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.

Mutual Aid Partners

In the event of a major spill requiring additional resources, equipment and manpower will be made available through mutual aid agreements with the Canadian Coast Guard, the Hamlet of Rankin Inlet and the NWT Power Corporation.

Canadian Coast Guard (CCG) - Rankin Inlet Inventory

Material from the CCG inventory at Rankin INLET is available on a cost recovery basis and will be
made available on request to the GNWT EMO representative who will be billed by CCG for material consumed and who will then bill WMC accordingly.

1500' X 24"	oil containment boom
6	boom towing devices
6	5/8" tow lines X 100' c/w snap hooks
6	anchoring devices
6	Danforth anchors (22 lbs)
6	3/8" X 75' trip lines
6	trip line marker buoys type mb40
8	bales disposable boom (8" X 10' X 4 lengths per bale)
9	bales sorbent pads (18" X 18" X 3/8" X 100 pads)
10	sorbent rolls (36" X 150' X 3/8")
5	boxes of oil snare
2	1000 gal. portatanks
1	Spate pump
2	lengths 3" oil resistant suction hose - 50' each.
2	lengths oil resistant discharge hose - 50" each.
1	TDS-118 light medium oil skimmer c/w diesel power pack
1	spare parts kit for TDS-118 skimmer
1	4Kva diesel generator
1	16' aluminum boat
1	25 hp outboard motor
2	3000 psi portable high pressure washer
2	sets portable lights (each set has 3 X 500 watt halogen lamps, spare bulbs, 100" ext. cord and carrying case)
2	coils 1/4" polypropylene rope (1200')
2	coils ½" polypropylene rope (600')
2	coils 5/8" polypropylene rope (600')
72	pair disposable coveralls
120	pair work gloves
12	hard hat liners
40	dust / mist disposable masks
40	pairs assorted rain gear
20	pair safety glasses
20	safety vests
20	pair sunglasses
2	20' steel ISO containers
1	tool box

PETRO-CANADA

Material Safety Data Sheet

WHMIS (Pictograms)	WHMIS (Classification)	Protective Clothing	TDG (pictograms)
	B-3, D-2B		

Section 1. Chemical Product and Company Identification

Product Name	DIESEL FUEL	**Code**	File # W104
		DSL	On the DSL.
Synonym	Diesel 50, Diesel 50 LS, #1 Diesel , #1 Diesel LS, Diesel LC, Seasonal Diesel, Seasonal Diesel LS, Diesel AA, Domestic Marine Diesel, International marine Diesel, Seasonal Diesel Locomotive, Dosmestic Marine diesel LS, disesel -20°C (LS), Mining Diesel Special, Mining Diesel Special LS.	**TSCA**	On TSCA inventory list.
Manufacturer	PETRO-CANADA P.O. Box 2844 Calgary, Alberta T2P 3E3	**In case of Emergency**	Petro-Canada: 403-296-3000 Canutec Transportation: 613-996-6666 Poison Control Centre: Consult local telephone directory for emergency number(s).
Material Uses	Diesel fuels are distillate fuels suitable for use in high and medium speed internal combustion engines of the compression ignition type.		

Section 2. Composition and Information on Ingredients

			Exposure Limits (ACGIH)		
Name	**CAS #**	**% (V/V)**	**TLV-TWA(8 h)**	**STEL**	**CEILING**
Mixture of petroleum distillates. Aromatic content is 50%.maximum (benzene: nil). * Notice of Intended Change (1996): 350 mg/m³, A3.	68334-30-5	100	Not established*	Not established	Not established
Manufacturer Recommendation	Petro-Canada recommends an allowable exposure of 350 mg/m³ when handling Diesel fuel. Consult local authorities for acceptable exposure limits.				
Other Exposure Limits	Consult local, provincial or territory authorities for acceptable exposure limits.				

Section 3. Hazards Identification.

Potential Health Effects	Inhalation of vapours or mist in high concentration may cause headaches, nausea, dizziness, drowsiness, unconsciousness and passing out. May irritate skin, eyes and respiratory tract. For more information, refer to Section 11.

Section 4. First Aid Measures

Eye Contact	Check for and remove any contact lenses. IMMEDIATELY flush eyes with running water for at least 15 minutes, keeping eyelids open. DO NOT use an eye ointment. Seek medical attention if irritation persists.
Skin Contact	Remove contaminated clothing - launder before reuse. Wash gently and thoroughly the contaminated skin with running water and non-abrasive soap. Get medical attention if redness or irritation occurs.
Inhalation	Evacuate the victim to a safe area as soon as possible. Allow the victim to rest in a well ventilated area. If the victim is not breathing, perform mouth-to-mouth resuscitation. If resuscitation is required, physician assessment mandatory.
Ingestion	DO NOT induce vomiting because of danger of aspirating liquid into lungs. Physician assessment mandatory.
Note to Physician	Monitor blood gases to assure adequate ventilation. If vital signs become abnormal or symptoms develop obtain a chest x-ray.

