# "EXTREME" COLD WEATHER©
# OIL SPILL RESPONSE COURSE

## TECHNIQUES & RESPONSE STRATEGIES - ICE & SNOW

by

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•WHY CONDUCT
EXTREME" COLD WEATHER OIL SPILL RESPONSE

• WHY PLAN for
"EXTREME" COLD WEATHER OIL SPILL REPONSE ?

• WHY TRAIN for
"EXTEME" COLD WEATHER OIL SPILL RESPONSE ?

• WHY OBTAIN EQUIPMENT for
"EXTEME" COLD WEATHER OIL SPILL RESPONSE ?

•WHY PRACTICE for
"EXTEME" COLD WEATHER OIL SPILL RESPONSE ?

# Y CONDUCT "EXTREME" COLD WEATHER OIL SPILL REPO

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## APPLICABLE GOVERNMENTAL REGULATIONS:

Under EPA, USCG, DOT-RSPA, MMS Oil Pollution Regulations for Facility Response Plans, Final Rule Requires:

Owners or Operators of ***"Substantial Harm Facilities"*** Must Prepare Facility Plans to Response to a ***Worst Case Oil Spill Discharge,*** and Small and Medium Discharges as Appropriate.

Under Public Law 101-380-August 18, 1990- ***Oil Pollution Act of 1990***.

**OPA Section 4201 (b) (CWA Section 311 (a) (24) ) Defines a *"Worst Case Discharge"*** for a Facility as the Largest Foreseeable Discharge in the ***MOST ADVERSE WEATHER CONDITIONS.***

# " *Adverse Weather Conditions* " is defined as:

**The *Weather Conditions* that make it *Difficult* for Response Equipment and Personnel to Cleanup or Remove Spilled Oil, & that will be considered when *Identifying Response Systems* & Equipment in a *Facility Response Plan* for an Applicable Operating Environment.**

## Factors to Consider Include:

* ***Significant Wave Height,***
* ***Ice Conditions,***
* ***Temperatures,***
* ***Weather-related Visibility,***
* ***and Currents within the Area in which the Systems or Equipment are Intended to Function.***

# Y PLAN for "EXTREME" COLD WEATHER OIL SPILL REPON

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***Answer:***

**If you have *FRP* and your have an *Applicable Operating Environment* that has a *Winter Season* of:**

* ***Ice***

* ***Snow***

* ***Freezing & Sub-Freezing Temperatures,***

* ***Frozen Lakes, Stream, & Rivers,***

**then you Have Met the Requirement, to Plan for a *Worst Case*, *Medium and Small Spill* in *Adverse Weather Conditions* such as *"Extreme" Cold Weather.***

# * IN "EXTREME" COLD WEATHER OIL SPILL REPONSE

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## WHAT DO WE PLAN FOR ?

* *The Amount of Oil That the Plan Holder Anticipates will Reach Frozen Streams, Lakes, Rivers and Snow Covered Land Environments.*

* *What Spill Trajectory Does the Plan Holder Think, the Oil Will Take When it is Spilled on the Ice and/or Snow?*

* *How is the Plan Holder going to Detect Where the Oil Is?*

  - *On the Snow*
  - *On the Ice*
  - *In the Ice*
  - *Under the Ice*

* *How is the Plan Holder going to Determine How Much Oil is:*

  - *On the Snow*
  - *On the Ice*
  - *In the Ice*
  - *Under the Ice?*

## * IN "EXTREME" COLD WEATHER OIL SPILL REPONSE - WHAT DO WE PLAN FOR ? (cont.)

** What Oil Spill Response Strategy is going to be Selected?*

- *Do Nothing*
- *Wait till Spring*
- *Contain with Ice/Snow Berms & Trenches*
- *Conduct Ice Slotting Containment Operations*

** Once Contained How are we going to Recover the Oil from the Ice, Snow and/or Ice Slot.*

** Once we know where the Oil is Going and how Fast it is Traveling, How, When & Where Does the Plan Holder, Plan for locating the Containment and Recovery Sites ?*

- *Are the Containment & Recovery Sites Pre-planned?*

** What Will the Plan Holder's Responder Personnel Requirements Be and Where is the Plan Holder Going to Get Them?*

## * IN "EXTREME" COLD WEATHER OIL SPILL REPONSE - WHAT DO WE PLAN FOR ? (cont.)

* *What Extreme Cold Weather Oil Spill Response Equipment will the Plan Holder be Required to Obtain to Successfully Contain, Recover and Cleanup the Potential Discharge of Oil?*
  - *Will the Plan Holder Pre-purchase the Required Equipment?*
  - *Where will they Obtain It? (Most Not Off the Self)*

* *What Personal Protective Equipment & Clothing will be Required?*
  - *Will it be Pre-purchased?*
  - *Where will it be Obtained from?*

* *What Decontamination Procedures will be Determined and Conducted for this Extreme Cold Weather Environment?*
  - *What Equipment will be Selected & Purchased?*
  - *Where will the Equipment be Obtained from?*
  - *Who will Conduct the Decontamination?*
  - *What Training will they receive for this type of Decon?*

# Y TRAIN for "EXTREME" COLD WEATHER OIL SPILL REPON

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**Answer:**

**EPA 40 CFR Part 112:**

***Oil Pollution Prevention; Non-Transportation-Related Onshore Facilities; Final Rule.***

**112.21 - Facility Response Training and Drills/Exercises.**

*(a) The Owner or Operator of any Facility Required to Prepare a Facility Response Plan under 112.20 Shall Develop & Implement a Facility Response Training Program.*

# * WHY TRAIN for "EXTREME" COLD WEATHER OIL SPILL REPONSE ? (cont.)

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*(b) The Facility Owner or Operator Shall Develop a Facility Response Training Program to Train those Personnel Involved in Oil Spill Response Activities.*

*(1) The Owner or Operator Shall be Responsible for the Proper Instruction of Facility Personnel in the Procedures to Respond to Discharges of Oil and in Applicable Oil Spill Response Laws, Rules, and Regulations.*

*(2) Training Shall be Functional in Nature According to Job Tasks for Both Supervisory & Non-Supervisory Operational Personnel.*

**If You Have An Extreme Cold Weather Environment and a Facility Response Plan then**

**" IT'S REQUIRED "**

# REME" COLD WEATHER OIL SPILL REPONSE TRAINING SHOULD CO AT A MIMIMUM:

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- **EXTREME COLD WEATHER OIL SPILL RESPONSE**
  - **GENERAL BACKGROUND**
- **COLD WEATHER OILSPILL RESPONSE**
  - **PPE & SAFETY REQUIREMENTS**
- **SOURCE CONTAINMENT STRATEGIES & TECHNIQUES**
  - **RECOVERY ON and IN ICE & SNOW**
  - **RECOVERY UNDER ICE – SLOTTING**
  - **IN-SITU BURNING**
- **DECONTAMINATION PROCEDURES**
  - **COLD WEATHER OPERATIONS**

