Spill Contingency Plan

Modified After Meadowbank Plan

Appropriate For Exploration Conducted On

Meliadine East Project

Atulik Lake Camp Site

II. SPILL RESPONSE ACTION PLAN

SPILL RESPONSE SEQUENCE

1. REPORT ALL SPILLS TO:

Project Manager	or	Phone: (604) 608-2557
Senior Project Geologist		Phone: (604) 608-2557
Camp manager		Phone: (604) 608-2557

Note: Telephone numbers for the camp change year to year, but current numbers can be obtained through the Vancouver office number listed above.

The reporting requirement applies to all spills: on land, on water and on ice.

The reporting requirement applies equally to all substances covered by this contingency plan; fuels, hydraulic oil, lubricants, and waste oil.

All reports by telephone must be followed with a fax of the completed report form (see Appendix D for copies) to the number indicated on the reporting form.

Reporting and notification described below must be made by the first observer of the spill of the observer's superior immediately upon the spill being under control, or on failure to gain control of the situation.

2. ALERT Cumberland Personnel:

SPILL OBSERVER
IMMEDIATE SUPERVISOR or Meadowbank Camp manager

- Meadowbank Project Manager
- Contractors (clean up)

3. NOTIFY AGENCIES:

24 HOUR NWT SPILL REPORT LINE	PHONE	(867) 920 8130
	FAX	(867) 873 6924
KIVALLIQ INUIT ASSOCIATION		(867) 645 2810
DIAND – Rankin Inlet		(867) 645 2831
Iqaluit		(867) 979 4405
Environment Canada – Yellowknife		(867) 920 6060
Fisheries and Oceans Canada		(867) 645 2871
GNWT DRWED – Rankin Inlet		(867) 645 5067

4. **RECORD THE FACTS** Use Spill Report Form from Appendix D

NOTE:	If the On-Scene Coordinator is not available when a spill is detected then the spill must be Reported directly to NWT 24-hour spill report line without delay.

III. SPILL RESPONSE - FUEL TYPE

The procedure of dealing with a spill is dependent on the type of material spilled. The following sheets summarize the correct procedures for dealing with spills of the materials transported and stored at the Meadowbank project site - gasoline, Jet A and Jet B aviation fuel, P-50 diesel (stove oil), propane and acetylene. Other petroleum products such as lube oil and waste oil will only be present in small amounts, but product information sheets are included for all these products in Appendix A..

GASOLINE SPILL RESPONSE ACTIONS

CONSIDER ACTION ONLY IF SAFETY PERMITS

GASOLINE FORMS VAPOURS THAT CAN IGNITE AND EXPLODE

NO SMOKING

Refer to Product Guide below for:
Physical/Chemical Properties
Response to Fires
First Aid

- ELIMINATE IGNITION SOURCES
- STOP SOURCE OF GASOLINE IF SAFE TO DO SO

ON LAND
- Block entry into waterways by diking with earth, snow or other barrier(s).
- Do not contain spill if there is any chance of igniting vapours.
- On shop floors and in work/depot yards, apply particulate sorbents.
- On tundra use peat moss and leave to degrade if feasible to do so.

ON SNOW & ICE
- Block entry into waterways by diking with snow or other barrier.
- Do not contain spill if there is any chance of igniting vapours..
- In work/depot yards, apply particulate sorbents.

ON MUSKEG
- Remove pooled gasoline with pumps, if safe to do so.
- Do not deploy personnel and equipment on marsh or vegetation.
- Low pressure flushing can be tried to disperse small spills.
- Burn CAREFULLY only in localized areas, e.g., trenches, piles or windrows.
- Do not burn if root systems can be damaged (low water table).
- Minimize damage caused by equipment and digging.

ON WATER
- Contain or remove spills ONLY AFTER VAPOURS DISSIPATE.
- Use booms to protect water intakes.
- Skimming can be tried once light ends evaporate.

STORAGE/TRANSFER

- Store closed, labeled containers in cool, ventilated areas away from incompatible materials.
- Electrically ground containers and vehicles during transfer.

DISPOSAL

- Segregate waste types, if necessary.
- Place contaminated materials into marked containers.
- Consult camp manager on transportation and disposal requirements.

