Dispersant Efficacy & Effectiveness

Efficacy – do dispersants work in a controlled setting?
Effectiveness – do they have a benefit in the real world?

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Spill Response Options: *The Toolbox*

Mechanical Recovery: Booms & Skimmers

In-Situ Burning

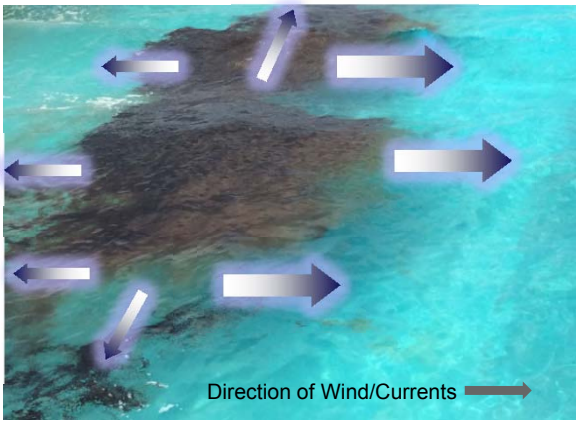
Aerial Dispersants

Boat-based Dispersants

Subsea Dispersants

Rapid Response is Key

- A slick continuously expands and oil thins
  - The size of the problem will increase with time
- Response options get less efficient with time
  - The goal is to respond as quickly and as close to the source as possible



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Challenges to Oil Spill Response

- Weather
  - Recovery very challenged in rough seas (>2 M) or high winds (>25 kts)
  - Safety concerns In high seas and inclement weather
- Thousands of different oils with a wide range of properties
  - Weathering effects
- Remote locations may not have immediate logistical support
- Wide range of impacted habitats
  - Rocky beaches to sensitive marshes
- Very little to no daylight during winter at higher latitudes
- Limited access to impacted areas

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Dispersants

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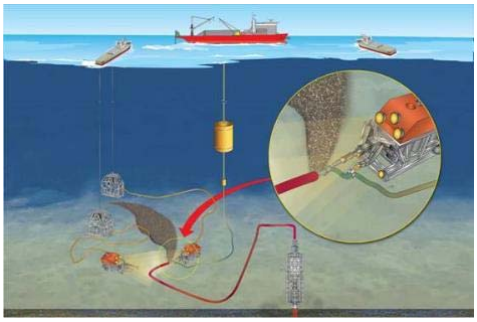
Introduction

Topics of Discussion

- Oil spill response options
- Background on dispersants
- Subsea dispersants
  - Observations on their use
- Summary



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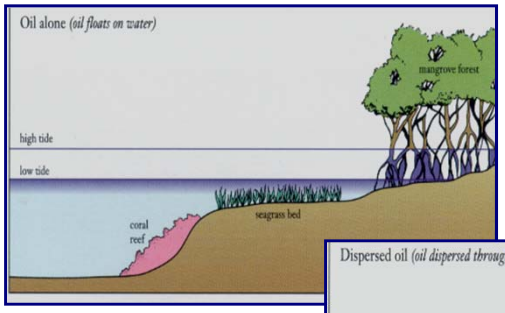
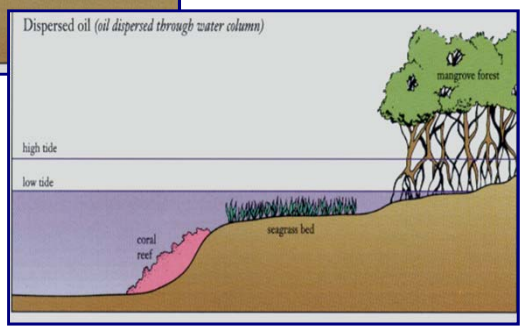
NEBA



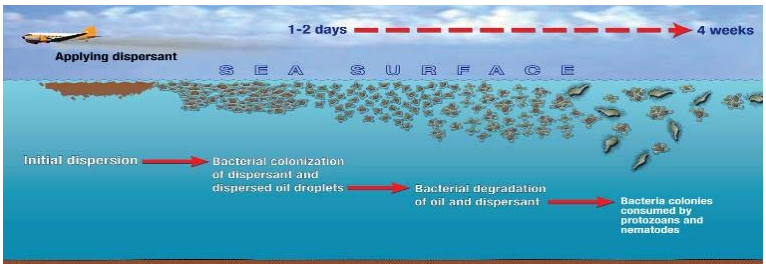
Limit Water Column Organism Exposure



Limit Surface Organism Exposure

Dispersants – What are they?

