The Use of Applied Response Technologies as tools for Response to Oil Spills

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Objectives for Presentation

- Context for ART in Spill Response
- Background and Legislation for ART
- Dispersant Quick Approval Process
- Proposed *In-Situ* Burning Policy
- Oil Spill Cleanup Agents (OSCAs)
- Questions and Answers

Definition of ART: Response technologies, other than mechanical cleanup, that can be employed to address an oil spill.

- Dispersants & other chemical countermeasures (OSCAs)
- in-situ burning
- bioremediation

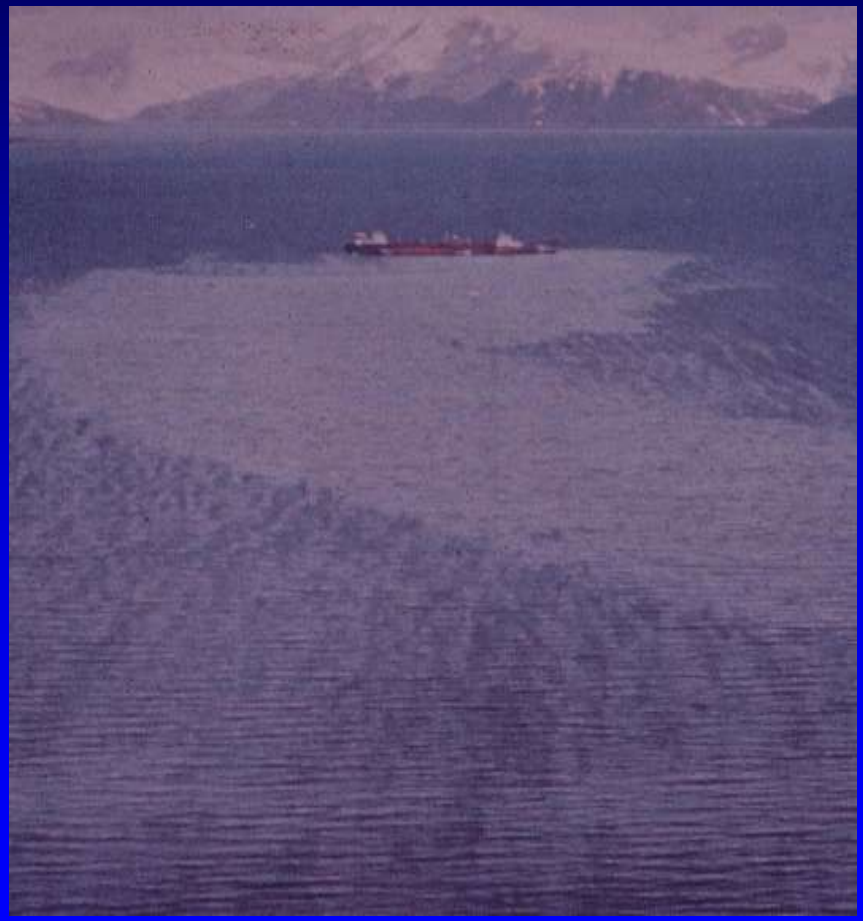
Response Options at the Time of an Oil Spill

- It is important to have as many tools in the tool box for use in an emergency situation:

Some of the contents of the "spill response toolbox" include, in clockwise order from the upper left, dispersants, skimmers, booms, and burning. Dispersants are usually used in conjunction with these other cleanup techniques.

Realities of Spill Response and Why Consider ARTs?

- Once oil is spilled, there will be injury to the environment. (it is hard to put humpty dumpty back together again).
- No amount of cleanup will remove all oil from the environment.



Realities cont.

- Question becomes how to minimize the injury, not that injury can be avoided.
- Need to look at short-term vs long-term impacts with regards to habitats and species at risk.

Realities

- All decisions associated with spill response have inherent trade-offs.
  - Mechanical
  - Dispersants
  - *In-Situ* Burning
  - No Response

The Use of ART in California

- The Administrator has the State's authority over all response technologies to address an on-water oil spill.

- The Federal Regional Response Team (RRT) must approve the use of all ARTs to address an oil spill within Federal jurisdiction.

Definition of an OSCA

"A chemical, or any other substance, used for removing, dispersing, or otherwise clean-up oil or any residual products of petroleum in, or on, any waters of the State."

- Exemption for sorbents and other chemical agents that do not cause aquatic toxicity.