GASOLINE

TYPICAL PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	Colourless Liquid (can be dyed)	FLASH POINT:	-50° C
ODOUR:	Gasoline / Petroleum	FREEZING PT:	-60° C
SOLUBILITY:	Insoluble	VISCOSITY:	Not viscous (< 1 cSt)
VAPOUR DENSITY:	Will sink to ground levels	SPECIFIC GRAVITY:	Floats on water (0.7 - 0.8)

SAFETY MEASURES

WARNINGS

- Vapours form instantaneously, and are heavier than air.
- Empty containers can contain explosive vapours.
- Vapours can travel to distant sources of ignition and flash back.
- Eye contact causes irritation.
- Material can accumulate static charges.
- Inhalation of vapours can cause irritation of the respiratory tract, headache, vomiting, and unconsciousness.

PERSONAL PROTECTION

- Always wear impervious, chemical-resistant clothing, gloves, footwear, and goggles; nitrile and Viton are suitable protective materials (DO NOT USE NATURAL RUBBER, NEOPRENE, OR PVC).
- Wear full-face organic vapour cartridge respirator where oxygen is adequate; otherwise wear positive pressure SCBA.

PRECAUTIONS

- Monitor for explosive atmosphere.
- Avoid contact with strong oxidizers, such as nitric acid, sulphuric acid, chlorine, ozones, peroxides.

- Eliminate ignition sources.
- Restrict access and work upwind of spill.

RESPONSE TO FIRES
CONSIDER ACTION ONLY IF SAFETY PERMITS!

- Wear SCBA in confined areas.
- Shut off fuel supply.
- Extinguish fire with CO_2, dry chemical, alcohol foam or water fog. Use water to cool containers exposed to fire.

JET B – SPILL RESPONSE ACTIONS

CONSIDER ACTION ONLY IF SAFETY PERMITS!

Refer to Product Guide below for:
- Physical/Chemical Properties
- Response to Fires
- First Aid

- ELIMINATE IGNITION SOURCES
- STOP SOURCE OF JET B IF SAFE TO DO SO

ON LAND
- Do not flush into ditches or drainage systems.
- Do not contain spill if there is any chance of igniting vapours.
- Block entry into waterways and contain with earth, snow or other barrier.
- Remove small spills with sorbent pads.
- On tundra use peat moss and leave in place to degrade, if practical.

ON SNOW & ICE
- Block entry into waterways and contain with snow or other barrier.
- Do not contain spill if there is any chance of igniting vapours.
- Remove minor spills with sorbent pads and/or snow.

ON MUSKEG
- Do not deploy personnel and equipment on marsh or vegetation.
- Remove pooled Jet B with pumps and skimmers if it is safe to do so.
- Flush with low pressure water to herd Jet B to collection point.
- Burn only in localized areas, e.g., trenches, piles or windrows.
- Do not burn if root systems can be damaged (low water table).
- Minimize damage caused by equipment and excavation.

ON WATER
- Contain spill ONLY AFTER VAPOURS DISSIPATE.
- Use spill containment boom to concentrate slicks for recovery.
- Do not deploy personnel and equipment onto mudflats or into wetlands.

STORAGE/TRANSFER
- Store closed, labeled containers outside away from flammable items.
- Electrically ground containers and vehicles during transfer.

DISPOSAL

- Segregate waste types.
- Place contaminated materials into marked containers.
- Consult camp manager on disposal procedures.

JET B

TYPICAL PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	White or Pale Yellow liquid	FLASH POINT:	-20 to -250° C
ODOUR:	Gasoline / Petroleum	FREEZING PT:	-18° C
SOLUBILITY:	Negligible	VISCOSITY:	Not viscous (0.6 cSt)
VAPOUR DENSITY:	Will sink to ground levels	SPECIFIC GRAVITY:	Floats on water (0.78)

SAFETY MEASURES

WARNINGS

- Vapours form instantaneously, and are heavier than air.
- Low-lying areas can trap explosive vapours.
- Vapours can travel to distant sources of ignition and flash back.
- Eye contact causes irritation.
- Material can accumulate static charges.
- inhalation of vapours can cause irritation of the respiratory tract, headache, vomiting, and unconsciousness.

PERSONAL PROTECTION

- Always wear impervious, chemical-resistant clothing, gloves, footwear, and goggles; nitrile and Viton are suitable protective materials (DO NOT USE NATURAL RUBBER, NEOPRENE, OR PVC).
- Wear full-face organic vapour cartridge respirator where oxygen is adequate; otherwise wear positive pressure SCBA.

