The BP Deepwater Oil Spill - the Dispersant Meeting Report - and Open Thread 2

Posted by Heading Out on June 11, 2010 - 10:49pm
Topic: Environment/Sustainability
Tags: bp, deepwater horizon, dispersant, oil spill [list all tags]

Because of the large number of comments, this is a new thread.

Concerns about the use of dispersant by the Rapid Response Teams (RRT) working on the Deepwater Horizon spill led to the "Deepwater Horizon Dispersant Use Meeting" that was held on May 26 -27. A report of that meeting is now available (h/t NatResDr). After a brief review of the current status at the well, with inclinometer readings going on, nuts apparently removed, and the apparent tear of one of the seals in the cap, we'll get back to that report. First the status:

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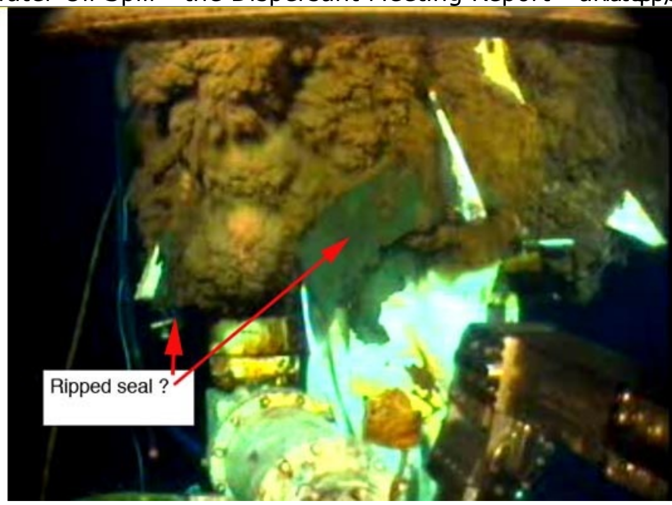
> For the first 12 hours on June 10th (midnight to noon), approximately 7,630 barrels of oil were collected and 15.3 million cubic feet of natural gas were flared.
>
> On June 9th, a total of approximately 15,800 barrels of oil were collected and 31 million cubic feet of natural gas were flared.

And here is the apparent seal that has torn, and slipped out of the cap.



View from the Skandi ROV 2 at 10 pm 10th June 2010.

And so on to what the report says.

The panel included experts from a variety of universities and agencies. To justify the use of dispersants, the report provides a background.

> To prevent landfall of the oil, mechanical recovery techniques were used, including skimming and booming, as well as in situ burning. However, when poor weather conditions limited the effectiveness and suitability of mechanical recovery and burning, dispersants were applied to disperse surface oil and prevent landfall. In early May, responders began injecting dispersants at the source of the release in order to prevent oil from reaching the surface. These techniques have largely been successful, and have reduced the amount of oil reaching the nearshore.

The meeting was divided into four breakout groups that addressed

(1) Efficacy and effectiveness of surface and deep ocean use of dispersants;

(2) Physical transport and chemical behavior of dispersants and dispersed oil;

(3) Exposure pathways and biological effects resulting from deep ocean application of dispersants; and

(4) Exposure pathways and biological effects resulting from surface application of dispersants.

What follows are direct quotes from the report.

As background they were also told that:

1. Surface dispersant operations have only been conducted in pre-approved zones (> 3 miles offshore, >10 m water depth).

2. Most dispersants have been applied 20-50 miles offshore where the water is much greater than 100 ft deep;

3. The footprint of surface dispersant application is relatively small;

4. The body of water in which the dispersants are applied is constantly changing; and

5. This meeting focused on oil effects and dispersants in general.

Group One (Effectiveness of dispersants)

They stated that the current state of knowledge was:

☐ Oil emulsion (> 15 – 20% water) is non-dispersible
☐ Plume is between 1100 – 1300 m deep moving SW direction
☐ DWH oil high in alkanes, and has a PAH composition similar to South Louisiana reference crude
☐ Lighter PAHs (< C15) are likely volatilizing
☐ Viscosity of emulsified oil is between 5500-8500 centistoke
☐ Emulsion may be destabilizing (50-60%)
☐ Primary detection method, C3 (fluorometer), only gives relative trends – does not accurately measure concentration of total oil or degree of dispersion

Their conclusions included the following.

For surface applications

1. Surface application of dispersants has been demonstrated to be effective for the DWH incident and should continue to be used.

2. The use of chemical dispersants is needed to augment other response options because of a combination of factors for the DWH incident (i.e., continuous, large volume release).

3. Winds and currents may move any oil on the surface toward sensitive wetlands.

4. Limitations of mechanical containment and recovery, as well as in situ burning.

5. Weathered DWH oil may be dispersible. Further lab and field studies are needed to assess the efficacy and efficiency and optimal dispersant application (e.g., multiple dispersant applications).

6. Spotter airplanes are essential for good slick targeting for large scale aerial applications (e.g., C-130), so their use should be continued.

