***

2 General Dust Suppression Guidelines

There are many aspects to consider before you apply a dust suppressant in Nunavut. The following are general guidelines to be followed:

2.1 Notification for use of Approved Products

The following parties must be notified:

Property Owner	Any application of a dust suppressant should be conducted according to an agreement between the applicator and the responsible road authority or property owner. A written agreement is recommended.
Department of Sustainable Development	Before any application, provide the local Environmental Protection Officer with the following information: the location of the site, the product(s) used and a timetable for the work.
Public	Notify the affected public before any application. This can be through signs, public notices or media announcements.

2.2 Approved Products

Calcium chloride, Bunker C and DL 10 are currently the only approved dust suppressants in Nunavut. Appendix B contains a list of approved products and information regarding the application of these products.

Other products cannot be used in Nunavut until they have been approved by EPS.

Used oil must not be used as a dust suppression/road stabilizing product or added to other dust suppression products.

2.3 Application Procedures

Directions	Follow the manufacturer's specifications or other tested and approved procedures.
Roadway	The application shall be limited to the roadway, driveway or parking lot.
Rate	Carefully monitor the application rate to ensure adequate coverage without pooling or runoff of products. The amount of dust suppressant applied should not exceed the minimum amount required to effectively suppress dust.
Incorporation	Products must be bladed or incorporated into the road immediately upon application, to ensure the product does not migrate off the roadway.
Migration	The material must not migrate or run off the traveled portion of the roadway.

2.4 Environmental Concerns

2.4.1 General

Contaminants	Dust suppressants must conform with the manufacturer's specifications and must not contain concentrations of contaminants that would not normally be found in the suppressant.
PCB Concentration	Materials that contain more than 2 parts per million (ppm) of PCB are considered unacceptable and shall not be applied as a dust suppressant.

2.4.2 Water

Proximity to Water	Ensure that dust suppressants do not enter and contaminate waterbodies, including surface and groundwater. Do not allow the product to leave the roadway.
Sensitive Environments	Application rates near sensitive environments, e.g. marshes, must be closely monitored. Remember**,** environmental restoration is the responsibility of the landowner, road authority or municipal authority.
Flooding	Do not apply products to areas of roads that are subject to flooding.
Imminent Precipitation	Do not apply products if precipitation is occurring, or forecast to occur before the product sets or cures.

2.5 Spill Contingency Plan

Provide EPS with a contingency plan, if required by the *Spill Contingency Planning and Reporting Regulations*, under the *Environmental Protection Act*.

Be prepared to respond to spills, including any product that migrates off the roadway.

3 New Products

Products that have not been approved by EPS must undergo an assessment before being approved for use as a dust suppressant. The following information is required before such an assessment can be done:

Manufacturer's Information	Manufacturer's specifications and application procedures.
Laboratory Analysis	All new products must be characterized by an accredited laboratory.
Material Safety Data Sheets	Complete workplace hazardous material information system data sheets (W.H.M.I.S.).

(M.S.D.S.)	(W.H.M.I.S.).
Toxicity Tests	Toxicity tests should be provided for LC-50 and LD-50.
Leachate Tests	See section 3.1
Other requirements	Provide a proposed schedule of field tests to confirm product efficiency and appropriate application rates. Provide any other materials, tests or analysis carried out on the substance. Provide copies of approvals from other jurisdictions. Laboratory or testing costs are the responsibility of the person(s) applying for approval.

3.1 Leachate Toxicity Testing

New, non-approved dust suppressant products may be required to undergo the leachate extraction procedure to determine toxicity of the polymerized product. Testing should be carried out on a sample consisting of the polymerized material, at the standard application rate, and a representative sample of road material. Such a leachate toxicity test can be undertaken by a variety of reputable commercial laboratories. Leachate extraction procedure CGBS #164-GP-1-MP, or an acceptable equivalent, must be used. (See appendix C).

4 Conclusion

This is a brief introduction to dust suppressant application in Nunavut.

If you would like more information please contact:

Environmental Protection Service
Department of Sustainable Development
P.O. Box 1000, Station 1195
Iqaluit, Nunavut, X0A 0H0
Phone: (867) 975-5900; Fax: (867) 975-5990

Remember that this document is to inform you of the procedures you must follow before applying dust suppressants in Nunavut. If you have any questions or comments, contact the Environmental Protection Service before beginning a dust control program.

5 Bibliography

Community Dust Control Program - Technical Services Division. *Calcium Chloride as a Dust Suppressant.* Department of Government Services and Public Works, Yellowknife, NWT, (1992).

