The Burning of Spilled Oil On Wetlands and Inland Waterways

Fifth Biennial
Freshwater Spills Symposium

April 6-8, 2004

Alan A. Allen
Spiltec
Woodinville, Washington

Topics

- Controlled Burning as a Response Option
- Response During Accidental Petroleum Fires
- Preferred Conditions, Burn Rates & Efficiencies
- Tactics & Equipment for Controlled Burning

Primary Reasons For The Use of Controlled Inland Burning

- To eliminate spilled oil as quickly as possible before it spreads over large areas and/or impacts sensitive resources.
- To provide a means of dealing with large quantities of oil at or near a point source.
- To provide a response option where access to the spill site may be difficult because of shallow water, sensitive substrate, or the lack of roads.
- To offer an alternative response technique when other options are impractical or intrusive.
- To minimize the impact of removing recovered oil and/or oily waste from the spill site.

The Role of Burning During Oil Spill Response

- Ignition may be deliberate or accidental
- A burn may be contained or uncontained
- Efficient burning requires containment with natural or man-made barriers (i.e. “thick oil”)
- Burning is a “High-Volume” removal option
- Burning is not for the “chase-down” & elimination of large-area spills
- Burning requires special consideration of:
  - Personnel Safety
  - Secondary Fires
  - Combustion Byproducts
  - Public Perception

Preferred Conditions for Burning

Oil Thickness > 2 to 3 mm > 1/10 inch	**Exposure** < 25% to 30% evaporated < 24 to 48 hours exposure
Emulsification < 20% to 25% water	**Wind** < 20 knots
Waves < 1 to 1 ½ m < 3 to 5 feet	**Current** < ½ m/sec < 1 knot


Highly emulsified
oil is not likely
to burn

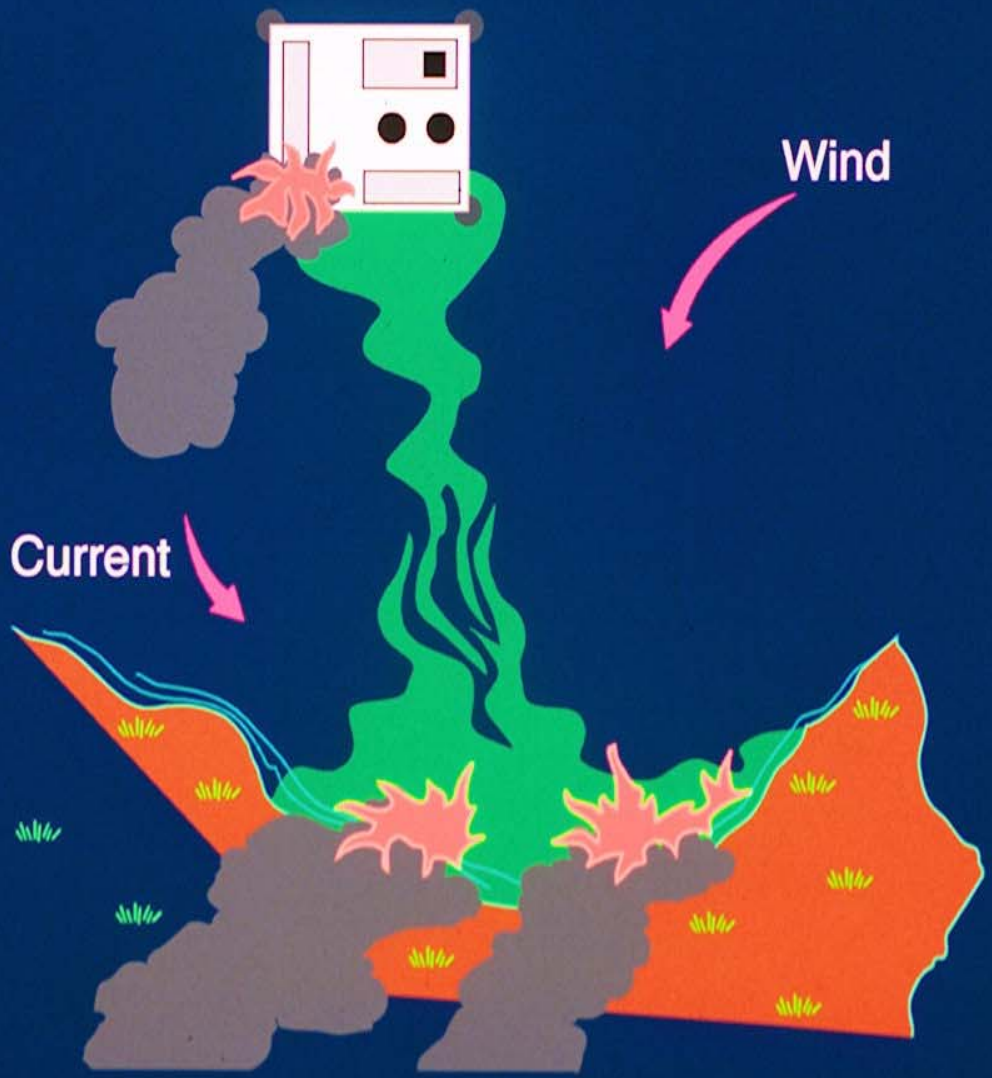
Required Conditions for Burning

- Supportive, “Burn-Educated”:
  - Regulators,
  - Facility (Spill Source) Owners & Managers,
  - Spill Responders, and
  - General Public
- Pre-Authorization Agreement

  (or at least “Expedited” approval agreement)


Representative Burn Rates
0.07 gal./min./ft2
4,350 bbl/hour/acre
2.85 liters/min./m2
1,710 m3/hour/hectare