Continued on Next Page

Section 5. Fire-fighting Measures

Flammability	Combustible liquid.	**Flammable Limits**	LOWER: 0.7%, UPPER: 6%
Flash Points	CLOSED CUP (tag): 52°C (126°F) for Mining Diesel Special and Mining Diesel special-LS. 40°C (104°F) for others.	**Auto-Ignition Temperature**	225°C (437°F)
Fire Hazards in Presence of Various Substances	Flammable in presence of open flames, sparks, or heat. Vapours are heavier than air and may travel considerable distance to sources of ignition and flash back.	**Explosion Hazards in Presence of Various Substances**	Do not cut, weld, heat, drill or pressurize empty container. Containers may explode in heat of fire. Vapour explosion hazard indoors, outdoors or in sewers.
Products of Combustion	Carbon oxides (CO, CO2), nitrogen oxides (NOx), sulphur oxides (SOx), sulphur compounds (H2S); smoke and irritating fumes as products of incomplete combustion.		
Fire Fighting Media and Instructions	NAERG96, GUIDE 128, flammable/combustible liquid (non-polar/water-immiscible). CAUTION: This product has a low flash point, use of water spray when fighting fire may be inefficient. SMALL FIRE: Use DRY chemicals, CO2, water spray or foam. LARGE FIRE: Use water spray, fog or foam. DO NOT use water jet. If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions. DO NOT extinguish a leaking gas flame unless leak can be stopped. Shut off fuel to fire if it is possible to do so without hazard. If this is impossible, withdraw from area and let fire burn out under controlled conditions. Withdraw immediately in case of rising sound from venting safety device or any discolouration of tank due to fire. Cool containing vessels with water spray in order to prevent pressure build-up, autoignition or explosion. Avoid flushing spilled material into sewers, streams or other bodies of water. Self-contained breathing apparatus (SCBA) will be required if approaching the fire from downwind, or to enter enclosed areas or buildings.		

Section 6. Accidental Release Measures

Material Release or Spill	NAERG96, GUIDE 128, flammable/combustible liquid (non-polar/water-immiscible). Evacuate in a downwind direction for at least 300 meters (1000 feet). ELIMINATE ALL IGNITION SOURCES. Ventilate closed spaces before entering. By forced ventilation, maintain concentration of vapour below the range of explosive mixture. Avoid contact, fully-encapsulating, vapour-protective clothing should be worn for spills and leaks with no fire. Stop leak if without risk. Remove the leaking container to an open area and allow it to bleeds off into the atmosphere. Use vapour suppressing foam or water spray to reduce vapours; it may reduce vapour, but it may not prevent ignition in closed spaces; isolate area until vapour has dispersed. Contain spill. Absorb with inert absorbents such as dry clay, or diatomaceous earth, or recover using electrically grounded explosion-proof pumps. Avoid inhaling dust of diatomaceous earth for it may contain silica in very fine particle size, making this a potential respiratory hazard. Place used absorbent in closed metal containers for later disposal or burn absorbent in a suitable combustion chamber. DO NOT FLUSH TO SEWERS, STREAMS OR OTHER BODIES OF WATER. Check with applicable jurisdiction for specific disposal requirements of spilled material and empty containers. Notify the appropriate authorities immediately.

Section 7. Handling and Storage

Handling	Keep away from heat, spark, open flames and other sources of ignition. Use explosion-proof ventilation to prevent vapour accumulation. Empty container may contain flammable/explosive residues or vapours, DO NOT reuse empty containers without commercial cleaning or reconditioning. Ground/bond line and equipment during pumping or transfer to avoid accumulation of static charge. Avoid contact with skin and eyes. DO NOT USE AS CLEANING FLUID OR SIPHON BY MOUTH. Practice good personal hygiene. Wash hands after handling and before eating. Launder work clothes frequently. Discard saturated leather goods.
Storage	Store in tightly closed containers in cool, dry, isolated and well-ventilated area. Ground all equipments containing material.

Section 8. Exposure Controls/Personal Protection

Engineering Controls	For normal outdoor application, special ventilation is not necessary. For indoor or confined spaces, provide explosion-proof local exhaust ventilation, or other engineer controls, to keep airborne concentration below the allowable threshold limit value. Make-up air should always by supplied to balance air removed by exhaust ventilation. Ensure that eyewash station and safety shower are close to work-station.
Personal Protection	
Eyes	Wear safety glasses or chemical splash goggles in case of splashing.
Body	Wear long sleeved clothing to minimize skin contact.