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Gazette officielle due Quebec. *Environmental Quality Act - Hazardous Waste Regulation -* Schedules III and IV, Quebec: Editeur officiel du Quebec, (1988).

Government of British Columbia, *British Columbia Waste Management Act - Special Waste Regulation*, Schedule 4, Queen's Printer of British Columbia, (1988).

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RTAC ARTC *Guidelines for Cost Effective Use and Application of Dust Palliatives*, (1987)

Ontario Ministry of the Environment, *Draft Guidelines for the Application of Product Dust Suppressant Materials*, Toronto, Ontario: Ontario Ministry of the Environment, (1992).

Secretary of Canadian General Standards Board (CGSB). *Leachate Extraction Procedure 164-GP-IMP,* Ottawa, Ontario: CGSB, (1987).

Techman Engineering Ltd. *Road Dust Suppression in Northern and Western Canada - Manual or Recommended Procedures,* Calgary, Alberta: Environment Canada, (1982).

Thompson, N. *Use of Entac Dust Suppressant*, Yellowknife, NWT: Environmental Protection Service, Renewable Resources Department (1990).

APPENDIX A

Environmental Protection Act

The following information is a subset of the *Environmental Protection Act.* The complete Act is available for viewing at any office of the Department of Sustainable Development.

1. In this Act;

"Contaminant" means any noise, heat, vibration or substance and includes such other substances as the Minister may prescribe that, where discharged into the environment,

(a) endangers the health, safety or welfare of persons;
(b) interferes or is likely to interfere with normal enjoyment of life or property
(c) endangers the health of animal life, or
(d) causes or is likely to cause damage to plant life or to property;

"Discharge" includes, but not so as to limit the meaning, any pumping, pouring, throwing, dumping, emitting, burning, spraying, spreading, leaking, spilling or escaping;

"Environment" means the components of the Earth and includes:

(a) air, land and water;
(b) all layers of the atmosphere;
(c) all organic and inorganic matter and living organisms, and
(d) the interacting natural systems that include components referred to in paragraph (a) to (c).

2.2 The Minister may

(a) establish, operate and maintain stations to monitor the quality of the environment in the Territories;
(b) conduct research studies, conferences and training programs relating to contaminants and to the preservation, protection or enhancement of the environment;
(c) develop, co-ordinate and administer policies, standards, guidelines and codes of practice relating to the preservation, protection or enhancement of the environment;

5. **(1)** Subject to subsection (3), no person shall discharge or permit the discharge of a contaminant into the environment.

(2) REPEALED, R.S.N.W.T. 1988, c. 117 (Supp.), s. 8.

(3) Subsection (1) does not apply where the person who discharged the contaminant or permitted the discharge of the contaminant establishes that

(a) the discharge is authorized by this Act or the regulations or by an order issued under this Act or the regulations;
(b) the contaminant has been used solely for domestic purposes and was discharged from within a dwelling-house;

(c) the contaminant was discharged from the exhaust system of a vehicle;
(d) the discharge of the contaminant resulted from the burning of leaves, foliage wood, crops or stubble for domestic or agricultural purposes;
(e) the discharge of the contaminant resulted from burning for land clearing or land grading;
(f) the discharge of the contaminant resulted from a fire set by a public official for habitat management of silviculture purposes;
(g) the contaminant was discharged for the purposes of combating a forest fire;
(h) the contaminant is a soil particle or grit discharged in the course of agriculture or horticulture; or
(i) the contaminant is a pesticide classified and labeled as Adomestic≅ under the *Pest Control Products Regulations* (Canada)

(4) The exceptions set out in subsection (3) do not apply where a person discharges a contaminant that the inspector has reasonable grounds to believe is not usually associated with a discharge from the excepted activity. R.S.N.W.T. 1988, c. 75 (Supp.), s. 5; c. 117 (Supp.), s. 8.

5.1 Where a discharge of a contaminant into the environment in contravention of this Act or the regulations or the provisions of a permit or license issued under the Act or the regulations occurs or a reasonable likelihood of such a discharge exists, every person causing or contributing to the discharge or increasing the likelihood of such a discharge, and the owner or the person charge, management or control of the contaminant before its discharge or likely discharge, shall immediately:

(a) subject to any regulations, report the discharge or likely discharge to the person or office designated by the regulations;
(b) take all reasonable measures consistent with public safety to stop the discharge, repair any damage caused by the discharge and prevent or eliminate any danger to life, health, property or the environment that results or may be reasonably expected to result from the discharge or likely discharge; and
(c) make a reasonable effort to notify every member of the public who may be adversely affected by the discharge or likely discharge. R.S.N.W.T. 1988, c. 75 (Supp.), s. 5: c. 117 (Supp.), s. 9.