State Licensing of OSCAs

- The Administrator has authority over the licensing and use of all OSCAs.
- All OSCAs must be licensed for use by the Administrator prior to use.
- Experimental use.

Federal Listing of OSCAs

- Address only chemical and biological countermeasures.
- Product must be listed on the National Contingency Plan by the USEPA to be used.
- Products are registered not licensed.
- Selection Guide

Chemical Countermeasures

- Emulsion-treating agents
- Solidifiers
- Vaso-elasticizers
- Shoreline Cleaners
- Dispersants

Emulsion Treating Agents

- Once stable emulsions are formed, it is difficult to disperse, burn or mechanically recover the oil.
- Emulsions are typically formed when energy is applied to oil and water.
- Emulsion breakers have been used extensively by oil industry in field production, but products not generally available off-the-shelf.
- Alaska Clean Seas did some work on breaking emulsions for in-situ burning and found could break-up emulsions up to 70% oil and still burn.
- More research needed into emulsion formation at sea.

Solidifying Agents

- Products used to solidify spilled oil and therefore easier to pick up.
- Products usually available in dry, granular form. Products bond with oil to form a solid mass.
- Main limitation is the large amounts of product required in significant spills and ability to dose the spill properly.
- Good for ship grounding to control loss of fuel.

Elasticity Modifiers

- Products are used to increase viscosity of spilled oil.
- Products are large chained organic polymers which are preferentially soluble in oil.
- Lake Tahoe and Navy Projects.
  - Preapprovals granted to evaluate the use of products to address spills of diesel.
  - Currentlyin contained forms.
  - Manufacturers are experimenting with different broadcast methods.

Chemical Shoreline Cleaning Agents

- Typically surfactant base but designed to lift but not to disperse oil.
- Can be used alone but typically used in combination with warm-water wash.
- Present studies suggest that shoreline cleaning agents may be used to clean marsh plants.
- Second type of cleaners use Lemonine as active ingredient; however, this chemical is very toxic.
- Method of use & type of cleaner is substrate dependant.
- Shoreline cleaning agents were evaluated at the *Cosco Busan* spill response with mixed results. A paper will be published and likely follow-up studies will be conducted.

Passive Flooding to Assist Shoreline Cleaning Agents

Low-Pressure Washing to Assist Shoreline Cleaning Agents

High-Pressure Washing to Assist Shoreline Cleaning Agents

Chemical Countermeasures: Dispersants

Chemical Countermeasures Dispersants

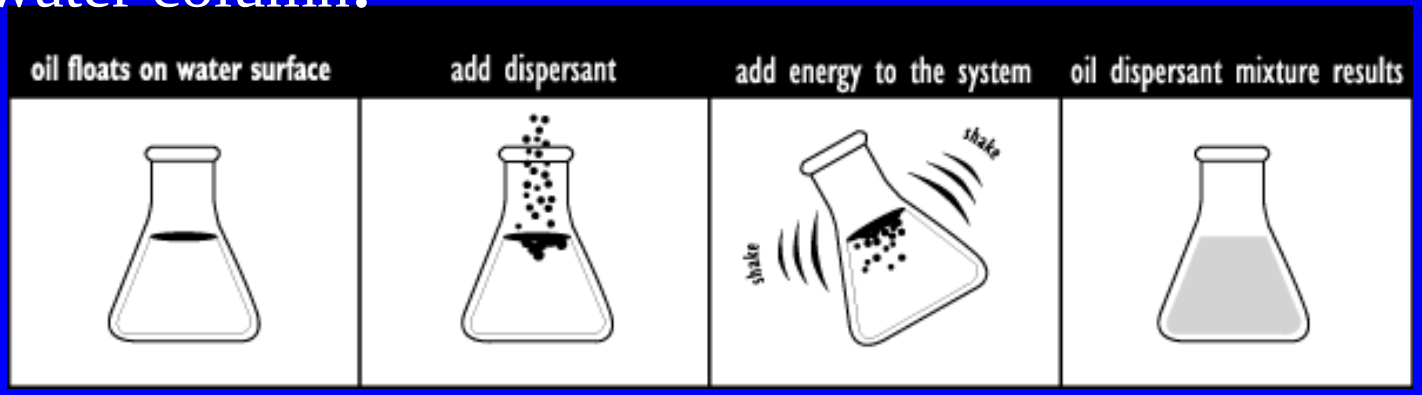
- Surface active agents (surfactants) - hydrophilic and hydrophobic components.
- Used to reduce oil-water intersurface tension.
- Effectiveness varies depending on weathering, salinity and emulsification.
- Requires addition of energy.