***The Hard Way***

# COLD & FROZEN WATER OIL SPILLS

## General Background

# GENERAL BACKGROUND

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- Difficult to Find Oil
- Difficult to Contain Oil
- Difficult to Recover Oil
- Safety Concerns with Temperatures, Weather & Cold Water
- Few Properly Trained Responder Personnel
- Equipment Difficult to Obtain & Maintain
- Little Research into Extreme Cold Weather Oil Spill Response
- Most Companies Ignore

# WHERE TO FIND THE SPILLED OI

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- *Oil in Extremely Cold Water*
- *Oil in Slush*
  *(Freeze Up)*
- *Oil in Snow*
- *Oil Encapsulated in Solid Ice*
- *Oil Under Solid Ice*
- *Oil in Melting Pools*
  *(Over Rotting Ice)*
- *Oil in Broken Ice*
  *(Breakup)*

# COLD WEATHER
# PERSONAL PROTECTIVE EQUIPMENT

COLD WEATHER
PERSONAL PROTECTIVE EQUIPMENT
Cold Weather Safety

## Cold Weather Safety

# COLD WEATHER INJURIES

## 3 Factors Involved in a Cold Challenge To the Human Body

* TEMPERATURE

* WIND

* WET CONDITIONS

All 3 Effect the Rate of Heat Loss from A Person's Body

# CONSERVING BODY HEAT

## 3 WAYS TO LOOSE BODY HEAR

- **RADIATION**

**( EMISSION of BODY HEAT )**

- **CONDUCTION**

**( ABSORPTION of COLD )**

- **CONVECTION**

**( LOSS of BODY HEAT DUE TO WIND CHILL )**

**" LIMIT the AMOUNT of BARE SKIN "**

# The LAYERING

**Layering Represents an Individual's PERSONAL THERMOSTAT.**

- **As you COOL, you put on ANOTHER LAYER.**
- **As you body begins to SWEAT, you REMOVE a LAYER.**

# LAYERED APPROACH to CLOTHING in EXTREME COLD WEATHER

- **BASE LAYER**
  **( Underwear )**

- **MIDWEAR LAYER**
  **( Pants & Shits – Fleece )**

- **WATERPROOF OUTERWEAR**
  **( Lightweight &Storm Jackets, Parkas, & Insulated Overalls )**

- **FOOT WEAR**

- **FACE, HAND & HEAD PROTECTIVE**

# CLOTHING in the Field

## A System of 3 Layers & Hand, Head and Foot Protection

- **BASE (Inner) LAYER**

**( Wicks Moisture Away from Skin )**

- **MIDDLE WEAR (Insulating) LAYER**

**( Possibly Several Layers )**

- **WATERPROOF OUTER LAYER**

**( Protection from Wind, Rain, Snow )**

# OTHER CONCERNS in "EXTREME" COLD WEATHER

- WATER CONSUMPTION
- BUDDY SYSTEM
- SAFETY & EQUIPMENT CHECKLISTS

# Harness, Hard Hat, Life Jackets & Layered Cold Weather PPE

# Safety Lines on Harness

# Boot Safety Chains for Work on Ice

# Personal Protective Equipment & Clothing for Field

- Insulated Underwear
- Midwear Layer
- Insulated Overalls
- Protective/Insulated Footwear
- Face, Hand & Head Protection
- Hard Hat
- Life Jacket
- Harness

# ICE CHARACTERISTICS & OIL BEHAVIOR

# ICE CHARACTERISTICS

** Water is a Chemical Compound Consisting of Hydrogen & Oxygen Molecules, with Unique Chemical Properties.*

*Unlike Most Compounds, as the Temperature of Water Drops, the Water Density Decreases.*

** Water is Densest at 4 degrees C*

** Water Cooler than 4 degrees C Floats to the Surface and Forms Ice Crystals.*

# ICE CHARACTERISTICS (cont.)

* *Strong Winds & Currents Agitate the Water, Slowing the Freezing Process. Light Winds & Calm Conditions Accelerate the Process.*

* *As Freezing Continues, the Water Continues to Lose Heat at the Surface, & the Ice Begins to Thicken Downwards.*

*New Ice is Normally Stronger the Old Ice.*

* *Ice Formed on Top of Deeper Lakes & Rivers Acts as an Insulator, Preventing Freezing to the Bottom.*

# ICE

* *Ice Rarely Forms in a Uniform Thickness as the Water Normally Freezes at Different Rates.*

* *Fast Running Water Can Continue to Flow at Temperatures Well Below Freezing.*

* *River Ice is Normally Weaker than Lake Ice, Due to Current Movement.*

* *Water Containing Salts & Minerals can Remain Fluid to -4 degrees C.*

# ICE CHARACTERISTICS (cont.)

***ICE STRENGTH*:**

**A Number of Factors Affect Ice Strength:**

* *Ice Type*
* *Ice Thickness*
* *Characteristics of the Water Body*
* *Ice Temperature*
* *Ice Condition*
* *Rate and Application of Stress*
* *Weight Bearing Capacity*

# ICE CHARACTERISTICS (cont.)

## *ICE TYPE:*

**Ice Profiles can be Very Complex & Depend to a Large Extent on the Mechanism of the Ice Formation. Generally Two (2) Types are Formed.**

* ***Clear Ice (Blue Ice)***

* ***White Ice (Snow Ice)***

**Blue Ice is Clear, Well Compressed & Does Not Contain Air Pockets. This Ice is Very Strong & has a High Load-Bearing Capacity.**