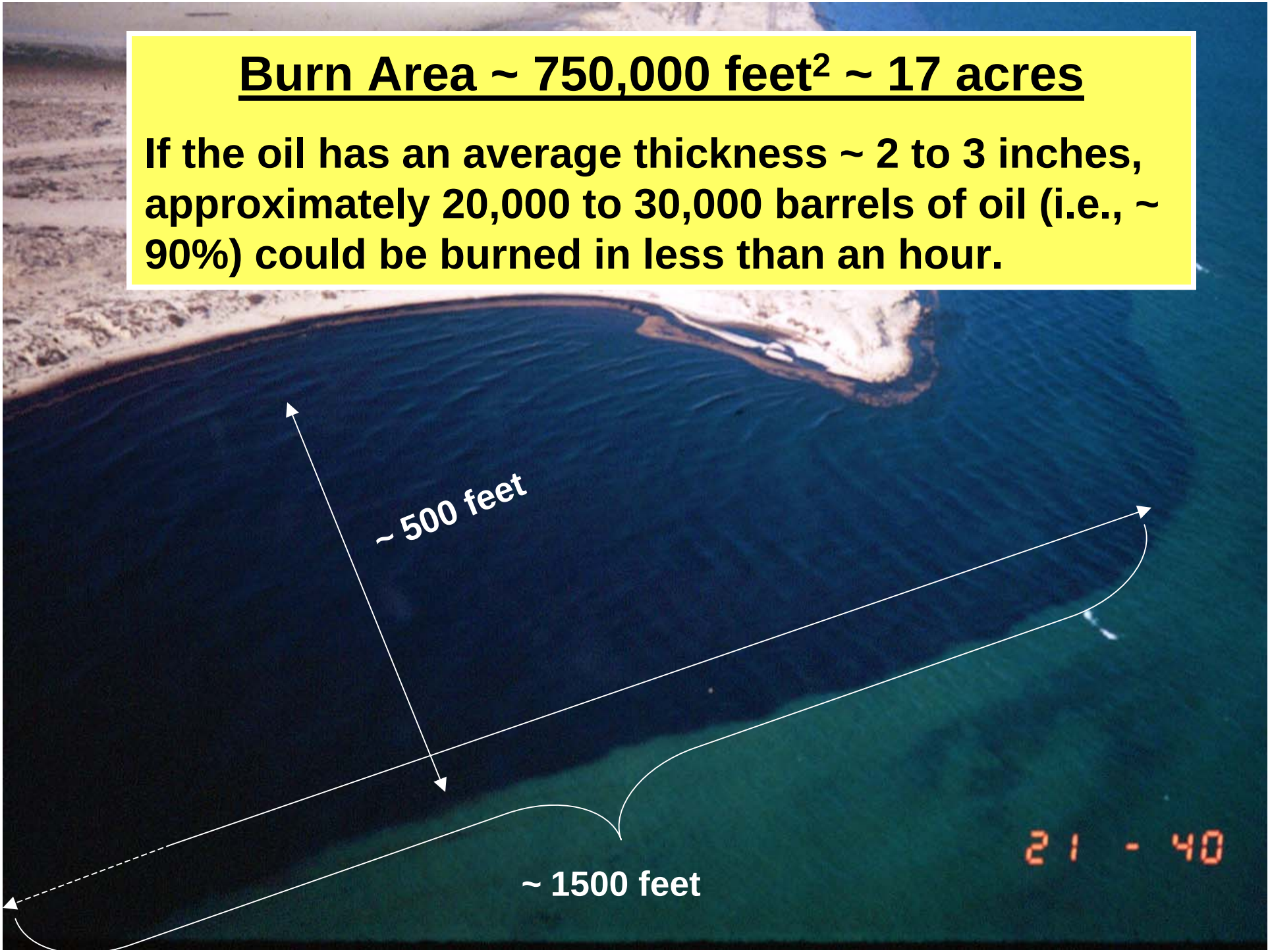
Burning of Naturally Contained Spill



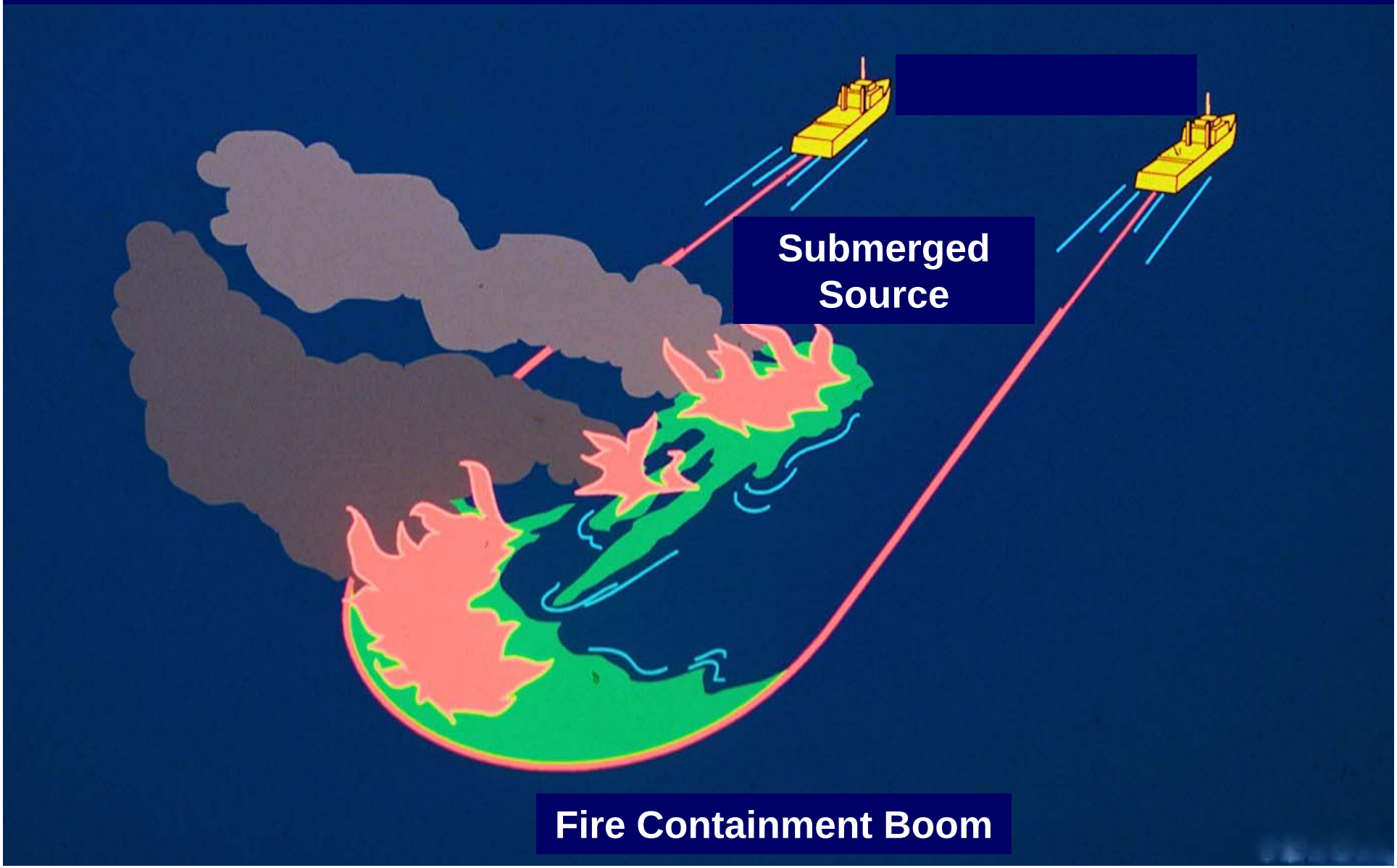
2090-047-ISB

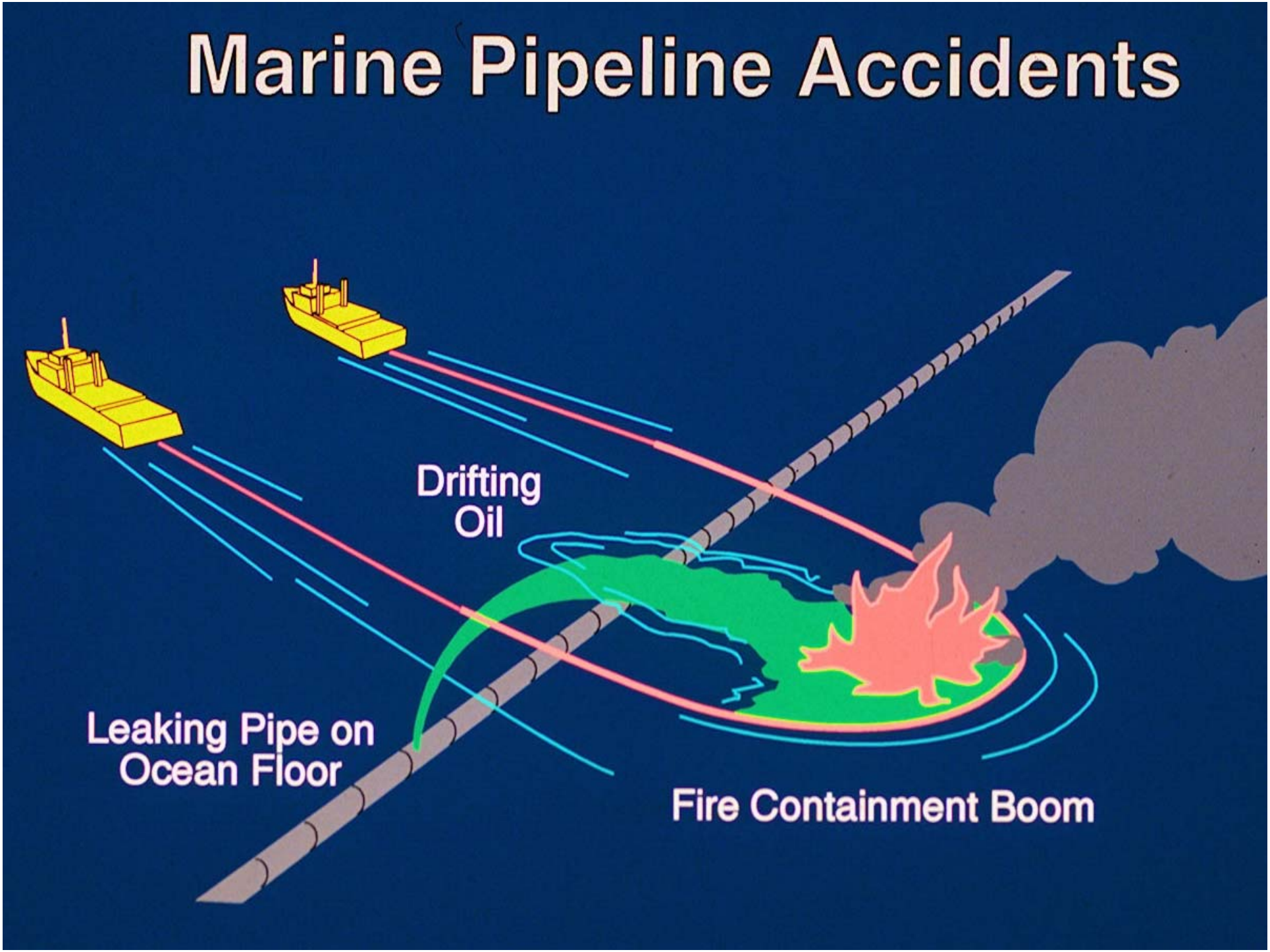

89 4 1

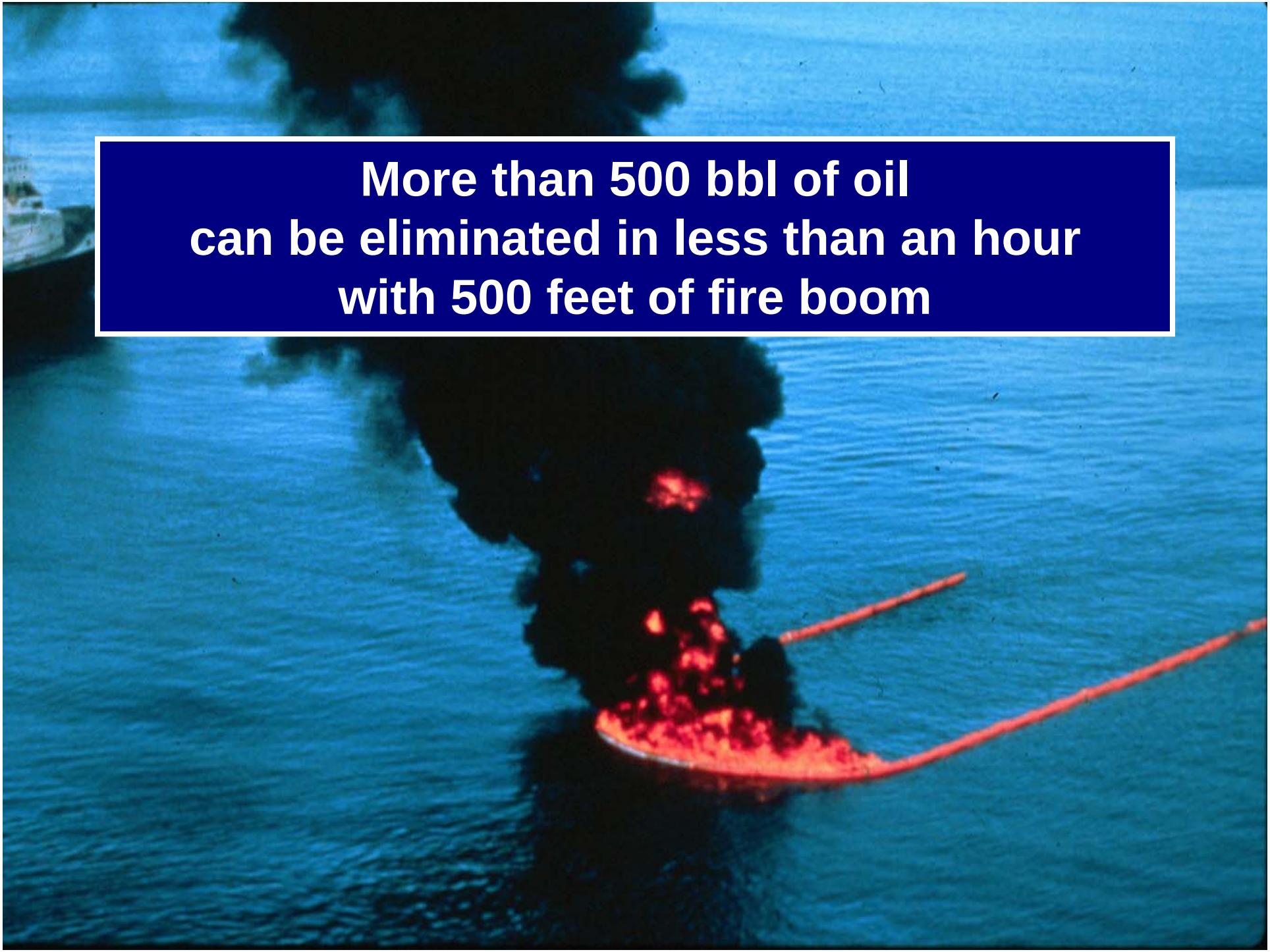

21 - 40


Burn Area ~ 750,000 feet² ~ 17 acres
If the oil has an average thickness ~ 2 to 3 inches, approximately 20,000 to 30,000 barrels of oil (i.e., ~ 90%) could be burned in less than an hour.
~ 500 feet
~ 1500 feet
21 - 40