6. (1) Where an inspector believes on reasonable grounds that a discharge of a contaminant in contravention of this Act or the regulations or a provision of a permit or license issued under this Act or the regulations has occurred or is occurring, the inspector may issue an order requiring any person causing or contributing to the discharge or the owner or person in charge, management or control of the contaminant to stop the discharge by the date named in the order.

7. (1) Notwithstanding section 6, where a person discharges or permits the discharge of a contaminant into the environment, an inspector may order that person to repair or remedy any injury or damage to the environment that results from the discharge.

APPENDIX B

Approved Dust Suppression Products and Application Information

Application of Bunker C

Bunker C is the heaviest viscosity oil that refineries produce, with an asphalt content varying between 7 and 25%.

Purity	Bunker C must not contain contaminants not normally found within the virgin products, i.e. tank bottom sludge, other fuels or oils, used oil, PCBs or solvents.
Blading	It must be bladed or otherwise incorporated into the road immediately upon application.
Containment	Bunker C must not be applied to sections of the road that are subject to flooding. Do not allow the product to enter waterbodies. The product contains hydrocarbons that are potentially toxic.
General Guidelines	Follow all other general guidelines listed in section 2.

Application of Calcium Chloride

This is a commonly used product in the NWT/Nunavut. It is available in granular and liquid form. Because it is hygroscopic and deliquescent, it draws moisture from the air and will control dust if applied frequently enough.

Road surface conditions and traffic volume dictate the amount, timing and frequency of calcium chloride application. With normal application procedures and concentrations, it is generally non-toxic with rapid dissolution in the environment. However, calcium chloride can wash away in heavy rain. For more information read: *Calcium Chloride as a Dust Suppressant,* (see section 5).

Toxicity to plants	Calcium chloride is toxic to some plants. Keep the product on the roadway.
Application Rate	Apply minimum amounts as it can cause roads to become slippery.
Applicator Competence	Ensure application personnel are informed of corrosive nature of the product (can be harmful to eyes and skin with direct contact).
General Guidelines	Follow all other general dust suppressant guidelines listed in section 2.

APPENDIX B (cont'd)

Application of DL 10

DL 10 is an asphalt product that is mixed with water and a soap solution. DL 10 should be applied to one side of the road at a time, and then allowed to set for approximately three hours. Braking may be difficult on freshly treated road, so a pilot car may be necessary to direct traffic during the application. Vehicles should travel no faster than 20 km/hr through areas where the application has not set.

Fresh DL 10 can be washed off using soap and water. If it is allowed to dry, a solvent may be required.

General Guidelines	Follow all general dust suppressant guidelines listed in Section 2.

APPENDIX C

Leachate Extraction Procedure Test and Equivalents:

(See reference section for complete documentation).

The Environmental Protection Service may require new products to undergo the following test:

- CGSB #164-GP-1-MP *Leachate Extraction Procedure* Canadian General Standards Board (or as amended).

Or one of these equivalent tests:

- Schedules III and IV - *Environmental Quality Act - Hazardous Waste Regulation* - Gazette officielle du Quebec.
- Schedule 4 - *British Columbia Waste Management Act - Special Waste Regulation,* Government of British Columbia.
- Schedule 4 - *Regulation 347* (formerly Regulation 309), Government of Ontario.

If you would like to be placed on a mailing list to receive guideline amendments or for public consultation on Environmental Protection Service legislation please fill this out and mail or fax to:

Environmental Protection Service
Department of Sustainable Development
P.O. Box 1000, Station 1195
Iqaluit, Nunavut, X0A 0H0
Fax: (867) 979-5990

Users of this guide are encouraged to report any errors, misspellings, etc. contained within, to EPS at the above address.