**White Ice (or Snow Ice) has many Air Pockets, & has a much Lower Load-Bearing Capacity.**

## *ICE THICKNESS:*

* ***Ice Thickness can be Variable.***

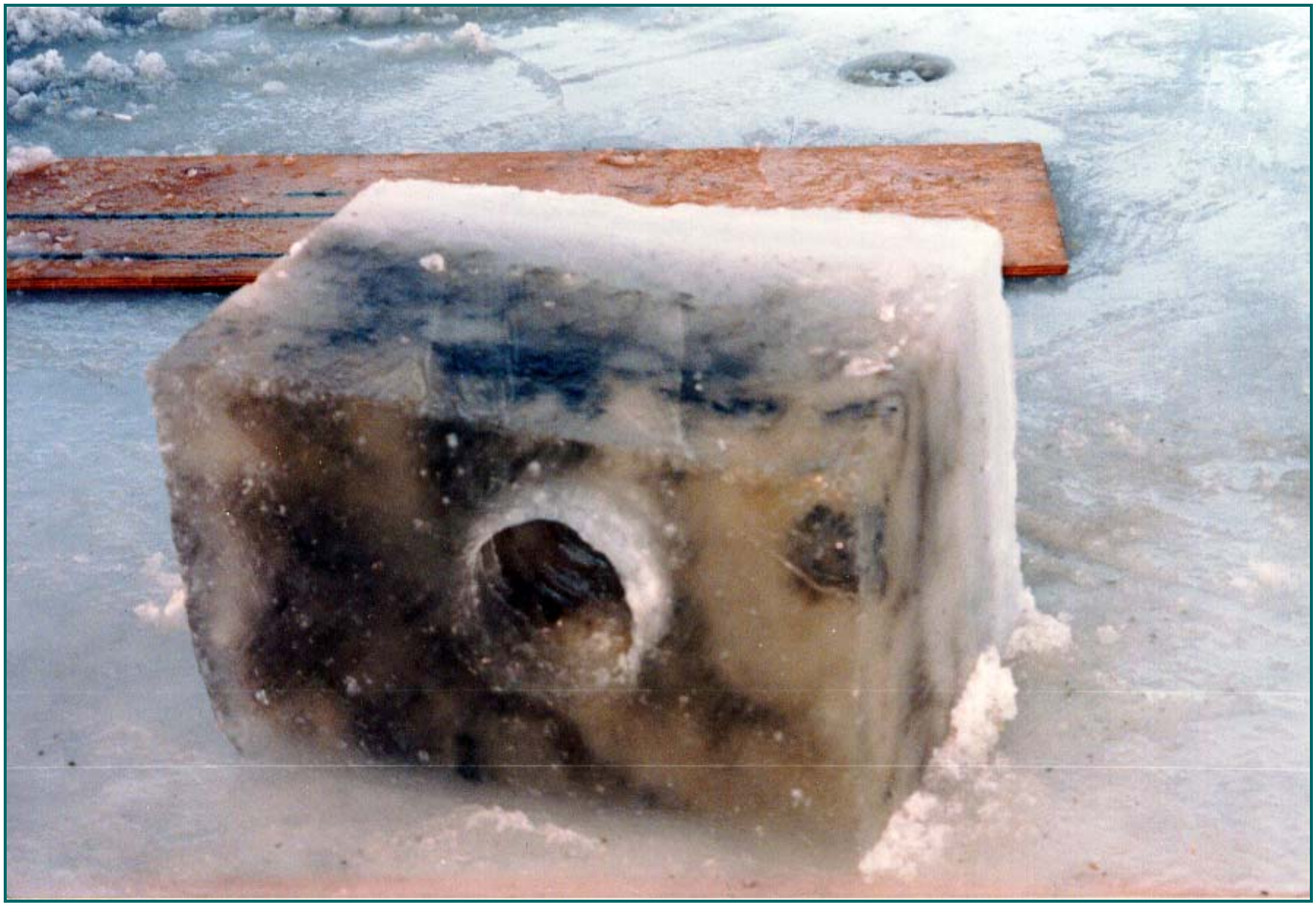
*8 to 10 ft. Clear (Lake) Ice Blocks with Bucks Cut*