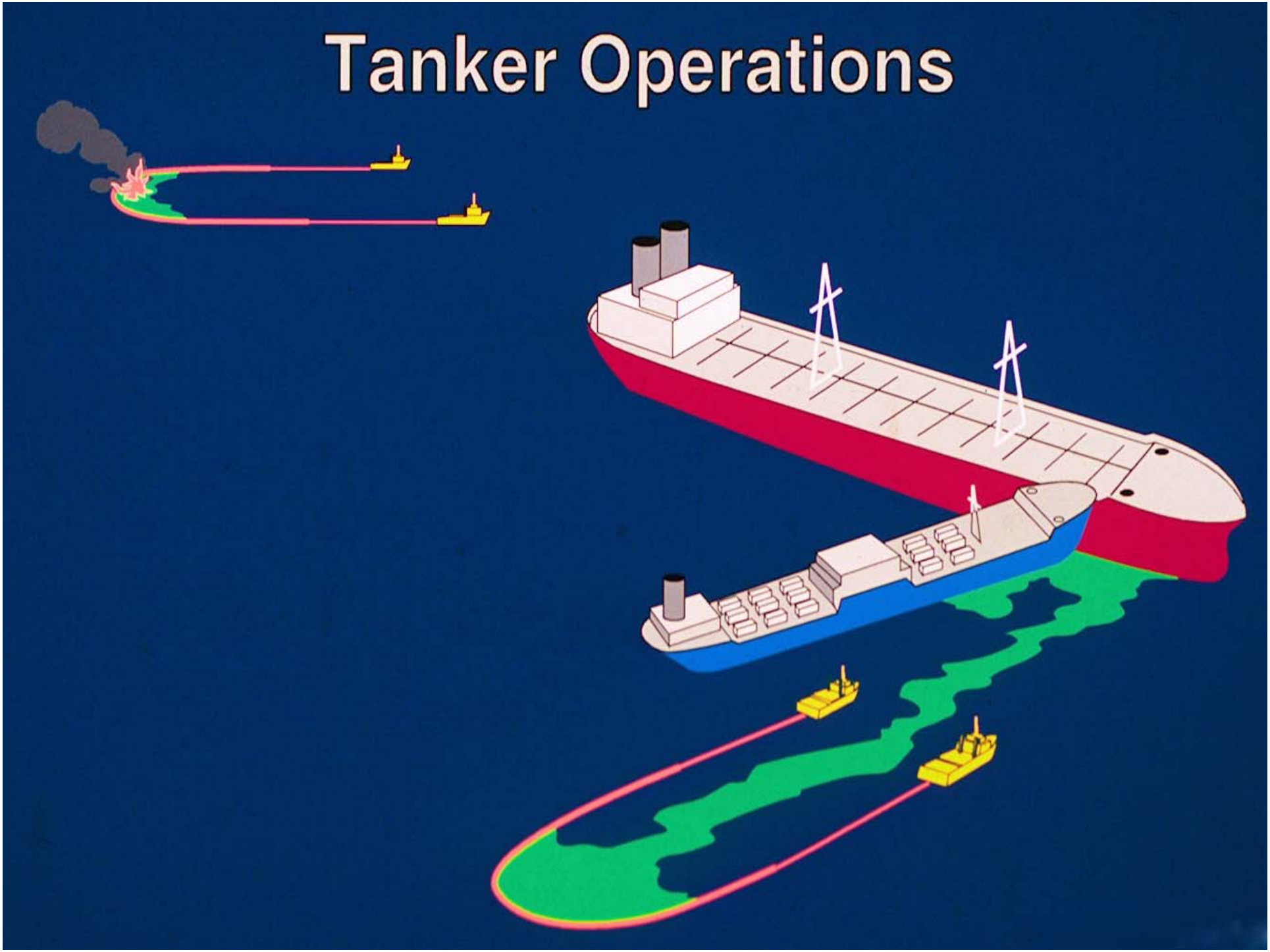
Immediate Containment and Burning of Oil on Water




Marine Pipeline Accidents
Drifting
Oil
Leaking Pipe on
Ocean Floor
Fire Containment Boom

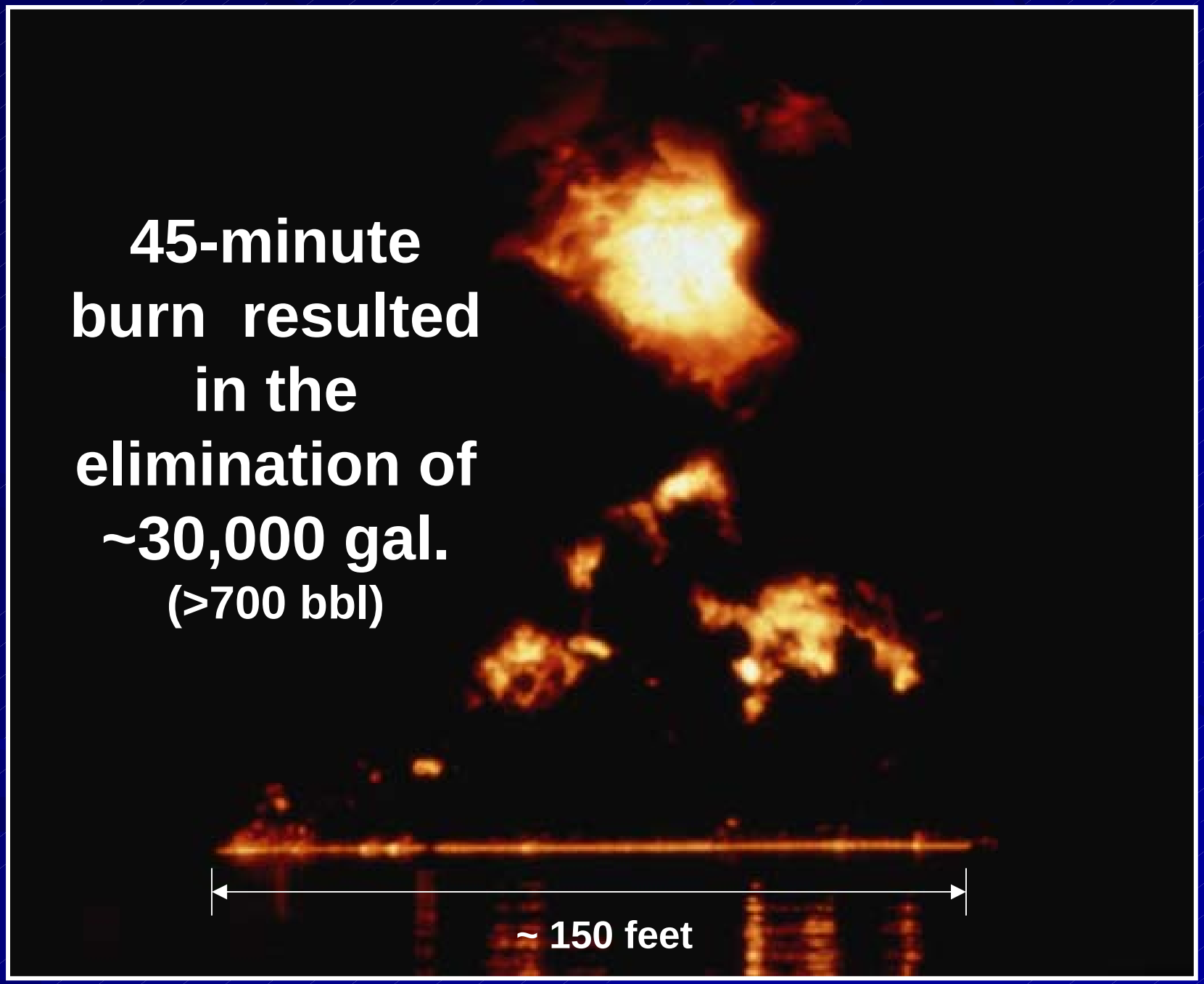

More than 500 bbl of oil
can be eliminated in less than an hour
with 500 feet of fire boom

Tanker Operations




Exxon Valdez
~ 6 ½ square miles
of continuous dark oil
89 3 24
Photo: Alan A. Allen