Mailing List for Environmental Protection Service Information

Name: _____

Title: _____

Address : _____

_____

Phone / Fax Number: _____

Attachment B
MSDS Sheet ‘Calcium Chloride’

Sel Warwick Inc. of Victoriaville, Québec

WARWICK SALT
5, Boutet Street
Victoriaville, Qc
G6P 8T6

This product is distributed by
Canada Colors and Chemicals Limited
General Inquiry: (905) 459-1232
24 Hour Emergency: (416) 444-2112
CCC: Product Code: 279213
CCC: Product Name: CALCIUM CHLORIDE FLAKE 77% -SW ML

FLAKE CALCIUM CHLORIDE

Material Safety Data Sheet

A. PRODUCT INFORMATION

TRADE NAME (PRODUCT IDENTIFIER): Flake Calcium Chloride Powdered Calcium Chloride	**CLASSIFICATION & SYMBOL** : Class D2B	
CHEMICAL NAME AND/OR SYNONYM: Calcium Chloride Dihydrate	**FORMULA :** $CaCl_2$ 2 H_2O	**CAS NO**: 10043-52-4

BNQ Standard 2410-300 / 2009 Certificat # 1156

Canadian Standard CAN-CGSB-15.1-92

PRODUCT USE : De-icer, Dust control, mud drilling lubricant, Freeze-proofing of ores and aggregates, thawing agent, concrete conditioner. Food Grade Calcium category is used as additive, refrigerants and heat exchange agent.	
MANUFACTURER/IMPORTER: Sel Warwick Inc. 5, Boutet Street Victoriaville, Qc, G6P 8T6	**SUPPLIER/DISTRIBUTOR**: **TETRA Technologies Inc** **369, Feed Mill Road** **Eldorado, AZ 71730** **USA**
EMERGENCY TELEPHONE NO: 819-758-5229	

B. PREPARATION INFORMATION

PREPARED BY : Sel Warwick Inc. 5, Boutet Street, Victoriaville Telephone : 819-758-5229	**PREVIOUS ISSUE DATE** : December 2010
	CURRENT ISSUE DATE: June 2012

C. TOXICOLOGICAL PROPERTIES

INHALATION: Dust or mist inhalation may irritate nose, throat and lungs	
INGESTION : Low in toxicity. May irritate gastrointestinal tract and cause nausea and vomiting	
SKIN : May cause skin irritation. Prolonged contact when moisture is present may result in superficial burns. Contact with abraded skin or cuts can cause severe necrosis	
EYES: May irritate or burn eyes	
ACUTE TOXICITY: Moderate toxic LD_{50} (oral-rat) 1000 mg/kg LD_{50} (oral-mouse) 1940 mg/kg	**EXPOSURE LIMITS**: Ontario Ministry of Labour Time-Weighted Average Exposure Value (TWAEV) for Nuisance Particulate 10 mg/m^3
CHRONIC TOXICITY : Not applicable	
OTHER :	**BIOLOGICAL EXPOSURE INDICES (BEI)** : Not applicable

D. PHYSICAL DATA

MATERIAL IS AT NORMAL CONDITIONS: **Liquid** ☐ **Solid** ☒ **Gas** ☐	**APPEARANCE AND COLOR :** Small White Flakes Very hygroscopic	**ODOR THRESHOLD** : Odorless
BOILING POINT : Not available **FREEZING POINT** : ^{0}C **(MELTING POINT)** : 176^{0}C	**SPECIFIC GRAVITY :** g/cc **(H_2O =1)** Not available	**VAPOR DENSITY:** **(AIR=1)** Not applicable
SOLUBILITY IN WATER : 97.7 g/100 ml @ 0^{o}C 326 g / 100 ml @ 60^{o}C	**PH** Neutral to slightly Alkaline	**VAPOR PRESSURE:** **(mm Hg @ 20^{o}C)** Not applicable **(PSIG)**
EVAPORATION RATE : **(Ether = 1.0)** Not applicable **Slow <0.3 Fast > 3.0** **Medium 0.3 – 3.0**	**% VOLATILES BY VOLUME:** (At 20^{o}C) Not applicable	**MOLECULAR WEIGHT:** 147.02 **COEFFICIENT OF WATER/OIL DISTRIBUTION:** Not available

E. REACTIVITY DATA

STABILITY: Stable	**CONDITIONS TO AVOID :** Not applicable
INCOMPATIBILITY (MATERIALS TO AVOID): Reacts violently with bromine trifluoride (BrF_3), or a mixture of boron trioxide and calcium oxide (B_2O_3 + CaO). Sulfuric acid : yields hydrogen chloride gas, which is corrosive, irritating and reactive. Water-reactive materials, such as sodium : causes an exothermic reaction. Methyl vinyl ether : starts runaway polymerization reaction. Zinc as in galvanized iron : yields hydrogen gas with solutions, which may explode under these conditions.	
HAZARDOUS DECOMPOSITION PRODUCTS: Fumes of Chlorides (Cl) are given off at temperature above 1600 ^{o}C	
HAZARDOUS POLYMERIZATION : Will not occur ☐	**OTHER PRECAUTIONS:** Will undergo violent polymerization with methyl vinyl ether. The anhydrous, monohydrate, dihydrate and tetrahydrate forms of calcium chloride, when dissolved in water, produce considerable amounts of heat.