PRECAUTIONS

- Monitor for explosive atmosphere.
- Avoid contact with strong oxidizers, such as nitric acid, sulphuric acid, chlorine, ozones, peroxides.
- Eliminate ignition sources.
- Restrict access and work upwind of spill.

RESPONSE TO FIRES
CONSIDER ACTION ONLY IF SAFETY PERMITS!

- Wear SCBA in confined areas.
- Shut off fuel supply.
- Extinguish fire with CO_2, dry chemical, alcohol foam or water fog.
- Use water to cool containers exposed to fire.

DIESEL – P50 – SPILL RESPONSE ACTIONS

CONSIDER ACTION ONLY IF SAFETY PERMITS!

Refer to Product Guide below for:
- Physical/Chemical Properties
- Response to Fires
- First Aid

- ELIMINATE IGNITION SOURCES
- STOP SOURCE OF DIESEL IF SAFE TO DO SO

ON LAND
- Do not flush into ditches or drainage systems.
- Block entry into waterways and contain with earth, snow or other barrier.
- Remove small spills with sorbent pads.
- On tundra use peat moss and leave in place to degrade, if practical.

ON SNOW & ICE
- Block entry into waterways and contain with snow or other barrier.
- Remove minor spills with sorbent pads and/or snow.
- Use ice augers and pump to recover diesel under ice.
- Slots in ice can be cut over slow moving water to contain oil.
- Burn accumulated diesel from the surface using Tiger Torches if feasible and safe to do so.

ON MUSKEG
- Do not deploy personnel and equipment on marsh or vegetation.
- Remove pooled diesel with pumps and skimmers.
- Flush with low pressure water to herd diesel to collection point.
- Burn only in localized areas, e.g., trenches, piles or windrows.
- Do not burn if root systems can be damaged (low water table).
- Minimize damage caused by equipment and excavation.

ON WATER
- Contain spill as close to release point as possible.
- Use spill containment boom to concentrate slicks for recovery.
- On small spills, use sorbent pads to pick up contained oil.
- On larger spills, use skimmer on contained slicks.
- Do not deploy personnel and equipment onto mudflats or into wetlands.

RIVERS & STREAMS

- Prevent entry into water, if possible, by building berm or trench.
- Intercept moving slicks in quiet areas using (sorbent) booms.
- Do not use sorbent booms/pads in fast currents and turbulent water.

STORAGE/TRANSFER

- Store closed, labeled containers outside away from flammable items.
- Electrically ground containers and vehicles during transfer.

DISPOSAL

- Segregate waste types.
- Place contaminated materials into marked containers.
- Consult camp manager on disposal procedures.

DIESEL P50

TYPICAL PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	White or Pale Yellow liquid; may be dyed.	FLASH POINT:	40° C
ODOUR:	Petroleum	FREEZING PT:	-50° C
SOLUBILITY:	Negligible	VISCOSITY:	Not viscous (1.8 cSt)
VAPOUR DENSITY:	Will sink to ground levels	SPECIFIC GRAVITY:	Floats on water (0.85)

SAFETY MEASURES

WARNINGS

- In warm temperatures, vapours form instantaneously, and are heavier than air.
- Eye contact causes irritation.
- inhalation of vapours can cause irritation of the respiratory tract, headache, vomiting, and unconsciousness.

PERSONAL PROTECTION

- Always wear impervious, chemical-resistant clothing, gloves, footwear, and goggles; nitrile and Viton are suitable protective materials (DO NOT USE NATURAL RUBBER, NEOPRENE, OR PVC).
- Wear full-face organic vapour cartridge respirator where oxygen is adequate; otherwise wear positive pressure SCBA.

PRECAUTIONS

- Monitor for explosive atmosphere.
- Avoid contact with strong oxidizers, such as nitric acid, sulphuric acid, chlorine, ozones, peroxides.

- Eliminate ignition sources.
- Restrict access and work upwind of spill.

RESPONSE TO FIRES
CONSIDER ACTION ONLY IF SAFETY PERMITS!

- Wear SCBA in confined areas.
- Shut off fuel supply.
- Extinguish fire with CO_2, dry chemical, alcohol foam or water fog.
- Use water to cool containers exposed to fire.

PROPANE RESPONSE ACTIONS

GAS STORED IN CYLINDERS THAT EXPLODE WHEN IGNITED!