Dispersants, cont.

- ENERGY + SURFACTANT = BREAKUP OF OIL
- Present formulations of dispersants less toxic than spilled crude oil.
- Present toxicity concerns are with dispersed oil not dispersants.
- DISPERSANT USE DECISION is a trade-off determination.
- In general, the lighter the crude, the easier it is to disperse.

How Dispersants Work A Pictoral

- First, the dispersant is applied to the water surface.
- Next, molecules of the dispersant attach to the oil, causing it to break into droplets.
- Wave action and turbulence move the oil-dispersant mixture into the water column, so that the oil that had been concentrated at the surface is diluted within the water column.



Bioremediation & Dispersants

- The act of breaking surface oil slicks into small droplet greatly increases the surface area of the oil.
- The smaller droplets of oil are now more bioavailable to bacteria and other microrganisms as a food source.
- Ultimate break-down of hydrocarbons is into CO_2 and H_2O.
- Contaminants must be broken down as well.

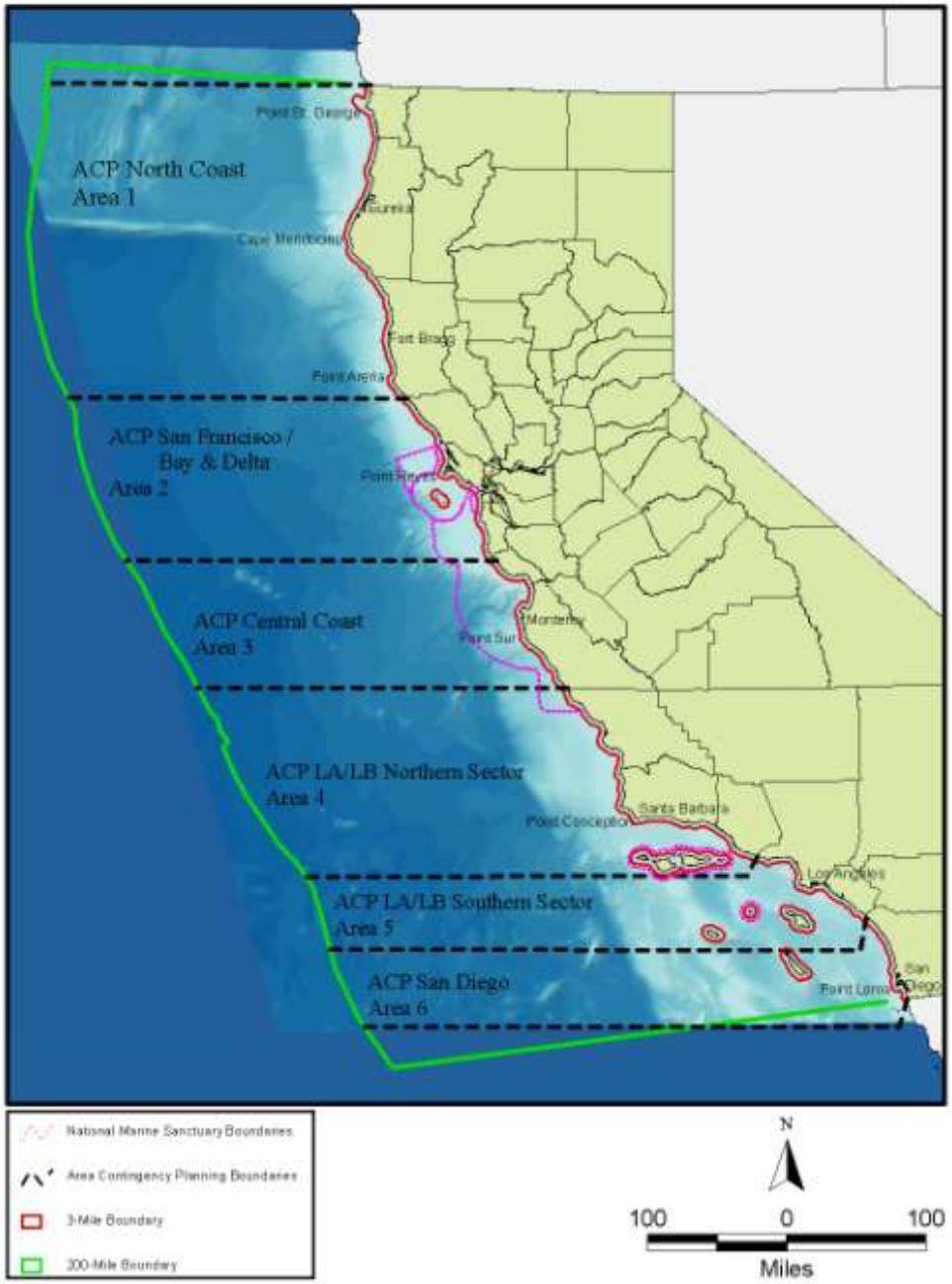
Dispersant Delivery Platforms

Dispersant Use Zones

- PRE-APPROVAL ZONES
  - Marine waters 3-200 nm from the coastline or island shoreline except:
    - waters part of a National Marine Sanctuary
    - waters within three miles of the CA/OR border

- RRT Approval Required Zone
  - State marine waters (0 – 3 nm miles from shore)
  - Waters part of a National Marine Sanctuary
  - Waters within three miles of the CA/Mexico border
  - Marine waters one mile from anadromous fish streams during times of emigration and immigration.

California Marine Waters Pre-Approval Dispersant Zone



Questions on Dispersants

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Other ARTs –
In Situ Burning

In-Situ Burning

•The MEGA BORG released 5.1 million gallons of oil as the result of a lightering accident and subsequent fire.

• The incident occurred 60 nautical miles south-southeast of Galveston, Texas on June 8, 1990.

IN-SITU BURNING