F. FIRE OR EXPLOSION HAZARD

CONDITIONS OF FLAMMABILITY : Not applicable	**FLASH POINT:** Not applicable **METHOD**
HAZARDOUS COMBUSTION PRODUCTS: None	
% BY VOL. IN AIR **UPPER FLAMMABLE LIMIT** : N/A **LOWER FLAMMABLE LIMIT:** N/A **AUTOIGNITION TEMPERATURE** : ^{o}C	**EXPLOSION HAZARDS** : See Section E incompatibility
SENSITIVITY TO MECHANICAL IMPACT : Not applicable	
SENSITIVITY TO STATIC DISCHARGE: Not applicable	
FIRE EXTINGUISHING PROCEDURES: Use extinguisher media appropriate for surrounding fire. For fire fighting wear NIOSH-approved self- contained breathing apparatus.	

G. HAZARDOUS INGREDIENTS (MIXTURES ONLY)

MATERIAL OR COMPONENTS/C.A.S. #	CONCENTRATION	HAZARD DATA
Not applicable		

H. PREVENTIVE MEASURES

PERSONAL PROTECTIVE EQUIPMENT：

RESPIRATORY PROTECTION：
For dusty or misty conditions, wear NIOSH approved dust or mist respirator

EYES AND FACE:
For dusty or misty conditions, or when handling solutions where there is reasonable probability of eye contact, wear chemical safety goggles and hard hat. Under these conditions, do not wear contact lenses.

HANDS, ARMS AND BODY：
As a minimum, wear long-sleeve shirt, trousers, rubber boots and gloves for routine product use. Cotton gloves permitted for dry product, impervious gloves when using solutions.

STORAGE：
Cool, dry area. Prolonged storage may cause product to cake and become wet from atmospheric moisture.

NORMAL HANDLING:
Avoid contact with eyes, skin or clothing. Avoid breathing dust. Use good personal hygiene and housekeeping

ENGINEERING CONTROLS:

Ventilation:Provide general and/or local exhaust ventilation to maintain dust or fume levels below exposure limits.

Eye wash facility should be provided in storage and general work area.

ENVIRONMENTAL:

DEGRADABILITY: Not applicable	**AQUATIC TOXICITY:** Harmful to aquatic life at concentrations greater than 500 ppm. $CaCl_2$ does not bioaccumulate $TL_m96 > 1000$ mg/1

SPILL OR LEAK (Always wear personal protective equipment):
Shovel up dry chemical and place in metal drum with cover. Cautiously spray residue with plenty of water. Keep contaminated water from entering sewers and water courses.

WASTE DISPOSAL:
Consistent with the requirements of local waste disposal authorities.

I. FIRST AID MEASURES

INHALATION:
Promptly remove to fresh air. Get medical attention.

INGESTION:
If conscious, immediately give 2 to 4 glasses of water, and induce vomiting under medical supervision.

SKIN:
Remove contaminated clothing. Wash with plenty of soap and running water. Get medical attention if irritation persists.

EYES:
Flush eyes promptly with plenty of running water, continuing for at least 15 minutes. Get medical attention.

ATTACHMENT 10: DRAFT GEOTECHNICAL MONITORING COMPONENTS

Structure	Location	Monitoring Device	Details	Qty	Description (See Notes)
Embankment Cuts	Km 19+820	Survey marker	*4 marker corners per slope*	8	5 m high cut area in ice-poor soils
		Thermistors	2 strings on slope per slope; 2 strings at toe base per slope	8	See Note 1
	Km 79+960	Survey marker	4 marker corners per slope	8	3.7 m high cut area, assume ice-rich soil
		Thermistors	2 strings on slope per slope; 2 strings at toe base per slope	8	See Note 1
	TBD	Survey marker	4 marker corners per slope	8	area to be determined - in other area built 2021
		Thermistors	2 strings on slope per slope; 2 strings at toe base per slope	8	See Note 1
Embankment Fills	Km 15+980	Settlement Plate	2 plates on each side slope at base	2	2.2 m high test fill in ice-rich area, see Note 1
		Survey marker	4 marker corners per slope	8	
		Thermistor	2 strings at base on each side of fill toe	4	
	Km 19+240	Settlement Plate	2 plates on each side slope at base	2	8 m high test fill in ice-poor area (with culverts). See Note 1
		2Survey marker	4 marker corners per slope	8	
		Thermistor	2 strings at base on each side of fill toe	4	
	Km 67+800	Settlement Plate	2 plates on each side slope at base	2	27 m high test fill area in bedrock (?) with culverts), see note 1
		Survey marker	4 marker corners per slope	8	
		Thermistor	2 strings at base on each side of fill toe	4	
	Km 61+900	Settlement Plate	2 plates on each side slope at base	2	16.6 m high test fill in assumed ice-rich area (with culverts), see Note 1
		Survey marker	4 marker corners per slope	8	
		Thermistor	2 strings at base on each side of fill toe	4	