CONSIDER ACTION ONLY IF SAFETY PERMITS

KEEP ALL VEHICLES INCLUDING SNOWMOBILES AWAY FROM ACCIDENT AREA

Refer to Product Guide below for:
Physical/Chemical Properties
Response to Fires
First Aid

- Vapours cannot be contained when released.
- Water spray can be used to knock down vapours if there is NO chance of ignition.
- Small fires can be extinguished with dry chemical or CO.
- Personnel should withdraw immediately from area unless a small leak is stopped immediately after it has been detected.
- If tanks are damaged, gas should be allowed to disperse and no attempt at recovery should be made.
- Personnel should avoid touching release point on containers since frost quickly forms.
- Stay clear of tank ends.

PROPANE

TYPICAL PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	Colourless Gas	FLASH POINT:	-104° C
ODOUR:	Natural Gas odour	FREEZING PT:	-190° C
SOLUBILITY:	Insoluble	VISCOSITY:	n/a
VAPOUR DENSITY:	Will sink to ground levels	SPECIFIC GRAVITY:	Liquid floats on water

SAFETY MEASURES

WARNINGS

- Vapours form instantaneously, and are heavier than air.
- Vapours can travel to distant sources of ignition and flash back.
- Eye contact causes irritation.
- Material can accumulate static charges.
- inhalation of vapours can cause irritation of the respiratory tract, headache, vomiting, and unconsciousness.

PERSONAL PROTECTION

- Always wear impervious, chemical-resistant clothing, gloves, footwear, and goggles; nitrile and Viton are suitable protective materials (DO NOT USE NATURAL RUBBER, NEOPRENE, OR PVC).
- Avoid frostbite burn to skin and eyes from contact with propane.
- Wear full-face organic vapour cartridge respirator where oxygen is adequate; otherwise wear positive pressure SCBA.

PRECAUTIONS

- Monitor for explosive atmosphere.
- Avoid contact with strong oxidizers, such as nitric acid, sulphuric acid, chlorine, ozones, peroxides.
- Eliminate ignition sources.
- Restrict access and work upwind of spill.

RESPONSE TO FIRES
CONSIDER ACTION ONLY IF SAFETY PERMITS!

- Wear SCBA in confined areas.
- Shut off fuel supply.
- Extinguish fire with CO_2, dry chemical, alcohol foam or water fog.

Use water to cool containers exposed to fire.

WASTE OIL

TYPICAL PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	Black to brown liquid	FLASH POINT:	100 to 200° C
ODOUR:	Petroleum	FREEZING PT:	-30 to -400° C
SOLUBILITY:	Generally insoluble	VISCOSITY:	Medium (200-300cSt)
VAPOUR DENSITY:	Few vapours emitted	SPECIFIC GRAVITY:	Floats on water (0.9)

SAFETY MEASURES

WARNINGS

- Vapours are heavier than air but are unlikely to form.
- Toxic gas can form in fire and at high temperatures.
- CO, CO_2 and dense smoke are produced upon combustion.
- Oil mist or vapour from hot oil can cause irritation of the eyes and respiratory tract.

PERSONAL PROTECTION

- Always wear impervious, chemical-resistant clothing, gloves, footwear, and goggles; nitrile and Viton are suitable protective materials (DO NOT USE NATURAL RUBBER, NEOPRENE, OR PVC).
- Use of organic vapour cartridge respirator is highly unlikely.

PRECAUTIONS

- Avoid excessive heat, which can cause formation of vapours.
- Avoid contact with strong oxidizers, such as nitric acid, sulphuric acid, chlorine, ozones, peroxides.
- Eliminate ignition sources.
- Restrict access and work upwind of spill.

RESPONSE TO FIRES
CONSIDER ACTION ONLY IF SAFETY PERMITS!

- Wear SCBA and eye protection when responding to waste oil fires.
- Shut off fuel supply.
- Extinguish fire with CO_2, dry chemical, alcohol foam or water fog.

NOTE: Water or foam may cause frothing.

- Use water to cool containers exposed to fire.