*8 to 10 ft. Clear (Lake) Ice Blocks with Bucks Cut*

*Clear River Ice with Layer of Blue River Ice*

*White & Clear River Ice with Layer of Sedimentation*

*White Ice Layer/White Ice with Sedimentation Layer/Clear Ice Layer*



***River White Ice with Large Layer of White Ice with Sedimentation***


***White Ice with Clear Irregular Ice Bottom***

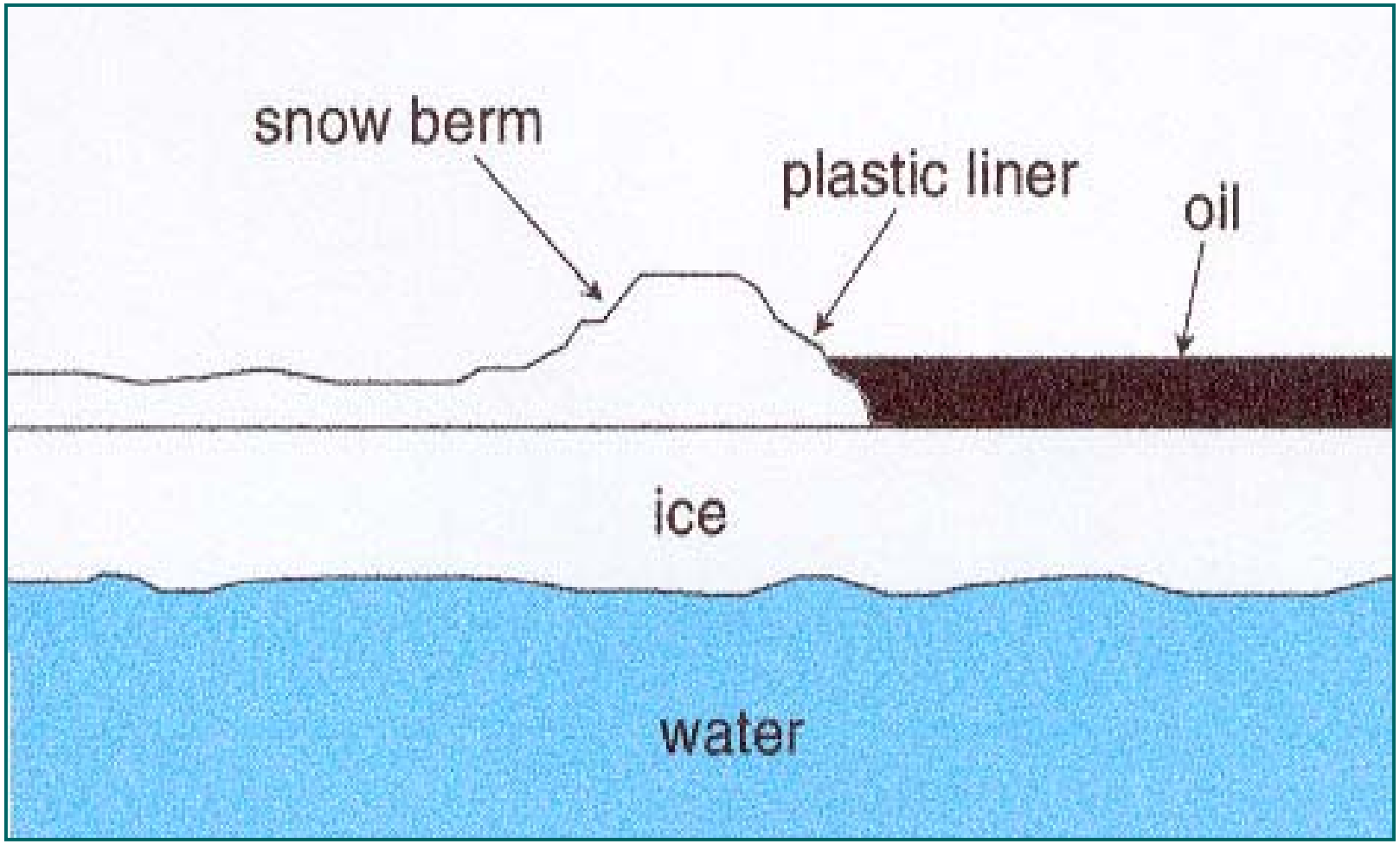
# SOURCE CONTAIMENT TECHNIQUES

# BERMS, TRENCHES

# &

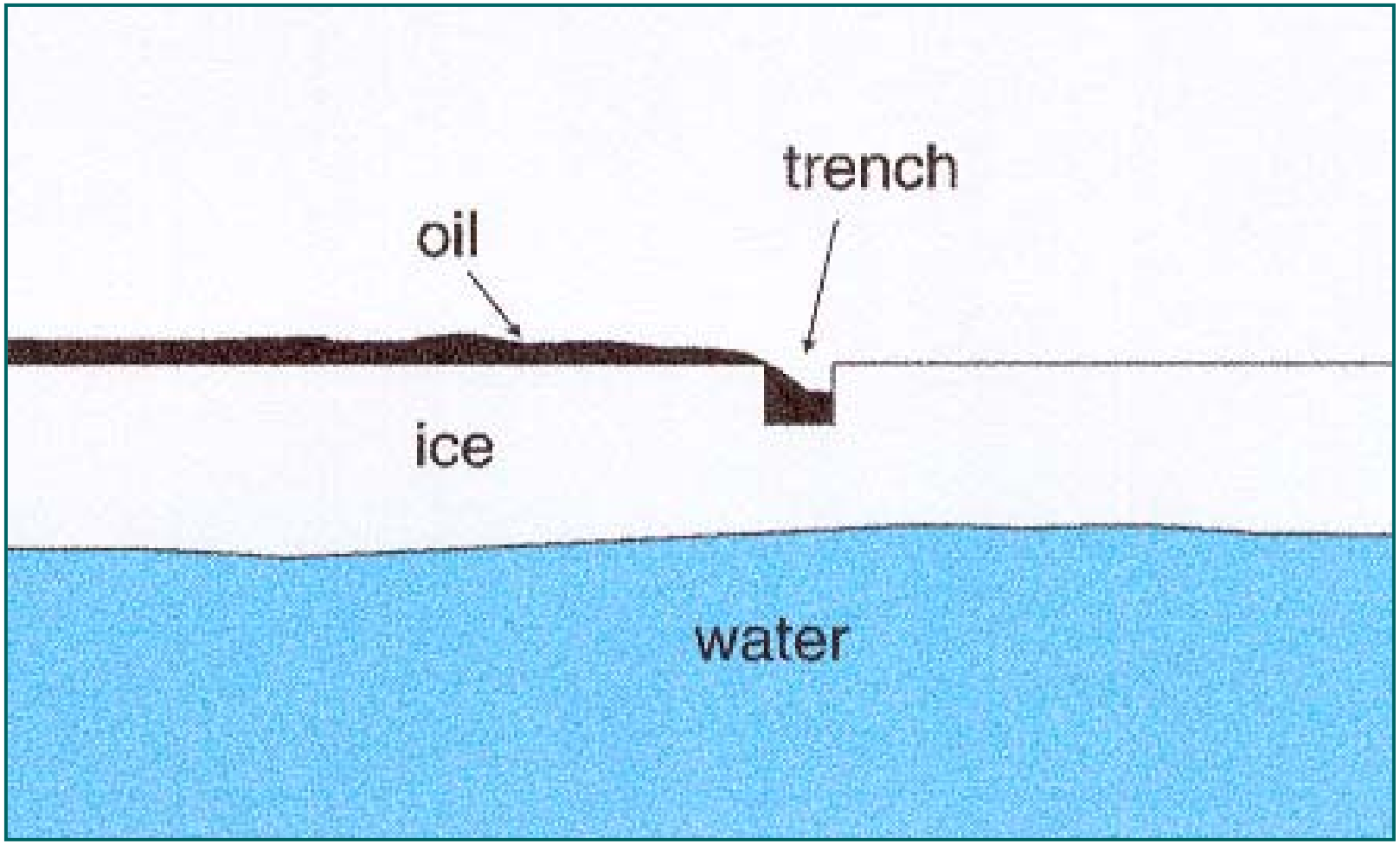
# ICE SLOTTING TECHNIQUES

# SNOW BERMS



# ICE TRENCH

ICE TRENCH



# ICE SLOTTING TECHNIQUES

- **STANDARD ICE SLOT with HOIST PULL**
- **BUCKS CUT ICE SLOT with Z Rig Pull**
- **DIVERSIONARY PLYWOOD SHEET BARRIER with COLLECTION SUMP**
- **RODNEY'S ROLL**
- **JANICKE SLOTTING GUIDE - ICE MITER BOX**

# STANDARD ICE SLOT TECHNIQUES

***Slots in the River, Creek & Lake Ice can be Cut at an Up River Diagonal Angle from the Bank into the Water Current below the Ice.***

***Oil Moving Below the Ice by the Water Current Can be Concentrated in the Open Slots in the Ice, as the Oil Passes Underneath the Open Slot and Rises to the Surface while being Contained Within the Ice Slot.***

***Oil Contained in the Ice Slots can be Recovered by Using a Varity of Oil Skimmers.***

***When Water Currents are Greater Than ½ MPH the Slots should be Cut at a 20 to 30 degree Angle to the Current, thus Allowing the Oil to Rise within the Cut Ice Slots Rather than Flow Underneath.***

***Test Ice Thickness to Determine Loading Bearing Capacity Prior to Ice Cutting.***

# ICE SLOTTING EQUIPMENT

- *Ditch Witch,*
- *Back Hoe,*
- *Chain Saw,*
- *Ice Auger,*
- *A Frame Hoist,*
- *Fred Miter Chain Saw Box*
- *Hand Ice Saw &*
- *Hand Tools*

# Use of Ditch Witch:

A ditch witch can be used provided you have sufficient weight-bearing capacity.

It is a good idea to use the ditch witch to cut one-side of the slot only, and finish construction with chain saws. The ditch witch will provide some flexibility in moving the ice blocks in the slot.