Continued on Next Page

Respiratory	When exposure is likely to exceed recommended exposure limit (see section 2), use NIOSH approved respiratory equipment. Respiratory should be selected based on the form and concentration of contaminant in air (refer to NIOSH Pocket Guide for chemical Hazard for respirator selection). In order to determine the concentration of the contaminant, air sampling is RECOMMENDED AND SHOULD BE PERFORMED BY A HEALTH & SAFETY SPECIALIST (AS PER THE NIOSH Manual of analytical Methods for method of measurement). If air sampling is not practical and concentration is unknown, use positive pressure self-contained breathing apparatus (SCBA). Contact appropriate HEALTH & SAFETY personnel or supplier for assistance.
Hands	For casual contact, PVC gloves are suitable. For direct contact for more than 2 hours, Viton or Nitrile gloves are recommended.
Feet	Safety boots or shoes.

Section 9. Physical and Chemical Properties

Physical State and Appearance	Bright oily liquid.	**Viscosity**	Not applicable.
Colour	Clear to yellow. Low sulphur diesel fuels are colourless to light yellow / brown, and are not dyed. Regular sulphur diesel fuels (>0.05wt.% Sulphur) may be colourless to yellow / brown. This product may be dyed purple or red for taxation purposes.	**Pour Point**	Not applicable.
Odour	Mild petroleum oil like.	**Softening Point**	Not applicable.
Odour Threshold	Not available.	**Dropping Point**	Not applicable.
Boiling Point	150°C (302°F)	**Penetration**	Not applicable.
Density	0.85 kg/L @ 15°C (Water = 1).	**Oil / Water Dist. Coeff.**	Not available.
Vapour Density	4.5 (Air = 1)	**Ionicity (in water)**	Not available.
Vapour Pressure	1.0 kPa @ 20°C (7.5 mmHg @ 68°F).	**Dispersion Properties**	Not available.
Volatility	Semivolatile to volatile	**Solubility**	Insoluble in cold water, soluble in non-polar hydrocarbon solvents.

Section 10. Stability and Reactivity

Corrosivity	Not applicable		
Stability	The product is stable under normal handling and storage conditions.	**Hazardous Polymerization**	Will not occur under normal working conditions.
Incompatible Substances / Conditions to Avoid	Strong acids, peroxides, alkalis, oxidizing agents (chlorine, oxygen)	**Decomposition Products**	Releases of COx, NOx, SOx, H2S, smoke and irritating fumes when heated to decomposition.

Section 11. Toxicological Information

Routes of Entry	Skin contact, eye contact, inhalation, and ingestion.
Acute Lethality	Acute oral toxicity (LD50): 12,000 mg/kg/rat.
Chronic or Other Toxic Effects	
Dermal Route:	Repeated exposure would produce drying and cracking or defatting dermatitis. Dermal primary skin irritation score (Draize) = 6.8; moderately to extremely irritating (rabbit), dose: 500 uL/24h.
Inhalation Route:	Central nervous system depression.
Oral Route:	Aspiration of the solvent into the lung may produce a potentially fatal chemical pneumonitis.
Eye Irritation/Inflammation:	Eye irritation index (Draize) = 0; non irritating (rabbit).
Immunotoxicity:	No studies were found.
Skin Sensitization:	It is not a skin sensitizer in guinea pig.
Respiratory Tract Sensitization:	No studies were found.
Mutagenic:	No evidence.
Reproductive Toxicity:	No evidence.
Teratogenicity/Embryotoxicity:	No evidence.
Carcinogenicity (ACGIH):	ACGIH Notice of Intended Changed (1996): proposed A3: animal carcinogen.
Carcinogenicity (IARC):	Group 3: cannot be classified as to carcinogenicity to humans.
Carcinogenicity (NTP):	No studies were found.
Carcinogenicity (IRIS):	No studies were found.
Carcinogenicity (OSHA):	No studies were found.
Other Considerations	Preexisting eye, skin, respiratory, neurological, liver or kidney conditions may be aggravated by exposure to this product.

Continued on Next Page

Section 12. Ecological Information

Environmental Fate	Biodegradable.	**Persistance/ Bioaccumulation Potential**	High potential to bioconcentrate in aquatic organisms, but it may not be important due to high metabolism.
BOD5 and COD	BOD5 : 5.3 ug/ml (C16), biodegradable.	**Products of Biodegradation**	Not available.
Additional Remarks	If released to soil, diesel fuel will strongly adsorb. It may biodegrade in water and soil or volatilize from water (half-life of 4.4 to 4.8 hrs from a model river) and moist soil surfaces, but adsorption may attenuate the rate of these processes.		