- Removal of oil from the environment by burning it in-place.
- Advantages over other response methods.
  - Removes large quantities of spilled oil quickly
  - Small amounts of residue to cleanup
  - Volatile organics destroyed
  - Combustion products readily dispersed within 500 meters of burn (over water)

Land –vs- On-Water Burn

- White Board Figure

Mechanics of Burning

- Need to boom the oil to maintain minimum burn thickness

Mechanics of Burning

Mechanics of Burning

- Need to be able to continue to control the burn and to stop the burn if necessary.

Mechanics of Burning

- When burn is done, need to clean-up oil residue.

Air District Zones

Quick Approval Zones

Prevailing Winds Off-Shore/Parallel to Shore

- North Coast AQMD
  - .5 miles and greater
- Mendocino AQMD
  - .5 miles and greater
- Bay Area AQMD
  - 5 miles and greater
- No. Sonoma AQMD
  - .5 miles and greater
- Monterey Bay Unified
  - no qap zones
- San Luis Obispo Co
  - 3 miles and greater
- Santa Barbara Co.
  - 3 miles and greater
- Ventura Co. APCD
  - .5 miles and greater
- South Coast AQMD
  - 8 miles and greater
- San Diego AQMD
  - .5 miles and greater

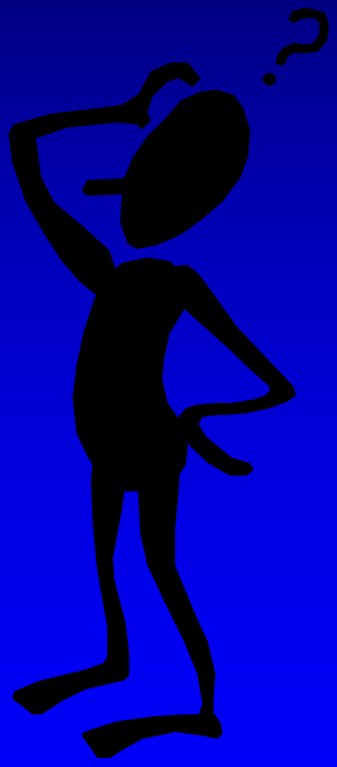
Summary of Main Points

- It is important that all tools be in the tool box at the time of an oil spill incident.
- All response options have inherent trade-offs associated with their use.
- All OSCAs must be federal listed and state licensed to gain approval for use during spill response.
- OSCA approval is gained by request of the Unified Command, and through approval of the Administrator of the OSPR and the RRT.

Summary of Main Points

- Currently Dispersant use can be approved through the Pre-approval and Incident Specific RRT Approval Processes depending on location of spill
- *In-Situ* Burning Policy can be authorized through preapproval (25 nmi from shore) or through the Case-by-Case process for waters <25 nmi or for inland areas.

Questions?



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