- Solutions of surfactants dissolved in a solvent
- Surfactants reduce oil-water interfacial tension – allows slick to disperse into very small droplets with minimal wave energy
- Dispersed oil rapidly dilutes to concentrations <10 ppm within minutes, <1 ppm within hours, ppb range within a day
- Each dispersed oil droplet is a concentrated food source that is rapidly colonized and degraded by marine bacteria
- Dilution allows biodegradation to occur within nutrient and oxygen limits



Graphic consistent with Venosa & Holder, EPA 2007

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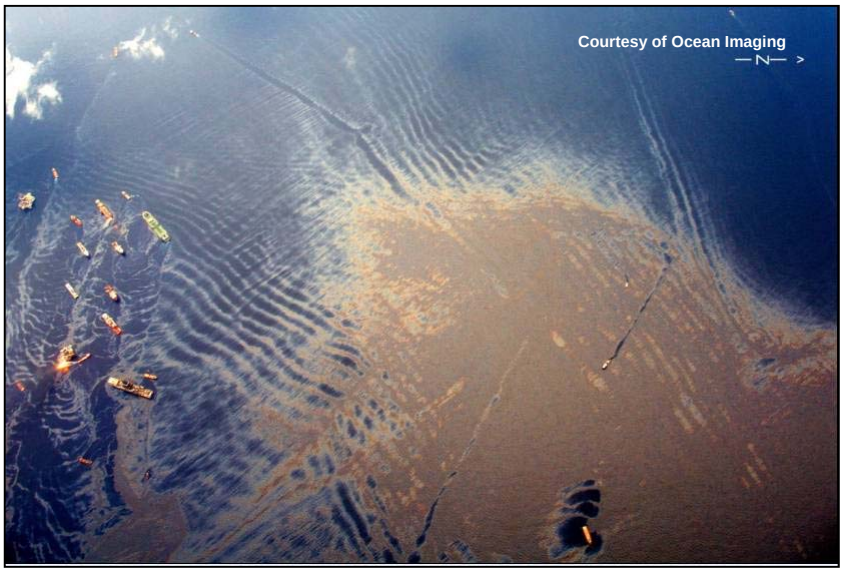
Encounter Rate



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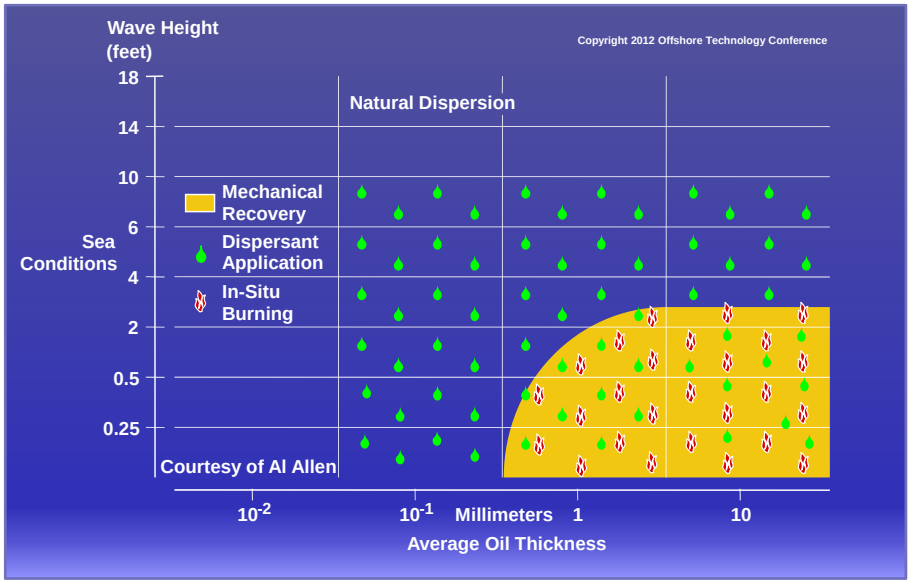
Spill Conditions Limit Response Options