Hand-held Igniter tossed from boat and allowed to drift into contained oil

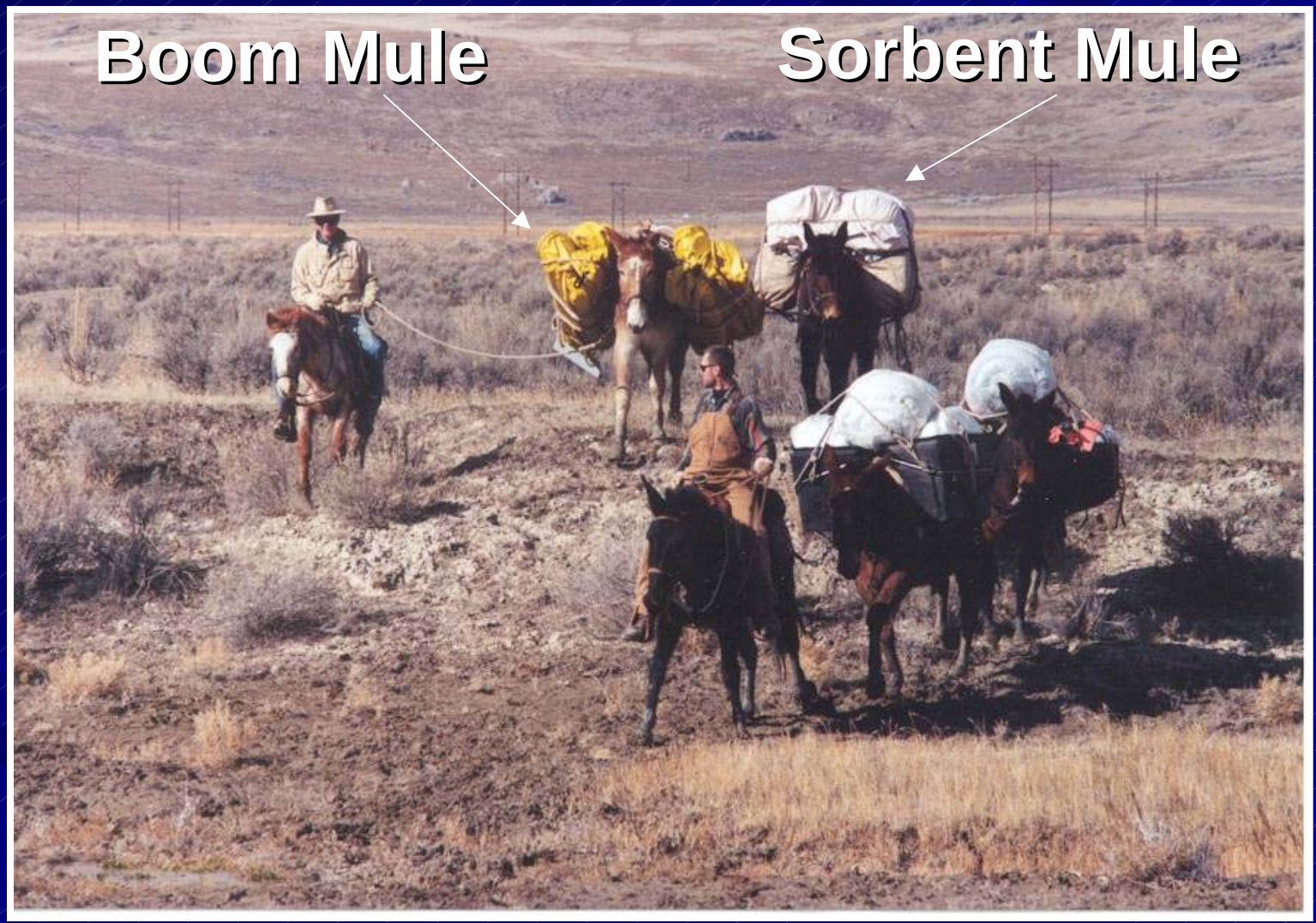

45-minute burn resulted in the elimination of ~30,000 gal.
(>700 bbl)
~ 150 feet


Typical Burn Residue

Preferred Conditions for Inland Burning

Unvegetated Areas (with caution over soil modifications)	**If Vegetated, mostly Herbaceous & Dormant**
Substrate Covered by a Water Layer	**In Cold Climates With Snow & Ice**
Remote Unpopulated Areas	**Fresh Unemulsified Crude or Refined Product**

Pipeline Diesel Spill, Utah (Jan. 2000)
Over 38 Acres of Salt Flat and Wetlands



Physical Containment and Removal

OK for Heavy, Pooled Layers

Marginal for Remaining Product

Aerial Ignition Preparations with Heli-Torch

Aerial Application of Gelled Gasoline

Chevron MP 68 Spill

(after burn)

