The Burning of Spilled Oil
On Wetlands and Inland Waterways

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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

<table>
<thead>
<tr>
<th>Oil Thickness</th>
<th>Exposure</th>
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</thead>
<tbody>
<tr>
<td>&gt; 2 to 3 mm</td>
<td>&lt; 25% to 30% evaporated</td>
</tr>
<tr>
<td>&gt; 1/10 inch</td>
<td>&lt; 24 to 48 hours exposure</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Emulsification</th>
<th>Wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20% to 25% water</td>
<td>&lt; 20 knots</td>
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</table>

<table>
<thead>
<tr>
<th>Waves</th>
<th>Current</th>
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<tbody>
<tr>
<td>&lt; 1 to 1 ½ m</td>
<td>&lt; ½ m/sec</td>
</tr>
<tr>
<td>&lt; 3 to 5 feet</td>
<td>&lt; 1 knot</td>
</tr>
</tbody>
</table>
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
Burn Area $\sim 750,000 \text{ feet}^2 \sim 17 \text{ acres}$

If the oil has an average thickness $\sim 2$ to $3 \text{ inches}$, approximately $20,000$ to $30,000 \text{ barrels}$ of oil (i.e., $\sim 90\%$) could be burned in less than an hour.
Immediate Containment and Burning of Oil on Water

Submerged Source

Fire Containment Boom
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
~ 6 ½ square miles of continuous dark oil
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)
Typical Burn Residue
### Preferred Conditions for Inland Burning

<table>
<thead>
<tr>
<th>Condition</th>
<th>Preferred Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unvegetated Areas</td>
<td>Fresh Unemulsified Crude or Refined Product</td>
</tr>
<tr>
<td>(with caution over soil modifications)</td>
<td></td>
</tr>
<tr>
<td>Substrate Covered by a Water Layer</td>
<td>In Cold Climates With Snow &amp; Ice</td>
</tr>
<tr>
<td>Remote Unpopulated Areas</td>
<td>If Vegetated, mostly Herbaceous &amp; Dormant</td>
</tr>
</tbody>
</table>
Pipeline Diesel Spill, Utah (Jan. 2000)
Over 38 Acres of Salt Flat and Wetlands

Boom Mule

Sorbent Mule
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)

July 2000

July 2001
Chevron Pipeline
MP 68 Diesel Spill

July 2000

75-80% Burned.
Bioremediation used on remaining oil

July 2001
Chevron Pipeline – Corinne, Utah
Gasoline Spill to Wetland Area – Nov. 2002
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

Preventive Measure

Spill Response
“Jupiter” Barge Fire at Dockside Bay City, Michigan – Sept. 1990
Containment at Source
(Dynamic Configuration)
Partial Containment and Deflection

Diagram showing the containment area with a fire boom, vessels, a burning fuel barge, a hotel, and a tank farm. The diagram illustrates the containment and deflection strategies to manage the incident.
Pipeline Rupture on Steep Hillside
Mlongo, Angola
Boom Deployment: 

BoomVane
Boom Deployment:
BoomVane – River Deflection Mode
Controlled Surface Transport with Air Deflection with BoomVane

- Boom
- Containment Area (Skim or Burn)
- Boom Vane
- Air Flow
- River Main Stream
- Air Boat
- Oil
Representative Fire Boom

“Metal”
Metal & Fabric
Representative Fire Boom
“Fabric-Dry”
(with steel components)
Defensive Use of Fire Boom

Water supplied from fire hydrant

Fire-fighting Foam
(for suppression of accidental spill and fire)
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.
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.