Section 13. Disposal Considerations

Waste Disposal	Consult your local or regional authorities. Preferred waste management priorities are: (1) recycle or reprocess; (2) incineration with energy recovery; (3) disposal at licensed waste disposal facility. Ensure that disposal or reprocessing is in compliance with government requirements and local disposal regulations.

Section 14. Transport Information

TDG Classification	Shipping name: Fuel Oil; UN 1202; Class 3; Packing Group III. Label required: Flammable liquid.	**Special Provisions for Transport**	No additional remark.

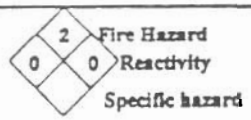
Section 15. Regulatory Information

Other Regulations	This product is acceptable for use under the provisions of WHMIS-CPR. All components of this formulation are listed on CEPA-DSL, and USEPA-TSCA. This product is not known to contain any of the carcinogens required to be listed under OSHA hazard communication standard, 29 CFR 1910.1200 (U.S.). Not listed in CERCLA (40 CFR 302.4). Not listed in EPCRA or SARA Title III, Section 302/304/311/312/313 (40 CFR 355/370/372). Not listed in RCRA (40CFR 261.33). Please note that the chemical identity of some or all of the ingredients that may be listed herein is confidential business information and is being withheld as permitted by 29 CFR 1910.1200 and various State Right to Know Laws.		
DSD/DPD (Europe)	10- Flammable. 18- In use, may form flammable/explosive vapor-air mixture. 36/38- Irritating to eyes and skin.	**HCS (U.S.A.)**	
ADR (Europe) (Pictograms)		**DOT (U.S.A) (Pictograms)**	

HMIS (U.S.A.)

Health Hazard	1
Fire Hazard	2
Reactivity	0
Personal Protection	B

NFPA (U.S.A.)



Rating
0 Insignificant
1 Slight
2 Moderate
3 High
4 Extreme

Section 16. Other Information

References Available upon request.

Glossary

ACGIH - American Conference of Governmental Industrial Hygienists
ASTM - American Society for Testing and Materials
ADR - Agreement on Dangerous goods by Road (Europe)
BOD5 - Biological Oxygen Demand in 5 days
CAN/CGA B149.2 - Propane Installation Code
CAS - Chemical Abstract Services
CEPA - Canadian Environmental Protection Act
CERCLA - Comprehensive Environmental Response, Compensation and Liability Act
CFR - Code of Federal Regulations
CHIP - Chemical Hazard Information and Packaging Approved Supply List
COD - Chemical Oxygen Demand
CPR - Controlled Products Regulation
DOT - Department of Transportation (U.S.A.)
DSCL - Dangerous Substances Classification and Labeling (Europe)
DSD/DPD - Dangerous Substance or Dangerous Preparations Directives (Europe)
DSL - Domestic Substance List
EEC/EU - European Economic Community/European Union
EINECS - European Inventory of Existing Commercial Chemical Substances
EPCRA - Emergency Planning And Community Right-To-Know Act
FDA - Food and Drug Administration
FIFRA - Federal Insecticide, Fungicide, and Rodenticide Act
HCS - Hazardous Communication System
HMIS - Hazardous Material Information System
IARC - International Agency for Research on Cancer
IRIS - Integrated Risk Information System
LD50/LC50 - Lethal Dose/Concentration kill 50%
LDLo/LCLo - Lowest Published Lethal Dose/Concentration
NAERG'96 - North American Emergency Response Guide Book (1996)
NFPA - National Fire Prevention Association
NIOSH - National Institute for Occupational Safety & Health
NPRI - National Pollutant Release Inventory
NTP - National Toxicology Program
OSHA - Occupational Safety & Health Administration
PEL - Permissible Exposure Limit
RCRA - Resource Conservation and Recovery Act
SARA - Superfund Amendments and Reorganization Act
SD - Single Dose
STEL - Short Term Exposure Limit (15 minutes)
TDG - Transportation Dangerous Goods (Canada)
TDLo/TCLo - Lowest Published Toxic Dose/Concentration
TLm - Median Tolerance Limit
TLV-TWA - Threshold Limit Value-Time Weighted Average
TSCA - Toxic Substances Control Act
USEPA - United States Environmental Protection Agency
USP - United States Pharmacopoeia
WHMIS - Workplace Hazardous Material Information System

Continued on Next Page

Information Contact	Petro-Canada Product Safety Coordinator (403) 296-4410	Prepared by McBride on 3/17/97. Data entry by May Chau.