Chevron Pipeline

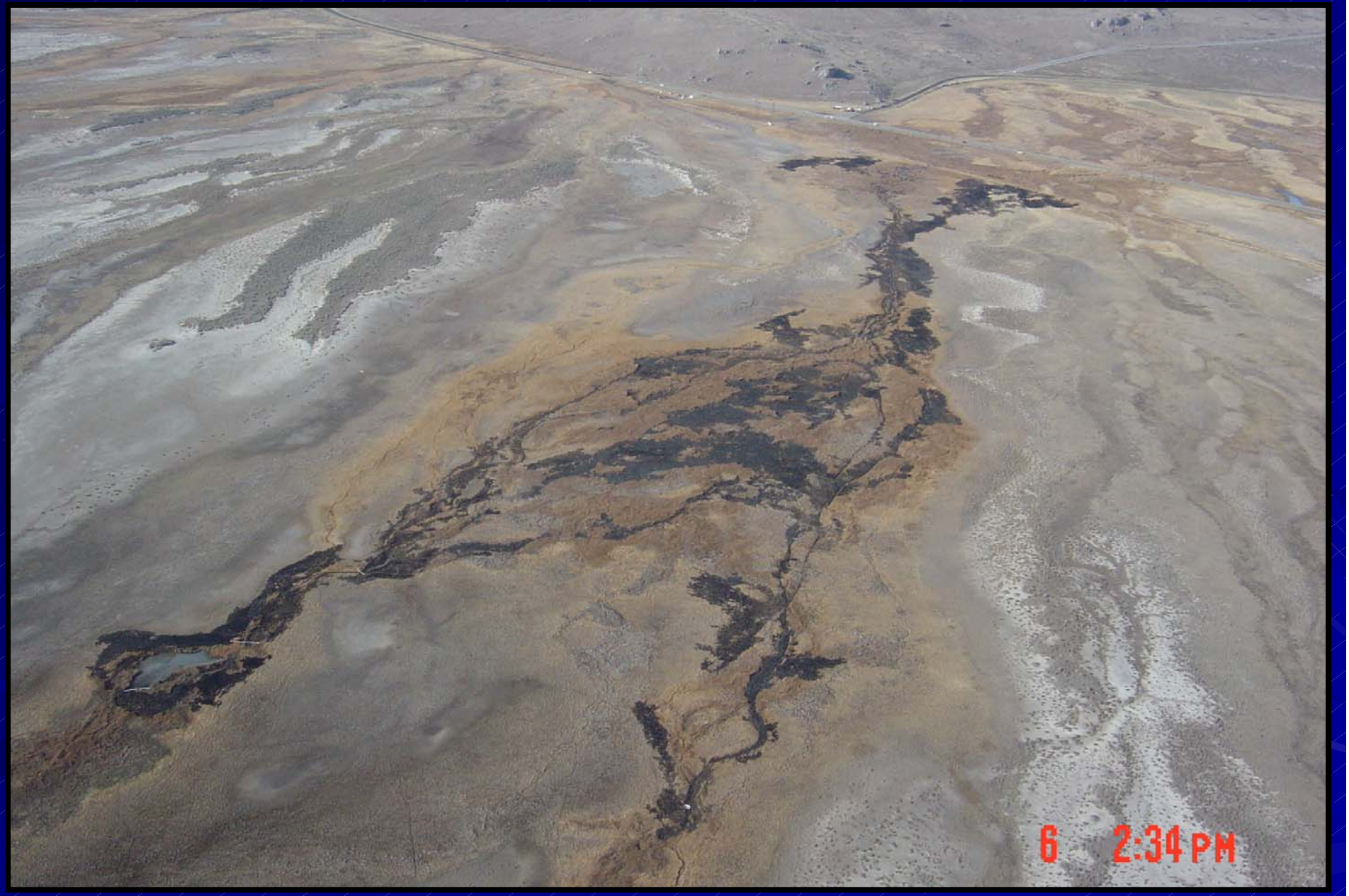
MP 68 Diesel Spill

75-80% Burned. Bioremediation used on remaining oil

Chevron Pipeline – Corinne, Utah
Gasoline Spill to Wetland Area – Nov. 2002


6 11:09 AM


6 11:29 AM

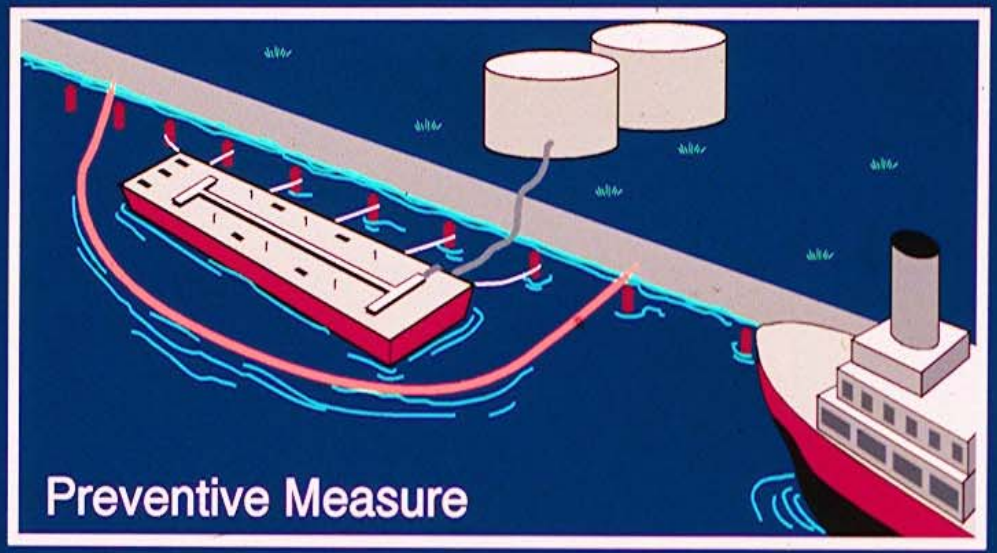

6 2:34 PM


Enbridge Energy Company
July 4, 2002
Cohasset, Minnesota
Below-ground Release (~6,000 bbl)
from 34-inch Crude Oil Pipeline

Field operations for 2002 were suspended on November 1

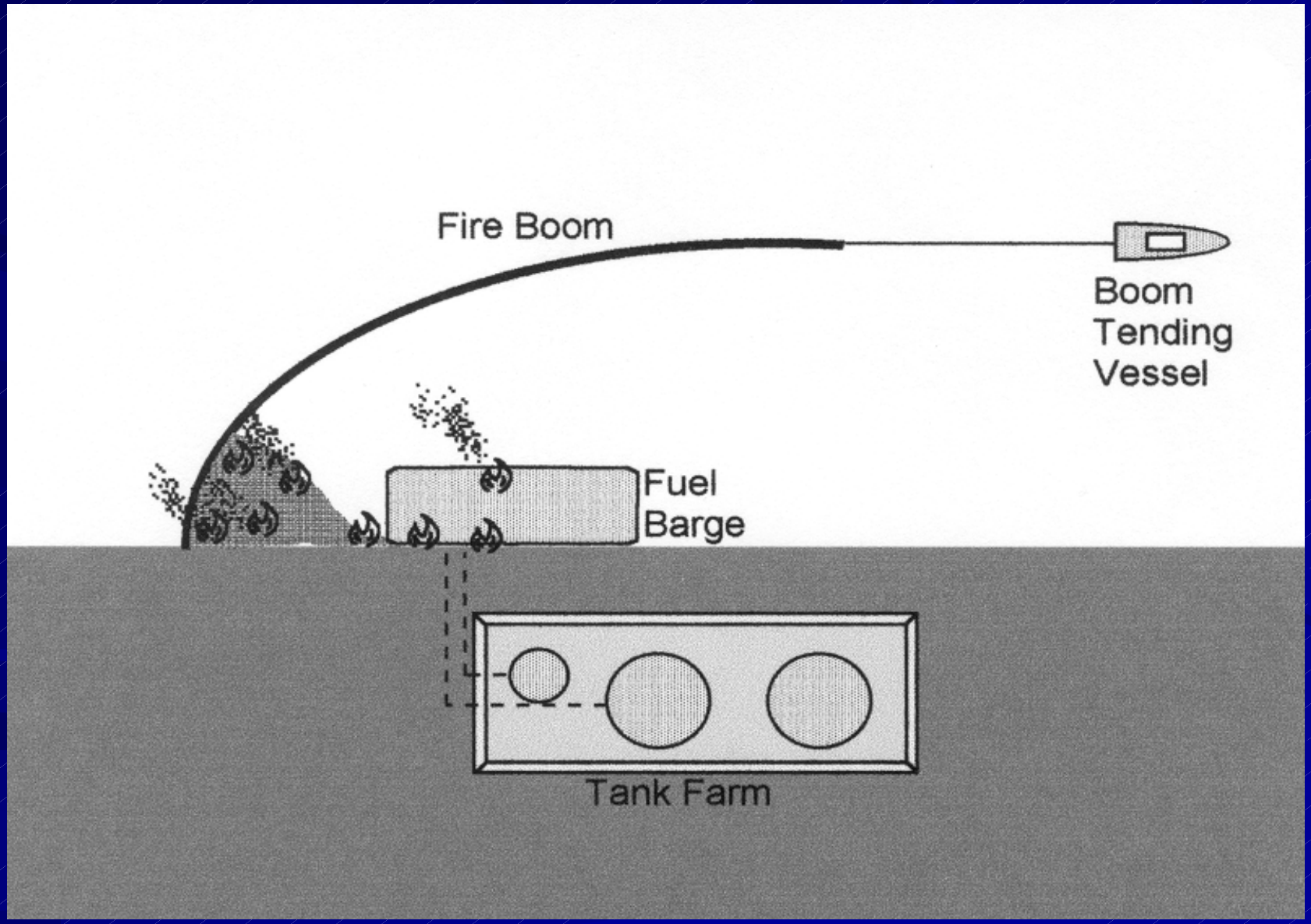
Lost Hills, California – 1998
Onshore Blowout (Light Crude Oil)
Oiled Area: ~500’-1,000’ x 4 miles
2-Day Burn, Nearly all oil eliminated

