The Effect of Dispersants on Mechanical Containment and Recovery

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“To promote safety, protect the environment and conserve resources offshore through vigorous regulatory oversight and enforcement.”
• Approach
• Skimmer Recovery Tests
• Skimmer Results
• Containment Boom Tests
• Boom Results
• Conclusions
Does the presence of dispersants affect mechanical recovery operations

“Slippery as a greased pig!”
Dispersants

Used to reduce surface tension

- Allow oil to be broken up into smaller droplets
- More available for biodegradation processes

Sometimes treated oil does not fully disperse

- Underdosing
- Lack of sufficient surface energy

This oil may need to be recovered mechanically
Testing conducted at the Ohmsett facility
Two Skimmers, One Containment Boom
Test Oil – HOOPS, 10-15% Weathered
Dispersant – Corexit 9500
2 dispersant/oil ratios (DORs) – 1:50 and 1:200, premixed
Salinity - near open ocean
Weathering Process - HOOPS Oil

- 7000 gallons of fresh HOOPS
- Three 330 gallon weathering tanks with custom air sparging system
- Weathering determined via weathering curve (% weathered vs density)
- Batches were consolidated and mixed to ensure uniformity
Skimmer Test Setup

- Portable tanks set up on Ohmsett north deck
- Shades used to minimize solar effects
- Skimmers were optimized prior to testing
- Test Tank Dimensions:
  - Drum 10 ft x 10 ft
  - Disc 6 ft 2 in x 6 ft 2 in
- Oil premixed with dispersant
Performance Measurements

Skimmer Recovery Rate = \( \frac{V_{\text{oil}}}{T} \)

Skimmer Recovery Efficiency (RE) = \( \frac{V_{\text{oil}}}{V_{\text{fluid}}} \)

- Volume of recovered fluid = \( V_{\text{fluid}} \)
- Water removed = \( V_{\text{oil}} \)
- Time of recovery measured = \( T \)
Disc Skimmer Test Results

**Disc Skimmer - Recovery Rates**

- **Total Fluid Recovery Rate**
- **Oil Recovery Rate**

**Water content in Recovered Fluid - Disc**

- **water entrained (%)**
- **water entrained (gallons)**
- **water decanted (gallons)**

**Results:**

- Fluid Recovery Rate not affected
- Increased water within oil caused drop in Oil Recovery Rate
- Water did not separate from oil even during time allowed for settling

**Recovery Efficiency:**
- Dropped from 99.5% to 81% for 1:50 DOR
Drum Skimmer Test Results

- Fluid Recovery Rate somewhat affected
- Oil Recovery Rate drop more significant than with disc skimmer
- Drum action seemed to enhance process of oil/water mixing

• Recovery Efficiency dropped from 88% to 57% for 1:50 DOR
Containment Boom Test Setup

- 50 foot foam filled curtain boom
  - Overall height: 22 inch
  - Draft: 15 inch
- Rigged for 1:3 gap ratio
- Load cells measured tow forces
- Oil/dispersant preloaded into boom apex through low velocity distribution bar
Containment Boom Preliminary Tests

Determining Oil Volume and Tow Speeds
• Preliminary tests conducted with HOOPS crude and Hydrocal 300 to determine speed at which “first loss” occurs
• First loss tow speed relatively constant 0.9-1.1 kt between oil volumes and oil types
• Manageable preload volume 80-100 gallons

First Loss tow/current Velocity
“Minimum tow/current velocity normal to the membrane at which oil continually escapes past the boom”
ASTM 2084

https://www.youtube.com/watch?v=RDefXwgTnJM
Containment Boom Data Collection

- Acceleration to speed - 75 ft
- Tow distance - 300 ft
- Tow speeds
  - 1.2 kt
  - 0.9 kt
- Underwater cameras recorded oil behavior
- Oil remaining in boom after test was collected – J trap skimmer

Oil DOR 1:50 Dispersing During Preload

Recovering Fluid after Test

J Trap Skimmer
Containment Boom Test Results

- Energy added due to towing of boom caused oil/dispersant to mix
- Effect more pronounced with increased DOR
- Oil treated DOR 1:50 could not be contained for recovery

https://youtu.be/zxbtTalKOYQ1
Conclusions

**Skimmer Recovery**
- Skimmer’s rate of recovering fluid was not highly affected by presence of dispersant for these test conditions
- Type of skimmer influenced the mixing of oil/water/dispersant
- Percentage of water held by recovered oil increased significantly with presence of dispersants. Water did not separate out during settling time

**Oil Containment During Tow Operations**
- Containment during tow operations affected by presence of dispersants
- With HOOPS, not possible to contain oil treated at DOR 1:50
- Containment Boom action provided excellent mixing energy, producing well dispersed oil
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