Structure	Location	Monitoring Device	Details	Qty	Description (See Notes)
	Km 77+300	Settlement Plate	2 plates on each side slope at base	2	15.7 m high test fill in assumed ice-rich area (with culverts), See Note 1
		Survey marker	4 marker corners per slope	8	
		Thermistor	2 strings at base on each side of fill toe	4	
	TBD	Settlement Plate	2 plates on each side slope at base	2	area to be determined - in other area built 2021, See Note 1
		Survey marker	4 marker corners per slope	8	
		Thermistor	2 strings at base on each side of fill toe	4	
	TBD	Settlement Plate	2 plates on each side slope at base	2	area to be determined - in other area built 2021, see Note 1
		Survey marker	4 marker corners per slope	8	
		Thermistor	2 strings at base on each side of fill toe	4	
	TBD	Settlement Plate	2 plates on each side slope at base	2	area to be determined - in other area built 2021, see Note 1
		Survey marker	4 marker corners per slope	8	
		Thermistor	2 strings at base on each side of fill toe	4	
Culverts	KM 19+240 - Culvert CV19-2	Thermistors	3 strings per site	3	See Note 1
		Survey marker	2 survey markers, each at exit and entrance of culvert	4	
	KM 61+900 - Culvert CV62-1	Thermistors	3 strings per site	3	See Note 1
		Survey marker	2 survey markers, each at exit and entrance of culvert	4	
	KM 67+800 - Culvert CV68-1/1a	Thermistors	3 strings per site	3	See Note 1
		Survey marker	2 survey markers, each at exit and entrance of culvert	4	
	KM 77+300 - Culvert CV77-2	Thermistors	3 strings per site	3	See Note 1
		Survey marker	2 survey markers, each at exit and entrance of culvert	4	

Structure	Location	Monitoring Device	Details	Qty	Description (See Notes)
	TBD	Thermistors	3 strings per site	3	area to be determined - in other area built 2021,
		Survey marker	2 survey marker, each at exit and entrance of culvert	4	
	TBD	Thermistors	3 strings per site	3	area to be determined - in other area built 2021, ee Note 1
		Survey marker	2 survey markers, each at exit and entrance of culvert	4	
Bridges	Km 16	survey marker for pile cap	2 per pile cap	4	
		survey marker for bridge abutment	4 markers per bridge abutment	8	Need to survey at least 80 points per abutment = 160 points,
		Settlement Plates	6 plates	6	
		Inclinometers	2 per site	2	Require drilling
		Thermistors	12 strings	12	Require drilling
	Km 70	survey marker for pile cap	2 per pile cap	4	
		survey marker for bridge abutment	4 markers per bridge abutment	8	Need to survey at least 80 points per abutment = 160 points
		Settlement Plates	6 plates + 2 = 8 plates	8	
		Inclinometers	2 per site	2	Require drilling
		Thermistors	12 strings	12	Require drilling
	Km 86	survey marker for pile cap	2 per pile cap	4	
		survey marker for bridge abutment	4 markers per bridge abutment	8	Need to survey at least 80 points per abutment = 160 points
		Settlement Plates	6 plates + 2 = 8 plates	8	
		Inclinometers	2 per site	2	Require drilling
		Thermistors	12 strings	12	Require drilling
	Km 103	survey marker for pile cap	2 per pile cap	4	

Structure	Location	Monitoring Device	Details	Qty	Description (See Notes)
		survey marker for bridge abutment	4 markers per bridge abutment	8	Need to survey at least 80 points per abutment = 160 points
		Settlement Plates	6 plates	6	
		Inclinometers	2 per site	2	Require drilling
		Thermistors	12 strings	12	Require drilling

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