Isolation of Accidental Marine Fires

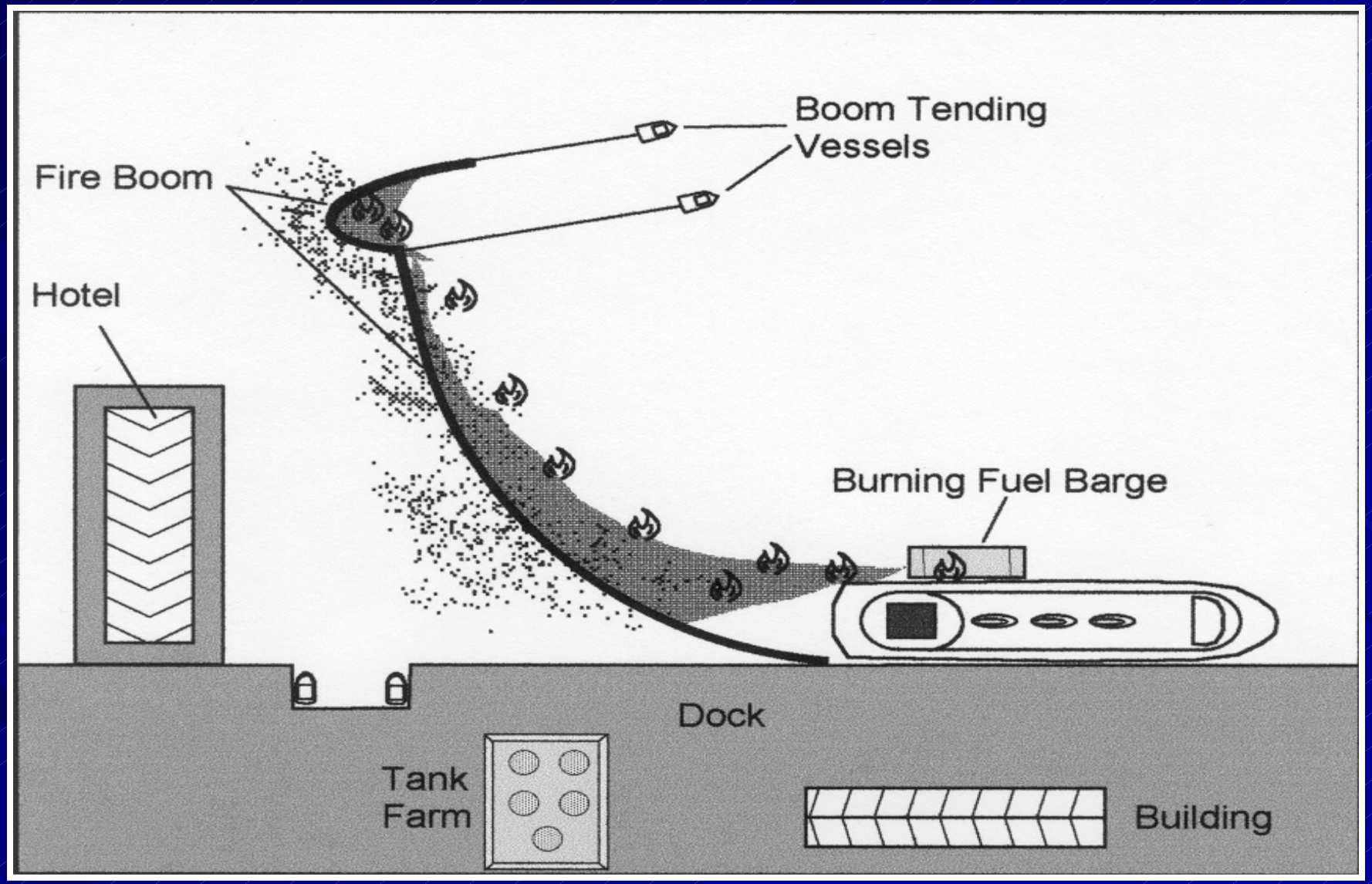


“Jupiter” Barge Fire at Dockside Bay City, Michigan – Sept. 1990

Containment at Source
(Dynamic Configuration)