# Use of Back Hoe:

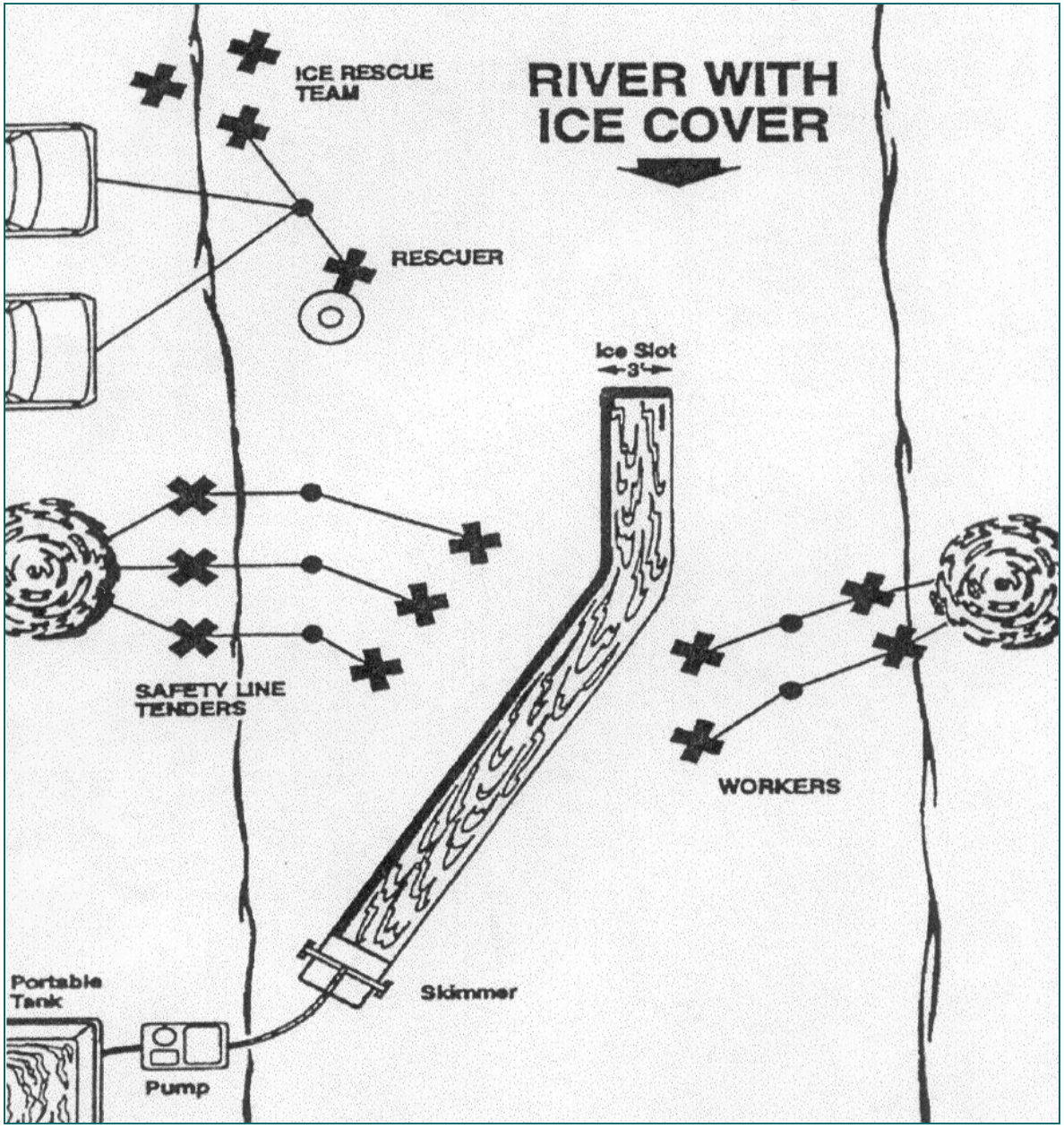
A hoe with ice-cleats can be very effective for constructing an ice slot, provided a sufficient quantity of ice is available to support its weight.

*Note*: Ensure that ice blocks are removed from the slot area, and move equipment off of the ice if it is not required.

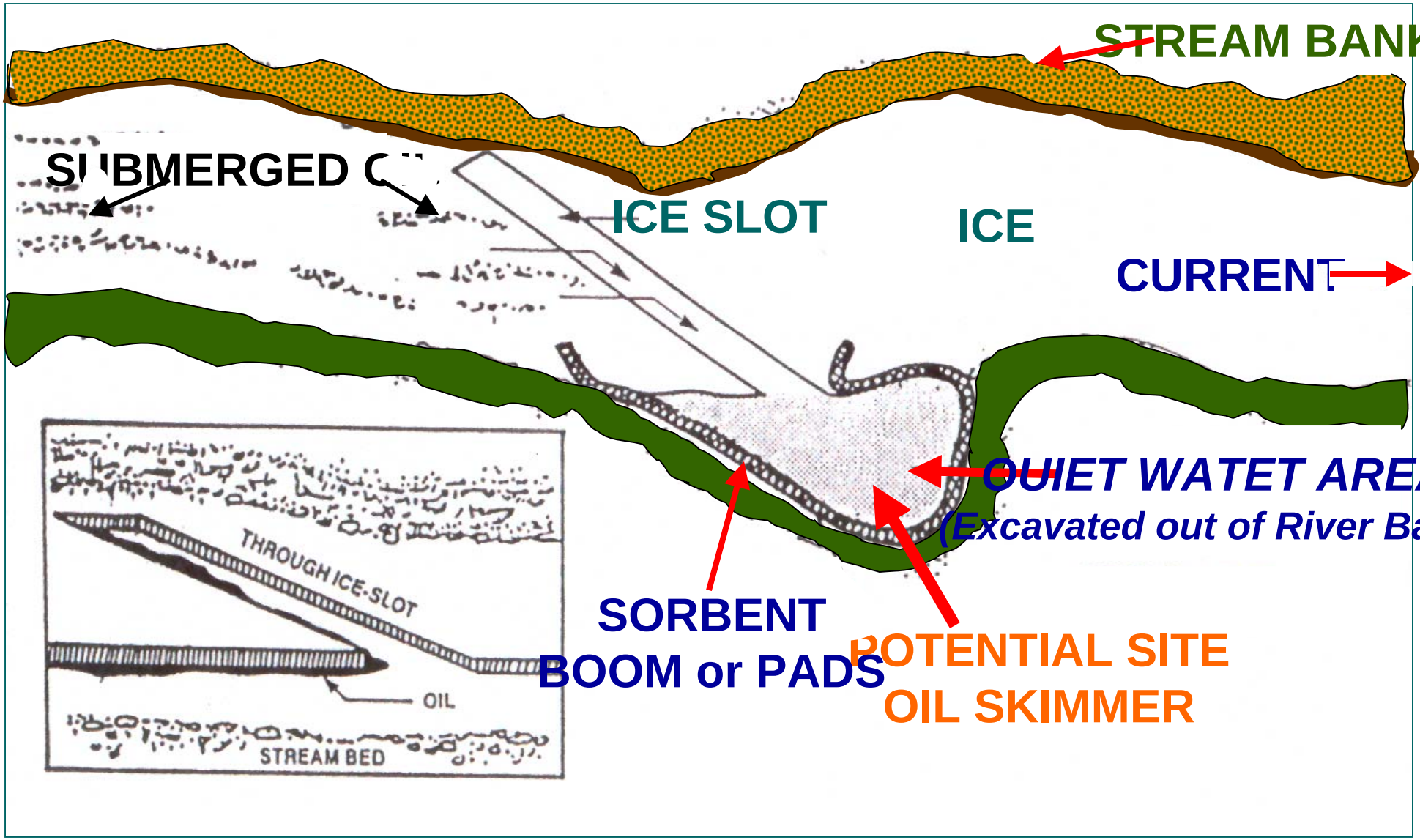
# Use of Ditch Witch:

# Back Hoe:

# Standard Ice Slotting Layout



# version & Containment of Oil Moving Beneath I



# Finished Ice Slot with “J” End, Using “Bucks Cut” and “Z” Rig to Pull Ice Blocks.

# Step. 1. – Inspect Ice for Cracks & Determine Ice Slot Positio

# Step 2. – Drill Auger Holes to Determine Ice Thickness & Water Depth Below Ice.

# Step 3. – Layout Ice Slot Design with Paint, Caulk. or Itch

# Step 4. – Ice Slot Outlined with Square Pattern & Auger Holes Drilled in Each Squire, Prior to Cutting Sides

# Step 5. – Constant Clearing of Ice & Snow from Ice Slot

# Step 6. – Cutting of Sides of Ice Slot Design

# Step 7. – Lifting of 1st Ice Block with A Frame & Hoist, Neare

# Step 8. – Lifting of 1st Ice Block with A Frame & Hoist & Pus

# Step 9. – Lifting of 2nd Ice Block with A Frame & Hoist & "

# " BUCK'S CUT "

# ICE SLOT TECHNIQUES

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# with "Z" Rig Pull

# Drilling 1st Auger Hole to Determine, Ice Thickness Water Depth & Load Bearing Capacity

# Horizontal Lines being Etched on Ice with Plywood Safety Walk Sheets

# Vertical Lines being Etched on Ice with Plywood Safety Walk Sheets

# Laying Out the Ice Slot Pattern with Chain Saw

# Drilling Auger Holes & Cutting 1st Block

# e Block Being Cut with Chain Saws in Opposite Direc

# 2nd Ice Block being Cut with Chain & Hand Saws

# Attaching “T” Bar in Reverse Method

# 2ne Ice Block being Pulled Out with “Z” Rig

# 4"x 4" x 6' used as Anchor Post for "Z" Rig to Haul 8 to 10" Ice Block from Ice Slot.

# "Z" Rig being used to Hall Ice Blocks

# Last Ice Block being Removed

# 8 to 10’ Ice Block being Hauled Out with “Z” Rig

# 8 - 10’ Ice Block Cut at Angles

# Completed Ice Slot

# Completed Ice Slot

# "Rodney's Roll"

## Use of Pry Bars to Lift & Move Ice Blocks to Side

# "Rodney's Roll"

## Using Pry Bars to Lift & Move Ice Blocks to Side

# "Rodney's Roll" in Use

# "Rodney's Roll" in Use

# 1,600 Lbs. Success with "Rodney's R

# Completed Ice Slot

# ANICKE SLOTTING GUID

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## - Ice Miter Chain Saw Box

# Janicke Slotting Guide – Ice Miter Chain Saw Box

# CKE SLOTTING GUIDE (JSG) – Ice Miter Chain Saw Box Cutting

# CKE SLOTTING GUIDE (JSG) – Ice Miter Chain Saw Box Cutting

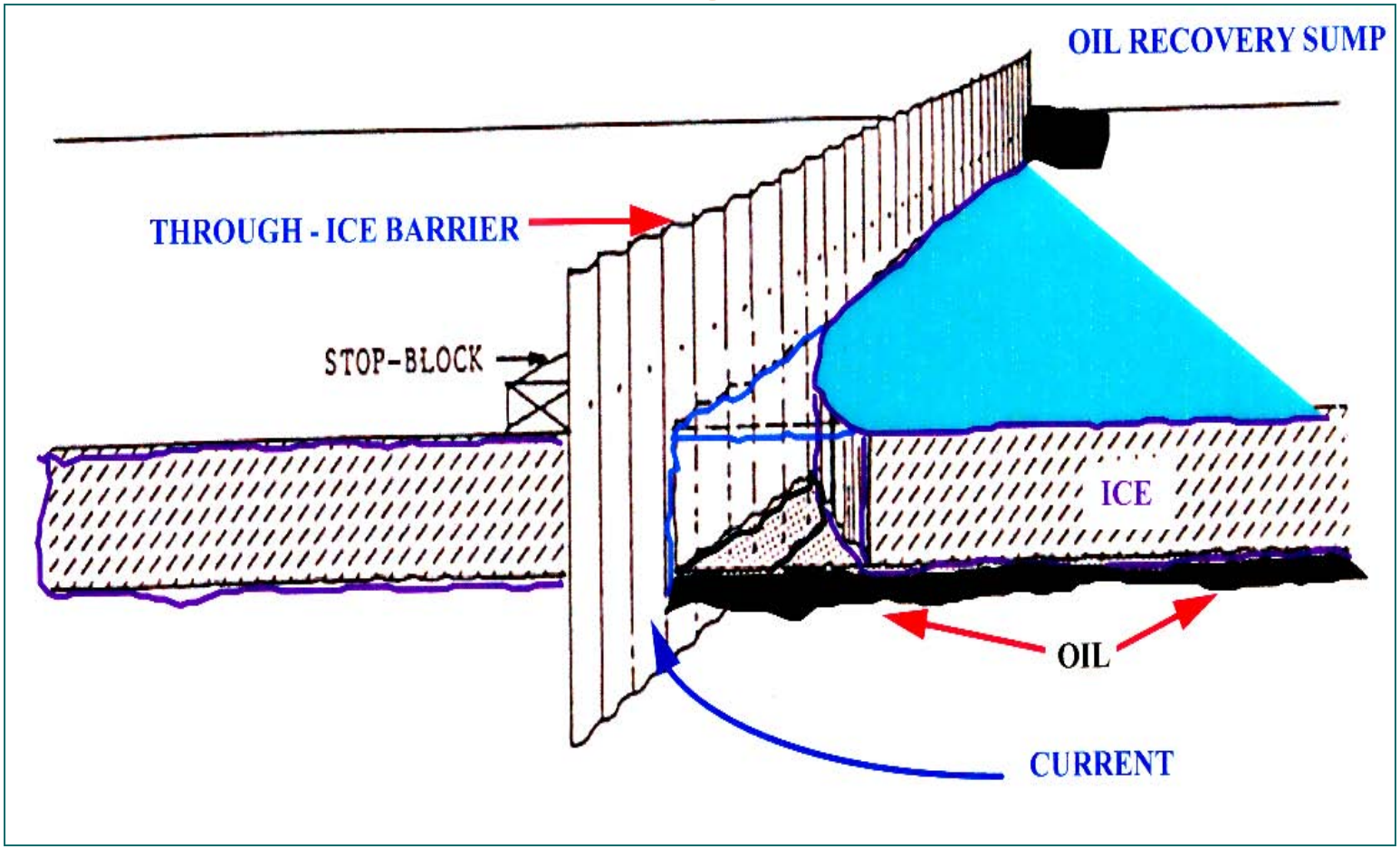
# JSG – Ice Miter Chain Saw Box Cutting Ice