Appendix C - NWT Spill Report Forms

Northwest Territories

N.W.T. SPILL REPORT (Oil, Gas, Hazardous Chemicals or other Materials)

ᓄᓇᕗᑦ ᑯᐃᓕᓴᕐᓂᖅ ᐅᓂᒃᑳᖅᑎᑦᑎᓂᖅ (ᓴᓇᓕᖅ, ᓱᓕᓐᓂ, ᐊᑦᑕᓇᒃᑐᑦ)

24-ᓂᑦ ᐃᑲᖏᓂᑦ ᐅᓂᒃᑲᕐᓂᐊᕐᓇᖅᑐᒃᑯᑦ ᐅᖃᓕᑦ

Phone/ᐅᖃᓕᒫᑦ (403) 920-8130

Fax/ᓱᒃᑐᐃᓐᑦ (403) 873-6924

A Report date and time
ᐅᑎᓂᒃ ᓯᑭᐦᓴᓕᖅᓂ ᖃᓄᐃᓕᐊᑎᒃᓴᓄᑦ ᐅᓂᒃᑲᐅᑎᓕᕐᓂᓄᑦ

B Date and time of spill (if known)
ᐅᑎᓂᖓ ᑯᐃᑎᓄᑦ ᖃᓄᐃᓕᐊᑎᒃᓴᓄᑦ (ᖃᐅᔨᒪᔪᐅᑎᑦᑎᓂ)

C ☐ Original report ᓯᑐᓂᒃᑯᒥ ᐅᓂᒃᑲᐅᑎᐅᒃ
☐ Update no. _____ ᐅᓂᒃᑲᐅᑎᖃᓂᑐᒃ ᓇᓕᑦ __

Spill number
ᑯᐃᓱᑦ ᓇᓕᐅᑦ

D Location and map coordinates (if known) and direction (if moving)
ᓇᓂ ᑯᐃᓱᑦ ᑭᓚᓄ ᓂᓇᓴᐊᑦ ᓇᓕᐅᑎᖅᑦ (ᖃᐅᔨᒪᔪᐅᑎᑦᑎᓂ) ᑭᓚᓄ ᓇᓗᖏᓚᐅᑦᓂᐊᕐᓕᖏᓐᓄᑦ (ᐃᓅᑦᓴᑦᑎᑦ)

E Party responsible for spill
ᑭᓇᑦ ᑯᐃᑎᑎᓂᑦ

F Product(s) spilled and estimated quantities (provide metric volumes/weights if possible)
ᑭᓱᑦ ᑭᓱᓕᓐᓂᑦ ᑯᐃᑦ ᖃᓄᑎᓄ ᐊᓯᐅᖃᖅᑎᑦ (ᐊᓯᐅᓂᖓ ᐅᑭᓯᑦᓂᓯᓕᓐᓂᑦ ᐊᓱᓕᓯᑦᑎᑦ)

G Cause of spill
ᑭᓱ ᑯᐃᑦᓴᑕᒃᑲᑦ

H Is spill terminated?
ᑯᐃᓱᐅᒃ ᓄᖅᑲᑎᑕᒃᑲᓴᑦ?
☐ yes/Δ ☐ no/ᐊᖏᓐ

I If spill is continuing, give estimated rate
ᓱᓕ ᑯᐃᓱᑦ ᖃᓄᑎᓄ ᓯᓚᓚᑎᑦᓴᓕᓴᑦ

J Is further spillage possible?
ᑯᐃᖏᓐᓂᑐᐃᓐᓇᖅᑐᖅᑕᓴᑦ?
☐ yes/Δ ☐ no/ᐊᖏᓐ

K Extent of contaminated area (in square metres if possible)
ᖃᓄᐅ ᐊᔪᑎᑎᓂᑦ ᑯᐃᐊᑎᑦᓴᑦ (ᐅᓪᓗᕐᓂᓕᓚᔪ ᐊᑦᓇᓱᑦᑎᑦ)

L Factors affecting spill or recovery (weather conditions, terrain, snow cover, etc.)
ᑭᓱᑦ ᐱᓕᔪᑎᑦᑎᓂᑦ ᑯᐃᓴᒧᑦ ᐅᑭᐅᑎᑕᐅᓂᐊᕐᓂᓚᔪ (ᓂᓇ ᖃᓄᐃᓕᓐᓄᓂᖃᓄᑦ, ᓄᓇ ᖃᓄᐃᓕᓐᓄᓂᖃᓄᑦ ᐊᑐᓴᐅᓂᐊᕐᓕᖏᓐᓄᑦ ᐊᓯᐅᓂᐊᕐᓕᖏᓐᓄᑦ)