Partial Containment and Deflection

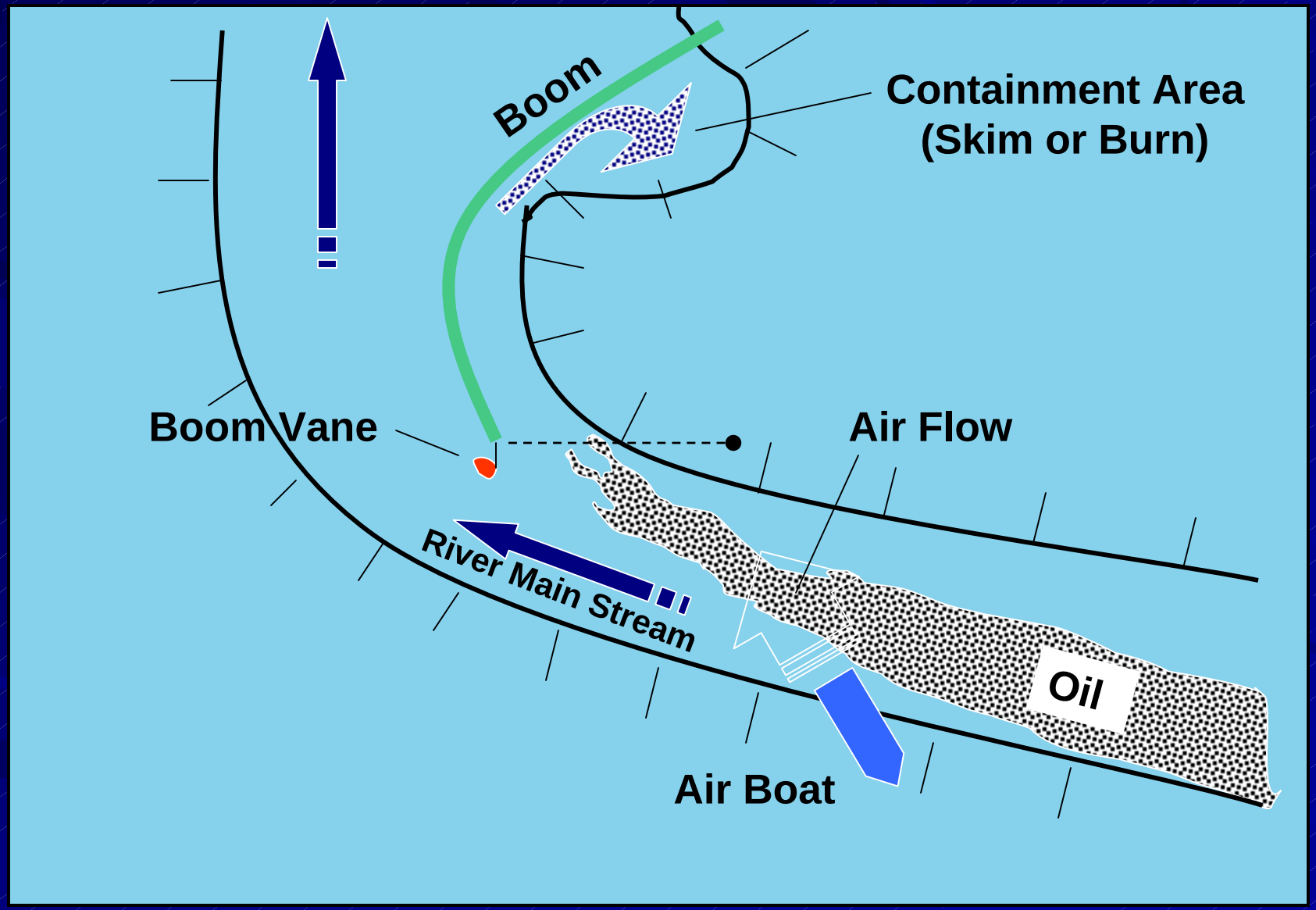


Pipeline Rupture on Steep Hillside Malongo, Angola

Boom Deployment:
BoomVane

Boom Deployment:
BoomVane – River Deflection Mode

Controlled Surface Transport with Air Deflection with BoomVane



Representative Fire Boom

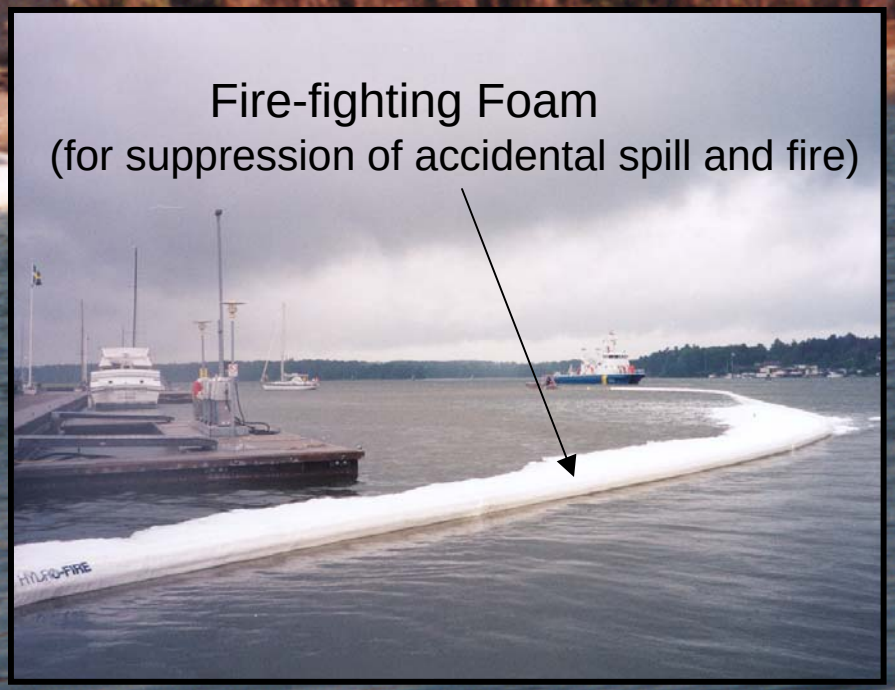
“Metal”


Metal & Fabric

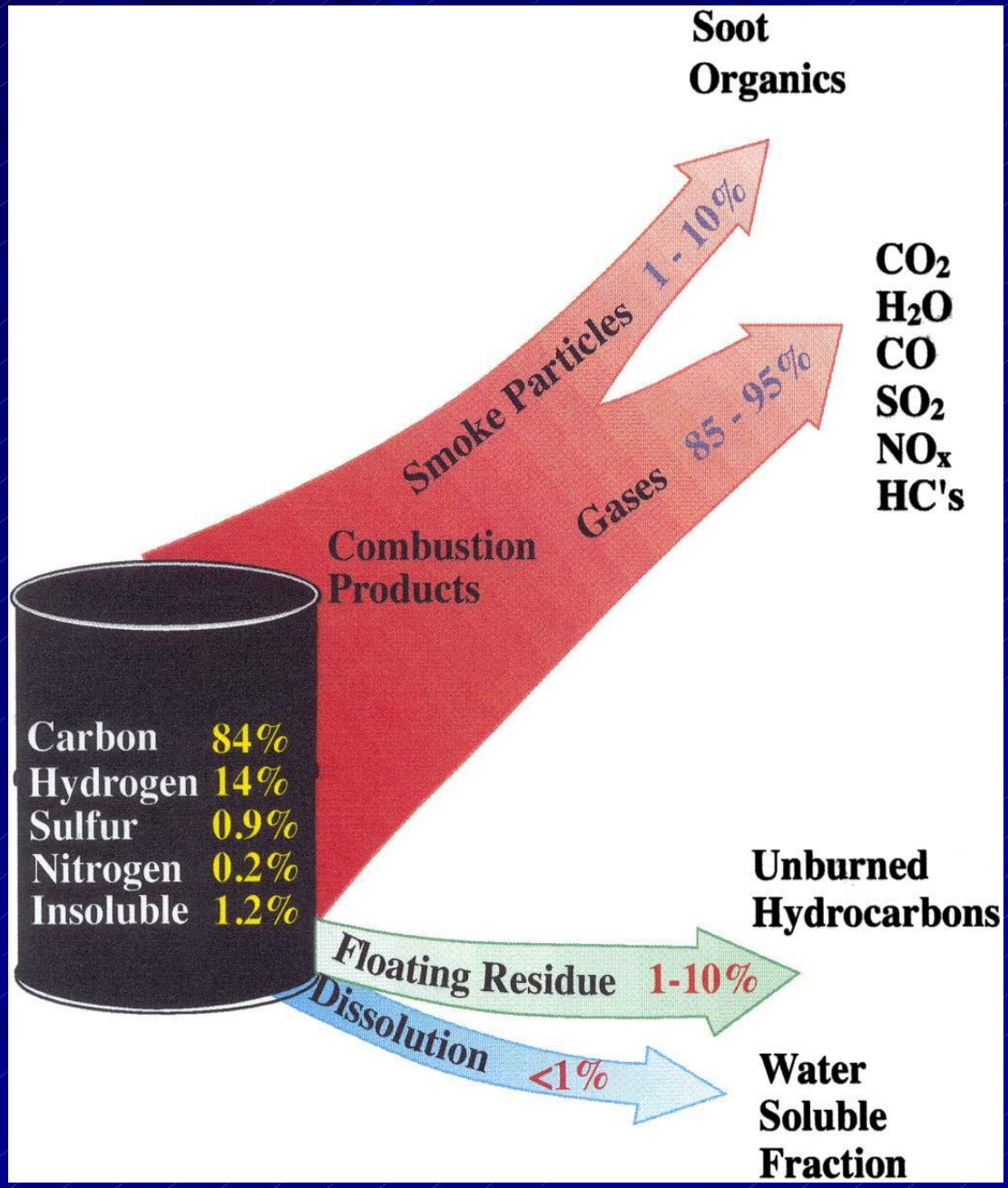
Representative Fire Boom
"Fabric-Dry"
(with steel components)

Defensive Use of Fire Boom

Water supplied from
fire hydrant



Products of Combustion (Crude Oil)



Products of Combustion:

- …normally at concentrations of concern for human health only within the visible plume,
- …likely to stay above ground level until diluted below such concentrations of concern, and
- …therefore easily avoided by operational personnel and the public.

Decision To Burn

When considering the air quality impacts of the decision to burn, one must also consider that we are dealing with an emergency. Short-term air quality degradation may be a more acceptable price to pay than long-term damage from the oil to ecosystems, animal populations, and shoreline resources.

Controlled Burning

- Nearly all fresh-to-lightly weathered oils can be ignited in calm-to-moderate wind/wave conditions.
- One needs containment for effective burns.
- Many offshore, nearshore and inland spills have been ignited and burned successfully.
- Burning, under the right conditions, is a safe, rapid and cost-effective option for the removal of large quantities of oil.
- Fire boom & igniter technology has improved substantially over the past 10 years.
- Public and agency acceptance is on the rise.