# Completed Ice Slot using JSG

# " DIVERSIONARY " THRU ICE PLYWOOD SHEET BARRIER

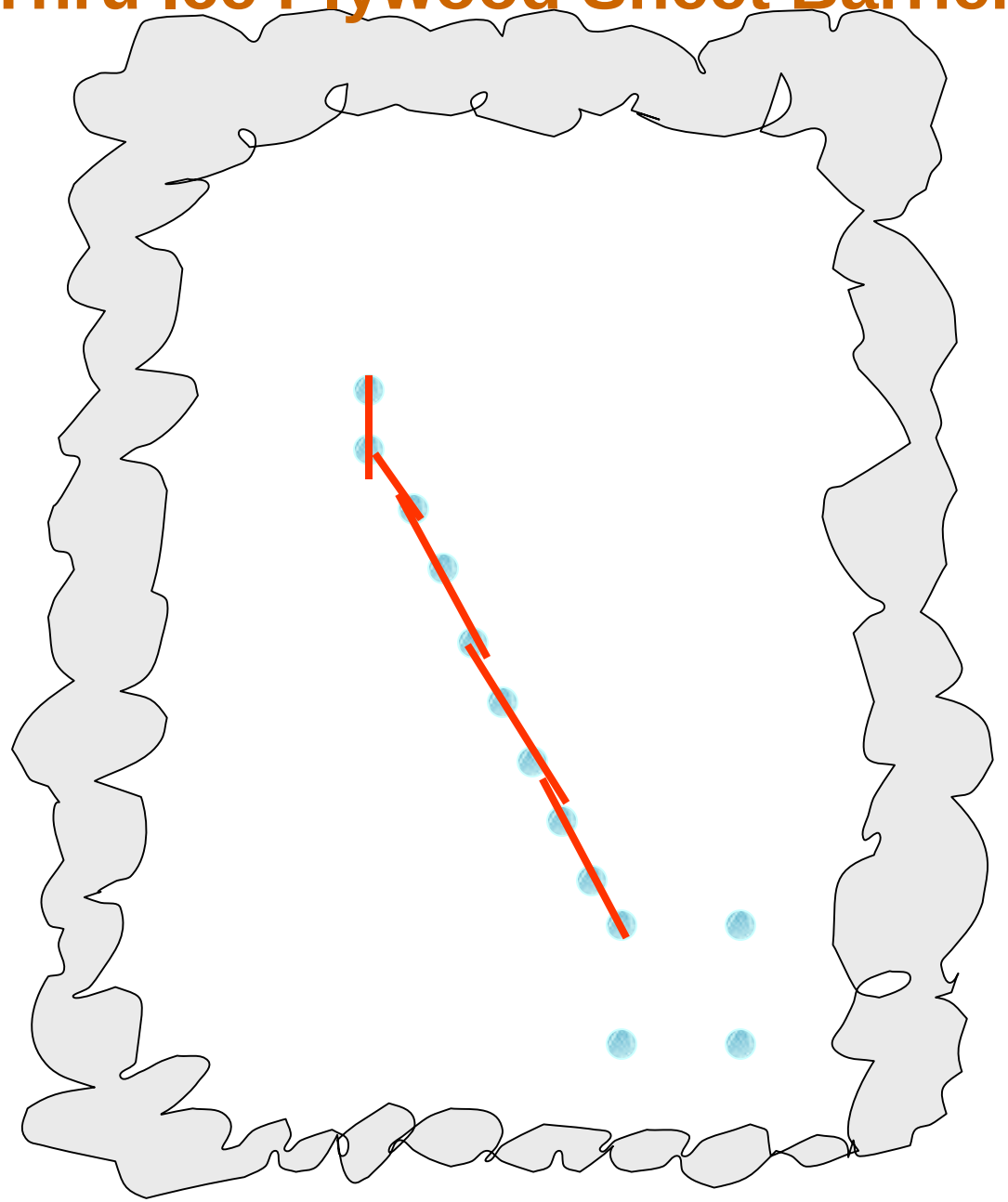
## with Oil Collection Sump

# Through Ice Barrier



# "Diversionary"
# Thru Ice Plywood Sheet Barrier

# "Diversionary"
# Thru Ice Plywood Sheet Barrier



# aying Out “Diversionary” Plywood Sheet Barri

# Etching Barrier Pattern with Chain Saw

# Drilling Auger Holes Along Layout Guide Line

# er Holes Completed on Plywood Sheet Barrier Guide

# Attaching Auger Holes

# Attaching Auger Holes using Hand S

# F Plywood Sheet with Spikes to Stabilize it on Ic

# 2nd Plywood Sheet Placed in Ice with Overlap

# Plywood Sheet being placed in “J” Portion of Thru Ice Barrie

# Plywood Sheet being placed in “J” Portion of Thru Ice Barrie

# IN SITU BURNING

## on POND ICE

# Snow Berm Created on Frozen Pond
# 5’ x 6’ – 50 gallons Diesel Fuel Red Dye No. 2

# Diesel Fuel being Lit within Snow Berm

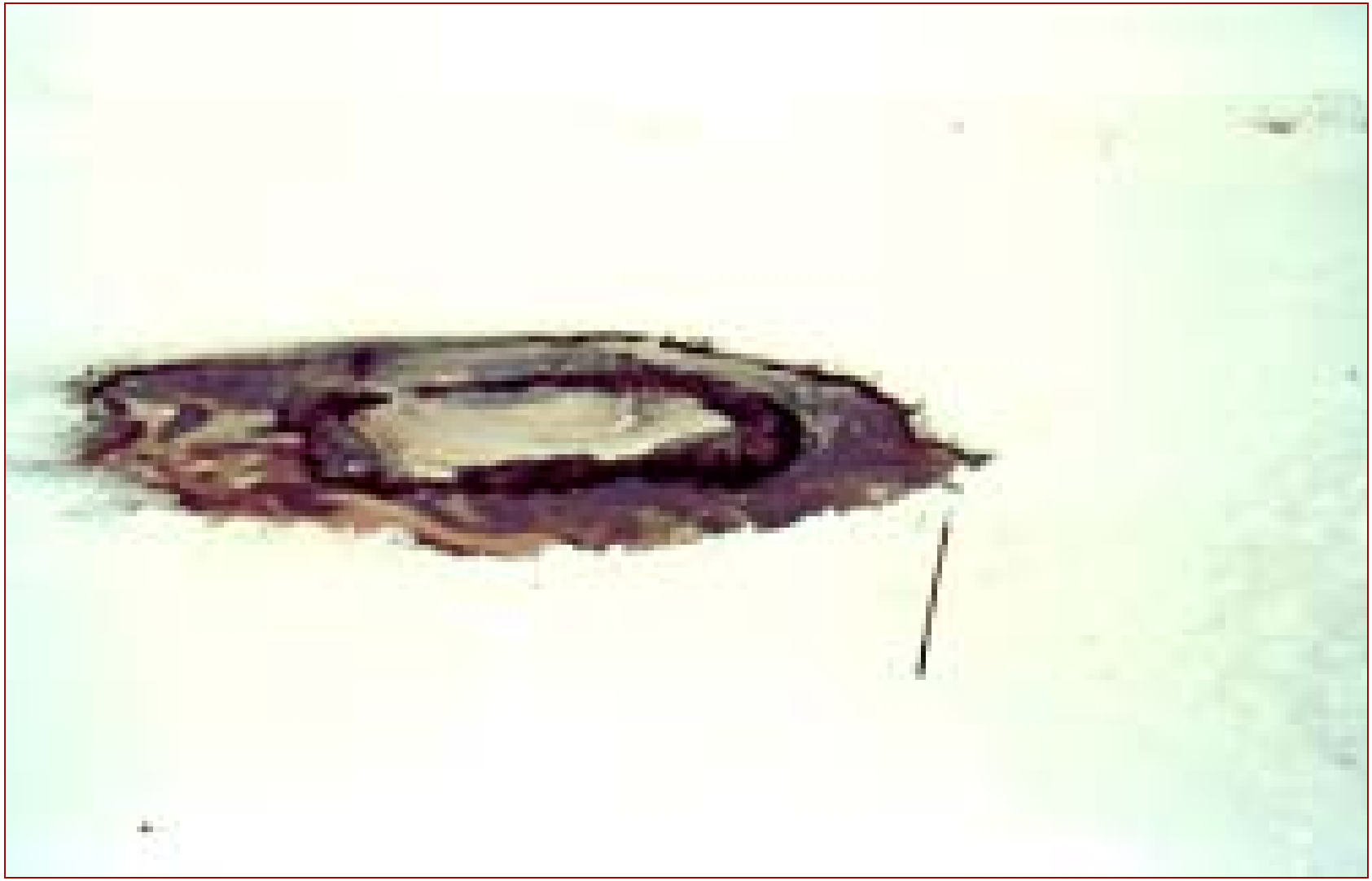
# Diesel Fuel on Fire within Snow Berm

# Diesel Fuel Beginning to Leaking under Snow E

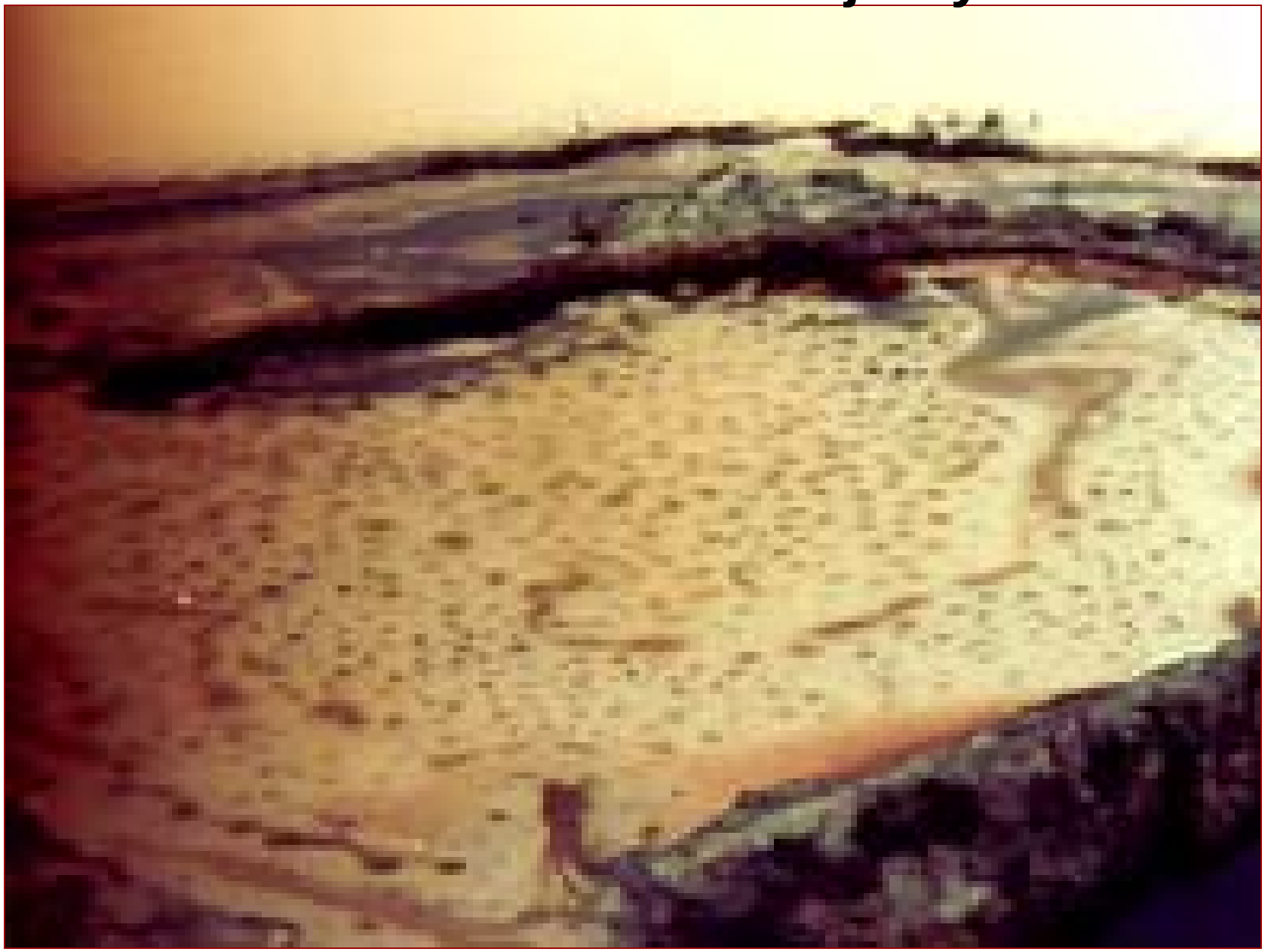