Dispersant Ingredients & Toxicity

Modern dispersants use ingredients found in household products

Relative Toxicity: Environment Canada Study
(96 hr Rainbow Trout LC_{50})*

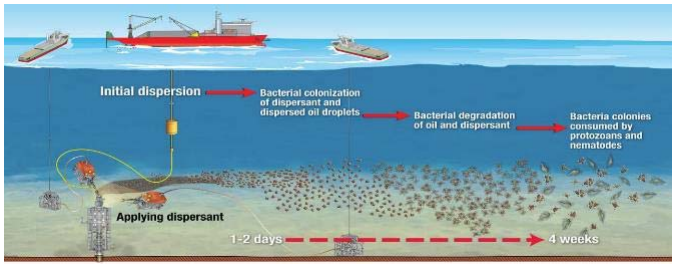
AGENT	LC_{50} (ppm)
Palmolive Dish Soap	13
Sunlight Dish Soap	13
Mr. Clean	30
Corexit® 9500 (27 times less toxic than dish soap)	350

Less toxic

*Lethal concentration to 50% of the test organisms

Subsea Injection of Dispersants

- Preliminary observations of Macondo experience
- Benefits of subsea injection
- Long-term fate and effects



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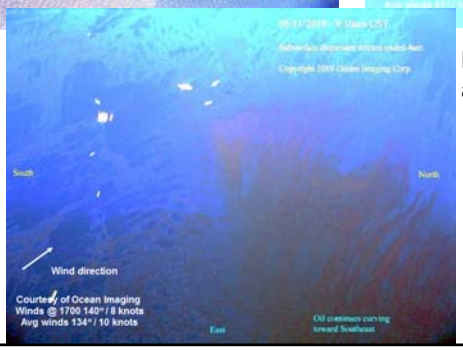
Release Site May prior to injection

Release Site May 10: 11 hrs of Injection



Release Site May 11 5 hrs after Injection Ended

Dispersant Use Approval

- May require a low inherent toxicity and a minimum level of effectiveness
  - Verified by test protocols before placement on an approved list if required
- Regulations require that permission be obtained before dispersants are used in certain locations, especially when close to shore and/or in shallow water
  - A pre-approval process may be used, especially for offshore and/or in deep water
- Documentation to support their use is often based on an environmental risk-analysis of relevant scenarios and is part of an approved contingency plan
  - Scenario-based contingency plans should demonstrate that the use of oil spill dispersants will give the best overall response for the environment (NEBA-approach)
- Potential for significant differences from country to country

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Dispersant Use Across the Globe

- Dispersants are a first or second response option in many countries today

- Angola
- Argentina
- Australia
- Belgium
- Brazil
- Brunei
- Cameroon
- Canada
- Chile
- China
- Columbia
- Côte d'Ivoire
- Croatia
- Cyprus
- Denmark
- Djibouti
- Ecuador
- Egypt
- El Salvador
- Eritrea
- France
- French Guiana
- Gabon
- Georgia
- Germany
- Ghana
- Greece
- Greenland
- Iceland
- India
- Indonesia
- Ireland
- Israel
- Italy
- Japan
- Kenya
- Kuwait
- Lebanon
- Libya
- Malaysia
- Malta
- Mexico
- Montenegro
- Morocco
- Namibia
- Nicaragua
- Netherlands
- New Zealand
- Nigeria
- Norway
- Oman
- Pakistan
- Papua New Guinea
- Philippines
- Poland
- Portugal
- Qatar
- Russia
- Saudi Arabia
- Senegal
- Sierra Leone
- Singapore
- South Africa
- South Korea
- Spain
- Sri Lanka
- Sudan
- Syria
- Tanzania
- Thailand
- UAE
- UK
- Uruguay
- US
- Vietnam

Countries where dispersants are first or second response option

Many countries consider dispersants an important tool in oil spill response. However, there is global inconsistency in the types of approved dispersants and how and when to use them.