M Containment (natural depression, dykes, etc.)
ᐅᖃᓕᓄᖅᑐᑎᑦ ᑭᓚᓂᒃᑯᑦ ᐃᓕᓐᓂᐊᕐᓕᕐᓂᐊᖅ (ᓄᓇᒥ ᐃᓕᓐᓂᐊᑦ, ᐊᓯᑭᓚᐅᑦᓴᑦ)

N Action, if any, taken or proposed to contain, recover, clean up or dispose of product(s) and contaminated materials
ᖃᓄᐃᓕᓴᐅᑎᑦ, ᖃᓄᐃᓕᓴᐅᑎᑕᐅᓂᖅᑎᑦ ᐅᑎᓂᒃ ᖃᓄᐃᓕᓴᐅᑎᑕᐅᓂᖅᑎᑦ ᐊᑕᐅᓯᑦᑎᑕᐅᓂᐊᕐᓕ, ᓄᓇᒃᓴᖅᑕᐅᓂᐊᕐᓕ, ᓴᓇᔨᓴᖅᑕᐅᑦ ᐅᑎᓂᒃ ᐃᓕᓐᓂᐊᕐᓕᖏᓐᓄᑦ ᐊᑐᓴᐅᓂᐊᕐᓕᖏᓐᓄᑦ (ᐊᑐᓴᐅᓂᒃᑯᑦ) ᑭᓚᓄ ᐊᑦᓇᓱᑦᑎᑦ.

O Do you require assistance?
ᐃᑲᓴᖅᑕᐅᓴᖅᓂᖃᖅᑎᑦ?
☐ no ᐊᖏᓐ ☐ yes, describe: Δ - ᓇᓄᐃᑦᓴᑦ

P Possible hazards to persons, property, or environment; eg: fire, drinking water, fish or wildlife
ᑭᑦᑕᓄᑐᐃᓐᓇᖅᑐᖅᑕᓴᑦ ᐃᓄᒃᓄᑦ, ᐱᓕᑎᒋᔭᐅᓂᑦ ᐅᑎᓄᑕ ᑯᐊᑎᒋᔪ ᓱᓕ - ᐃᑭᓚᓂ, ᐃᒋᓕᒋᔪ ᓄᑎᖅᑲᑕᐅᓱᒋᔭᓂ, ᐃᖃᓗᓕᓄᑦ ᐅᑎᓄᑕ ᓄᑎᖅᑲᑕᐅᓱᒋᔭᓂ

Q Comments and/or recommendations ᐅᖃᐅᓯᖏᓐᓄᑦ ᑭᓚᓄ ᐅᑎᓕᐅᑦ ᖃᓄᐃᓕᓴᐅᑎᑕᐅᔪᑦᑎᓂᑦ

FOR SPILL LINE USE ONLY
ᐊᑐᖅᑕᐅᔭᓕᖅ ᑯᐃᓱᓂᑦ ᐅᖃᓪᓚᐃᑦᑐᑎᓂᐊᑐᖅ

Lead Agency
ᐃᖅᑲᐃᔾᔨᖅᑕᓂᖅᑎᑦ ᑯᐃᓱᒋᑦ ᑲᒪᔨᖃᖅᑐᑎᑦ-

Spill significance
ᑯᐃᓱᑦ ᖃᓄᐃᓕᓴᐅᓂᖓ-

Lead Agency contact and time
ᐃᖅᑲᐃᔾᔨᖅᑕᓂᖅᑎᑦ ᑯᐃᓱᒋᑦ ᑲᒪᔨᖃᖅᑐᑎᑦ ᖃᐅᔨᒪᔪᐅᑎᑕᐅᓂᖅ ᑭᓚᓄ ᖃᓄᐃᓕᐊᑎᒃᓴᓄᑦ

.....

.....

.....

Is this file now closed? ᑕᒪᓐᓇ ᐅᓂᒃᓴᓇᔨᐅᑎᒃ ᒪᑐᐅᑦ?
☐ yes/Δ ☐ no/ᐊᖏᓐ

Reported by ᐅᓂᒃᑲᖅ	Position, Employer, Location ᖃᓄᐃᓐᑐᒋᑦ ᐃᖅᑲᐃᔾᔨᓕᒃ, ᐃᖅᑲᐃᔾᔨᖅᑎᖓ, ᓇᒥ	Telephone ᐅᖃᓕᑦ
Reported to ᑭᓇᐅᔭᑦ ᐅᓂᒃᑲᑕᐅᑎᖅ	Position, Employer, Location ᖃᓄᐃᓐᑐᒋᑦ ᐃᖅᑲᐃᔾᔨᓕᒃ, ᐃᖅᑲᐃᔾᔨᖅᑎᖓ, ᓇᒥ	Telephone ᐅᖃᓕᑦ