# Diesel Fuel Leaking under Snow Berm

# Berm is Floating on Water – Diesel Fuel on Fire Surrounding Outside of Snow Berm

# Diesel Fuel is Out and Snow Berm is Intact



# el Fuel Residue Embedded in Ice – Majority of Snow Berm Ir



# Diesel Fuel Cleanup - $7,500.

# DECONTAMINATION

## "EXTREME" COLD WEATHER

# Site Entry Team – Extreme Cold Weather Oil Spill Response

# pen Decontamination Line – Cold Weather Oil Spill Respons

# vered Decontamination Line – Cold Weather Oil Spill Respor

# "EXTREME" COLD WEATHER OIL SPILL REPONSE

## CONCLUSIONS:

** Do We Need to Plan for "Extreme" Cold Weather Oil Spill Response?*

**-YES, YES, YES !!!**

** What Do We Need to Plan For?*

*- Plan for Training Needs;*

*- Establish for Manpower & Equipment Needs;*

*- Plan for and Establish Predesignated Containment & Recovery Sites on Inland Waterways in Question;*

*- Plan for & Establish Recovery Methods from Ice & Snow;*

*- Plan for and Establish a Disposal Plan for Recovered Oil and Debris;*

*- Plan for and Establish Decontamination Plans;*

***- Plan for & Practice, Practice & Practice!!!***