Source: International Tanker Owners Pollution Fund (ITOPF)

energy API Used with permission of the API

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Summary

- Along with prevention, robust oil spill response is critical
- Highest priority in emergency response is human health and safety
- Basic strategy for addressing oil spilled from an offshore well
  - Respond as close to the source as possible
  - Utilize all appropriate tools to keep oil from reaching shorelines
- Dispersant use presents significant advantages over the limitations of mechanical recovery and should be considered as a primary response option
- Subsea injection can provide benefits over other oil spill response options

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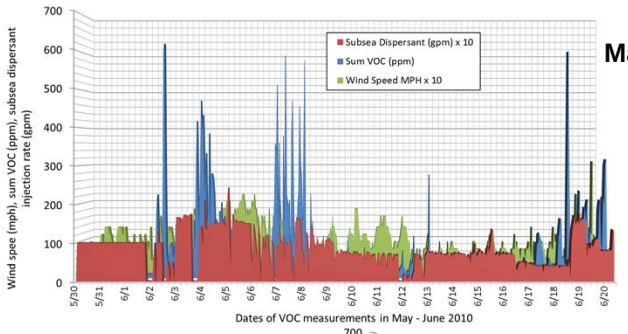
Questions?

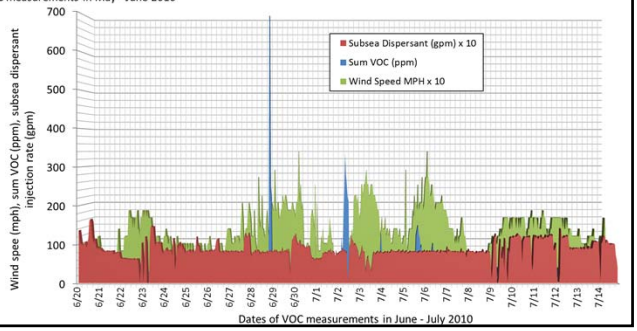
Backup Slides

VOC Data from Vessels Near Well Site



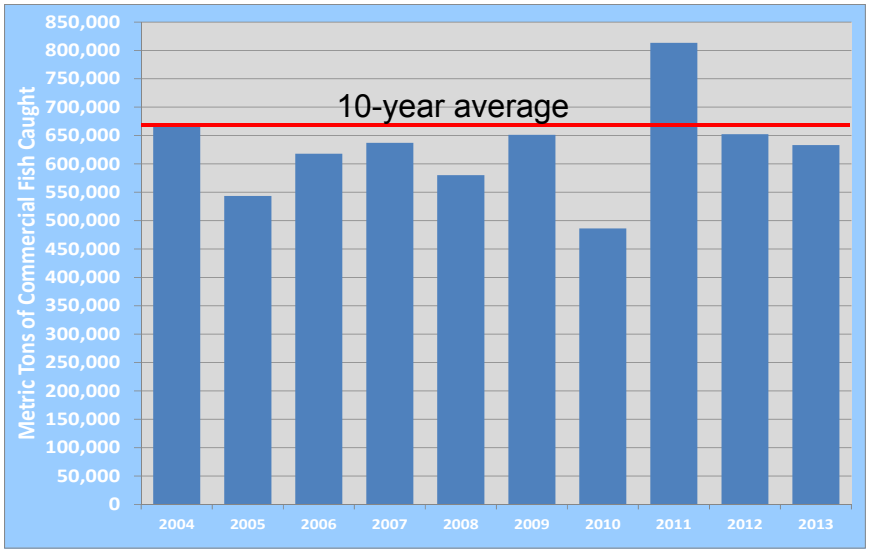
May 30 – June 20, 2010

June 20 – July 15, 2010



Commercial Fish Catch in the GOM

(obtained from the US NOAA Fisheries website*)



*Data available online as of November 2015 at http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html