STEP 3: CONTAINMENT AND RECOVERY OF OIL ON ICE AND SNOW

See Slides 5.3, 5.4, 5.5

Spills in Water with Thin Ice

Oil can be recovered with either vacuum trucks or skimmers. The major problem with these is ice debris. The use of screens and the skimmer types chosen can reduce the severity of this problem. One particularly useful skimmer has been the rope mop skimmer. At subfreezing temperatures, diesel is recoverable with these skimmers. However, for higher viscosity oils, such as Bunker C, hot water baths can be used to remove oil from the mop.

Another potential problem can be the pumps used with skimmers. Once started, a pump should be run continuously to prevent freeze-up of product in hosing. Since draining of pumping systems may not be feasible in freezing temperatures, antifreeze solutions should be added into the pump intake when a pump is not running. When a product is moving through the hose, product warmers, which heat the product or insulation placed below the hose (i.e., sorbent roll) can be used to keep the product moving. Since products under ice are near freezing temperature, subfreezing temperature above the ice surface can change the pumpability of products recovered. In some spills, bucket lines have been used to transport recovered oil from the skimmer to tank trucks when product in hosing has solidified.

Spills in Water Covered with Thick Ice

Oil can combine with thick ice in several ways to slow or stop its movement. Oil spilled on ice can stay on the surface or penetrate channels and cracks in the ice. Experiments with this phenomenon have recorded that as much as 25 per cent of the crude oil spread on ice was absorbed in the ice. In sea water, brine channels form where salt is expelled from the ice. Generally, salt water is 31 parts per thousand (ppt) or less in salinity. Although first year ice is around 10 ppt in salinity, salinity decreases as ice ages. These brine channels can allow surface oil to rise to the surface. Oil under ice can be trapped in subsurface ice pockets or cavities. If the temperature decreases, oil will become encapsulated in the ice as the surrounding ice freezes. Oil under or encapsulated in ice can penetrate small channels that form as the ice freezes and melts to form surface melt pools. This process is accelerated when the dark oil under the ice surface absorbs radiant energy from sunlight. This can cause the ice to melt, forming more channels. Experiments have demonstrated that oil under ice can flow into channels to a height of 15 cm (5.9 in) above the water, containing about 5 percent of the spilled oil.

Removal of Oil from Ice and Snow

When oil is found, the area should be marked, as additional snowfall can obscure a site and delay the cleanup response. Finding an unmarked site from memory will be difficult, as the site's physical characteristics may be changed by snowfall.

Before any oil spill control technique is initiated on ice, the ice thickness should be determined by drilling as many test holes through the ice as necessary. The weight bearing capacity of the ice should be checked, and other previously mentioned safety precautions should be observed.

Choosing a containment and recovery technique will not only depend on ice thickness but also on the ice type. If ice sheets are rafted (overlapping broken ice sheets), oil may surface between sheets in the openings. However, working on sloping ice sheets that may sink or rise due to the surrounding pressure from other rafted ice can be dangerous.

In areas where ice is relatively flat and stationary, oil can be contained with a number of subsurface barriers. One simple oil barrier can be made by cutting a thin slot in the ice and placing plywood or some similar barrier through the slot. Subsequent freezing will hold the material in place. These barriers should be placed at a 30 degree angle to the current to divert oil to a recovery point near the shoreline.

Oil on ice or snow is relatively easy to recover. Oil can be mixed with snow which can contain 30 to 50 percent oil by volume. The use of heavy equipment or manual removal techniques on oiled snow will depend on the ice thickness. The use of snow as a sorbent material decreases when oil viscosity is high, when oil-snow temperature differences decrease, and when snow porosity decreases (wet snow).

Cleanup of oil with thick ice will involve finding oil and making cleanup sites. Containment of oil can include subsurface barriers, ice barriers, ice troughs, and ice slots. Oil can be removed by vacuum devices, skimmers or burning. Oil on ice can be removed by manually or mechanically scooping oil into trucks, sucking oil with vacuum devices or mixing oil with snow and removing by trucks. Since oil weathers slowly with ice, spill cleanup can be postponed until weather conditions improve if access is poor or if weather or ice conditions threaten personnel safety.