7. In order to most effectively use the assets available, the appropriate vessels or aircraft should be selected based on the size and location of the slick and condition of oil.

Dispersing the oil reduces surface slicks and shoreline oiling. The use of chemical dispersants enhances the natural dispersion process (e.g., the smaller droplet size enhances potential biodegradation). Dispersing the oil also reduces the amount of waste generated from mechanical containment and recovery, as well as shoreline cleanup.

For underwater applications

1. The subsurface dispersant dosage should be optimized to achieve a Dispersant to Oil Ratio (DOR) of 1:50. Because conditions are ideal (i.e., fresh, un- weathered oil) a lower ratio can be used, reducing the amount of dispersant required. The volume injected should be based on the minimum oil flowrate, however an accurate volumetric oil flowrate is required to ensure that the

DOR is optimized.

2. If we assume a 15,000 bbls/day oil rate and a 1:50 DOR, then actual dispersant flowrate is roughly similar to the current application rate of 9 GPM.

3. To further optimize dispersant efficacy, the contact time between dispersant and oil should be maximized. Longer contact time ensures better mixing of oil and dispersant prior to being released into the water, and should result in better droplet formation.

4. Contact time can be increased by shifting the position of the application wand deeper into the riser, optimizing nozzle design on the application wand to increase fluid sheer, and increasing the temperature of the dispersant to lower viscosity.

5. Effectiveness should be validated by allowing for a short period of no dispersant application followed by a short time of dispersant usage to look for visual improvements in subsurface plume.

Dispersants are never 100% effective. The flow rate of oil out of the damaged riser is not constant, and significant amounts of methane gas are being released. Because the effective DOR is a function of oil flow rate, changes in the oil flow rate may significantly impact the actual DOR. If the DOR is too low, dispersion may not be maximized, while if it is too high, dispersant will be unnecessarily added to the environment. Assumptions are based on knowledge at standard temperatures and pressures (STP), while conditions at the riser are significantly different.

Group members suggested that the oil escaping the damaged riser may be in excess of 100°C, and it is unclear what effect this has on the dispersant, or the efficacy or effectiveness of droplet formation. These conditions may drastically alter fluid behavior. Finally, there is an opportunity cost of changes to application wand position and development and deployment of a new nozzle. When optimized, subsurface dispersant application may reduce or eliminate the need for surface dispersant application, and will reduce surfacing and resurfacing of oil.

Group 2 (Transport and behavior of dispersed oil)

The current state of knowledge is:

☐ Surface models are effective and continuously improving
☐ SMART protocols are improving
☐ Increase of sampling at depth
☐ Well researched region (oceanographic and ecological studies)
☐ Well established baseline data
☐ Airborne application protocols are established

Their conclusions included the following:

1. Create an on-scene environmental review committee to advise SSCs that will be responsible for providing immediate operational and scientific advice, and aid in dispersant decisions.

2. Clearly define geographic area/water volume of concern.

3. Establishment of a more comprehensive sampling and monitoring program to understand transport of oil on the surface and potential for long-term increases to TPH, TPAH, oxygen demand, or lowering of DO with continued dispersant application. This could be done by implementing off-shore water (first 10 m) monitoring stations (e.g., fixed stationary positions such as other drill rigs).

Continued dispersant use trades shoreline impacts for water column impacts. This increases the uncertainty of the fate of the oil, and potentially increases the oil sedimentation rate on the bottom.

Continued dispersant use reduces the threat distance, protects shorelines, likely increases the biodegradation rate of the oil, inhibits formation of emulsions, reduces waste management, and potentially reduces buildup of VOCs in the air.

Group 3 (Biological Effects of Dispersants)

The current state of knowledge is:

☐ Minerals Management Services, Gulf of Mexico deep water studies/reports:

☐ Natural hydrocarbon seepage in the Gulf of Mexico approximately 40 million gallons per year
☐ Some knowledge and past studies on deep water species in the Gulf of Mexico
☐ Preliminary modeling
☐ Preliminary monitoring data (Fluorometry data, Particle size analysis, Temperature, Salinity, D.O., Hydrocarbon, Acute toxicity, Acoustic data, sonar, Genomics)

Their conclusions included the following:

1. Dispersant risk assessment should consider volume of DWH incident relative to natural seepage

2. There is a net benefit to continued subsurface dispersant use and application should continue, these include:

☐ Surface water column and beach impacts vs. vertical water column impacts ☐ Observed reduction in volatile organics at surface
☐ Enhances the interaction between oil and suspended particulate material
☐ Accelerated microbial degradation through increased bioavailability
☐ Rapid recovery of downward sulfate diffusion and upward methane diffusion related to shallow sediment geochemistry
☐ Based on current knowledge, subsurface dispersant use confines the aerial extent of impact
☐ Current impact zone is less than 50 km radius
☐ Reduction in emulsified oil at the surface
☐ Reduction of phototoxic impacts

Group 4 (Biological Effects of Dispersant on surface water species)

The current state of knowledge is:

☐ The oil is being dispersed in the top ten meters of the water column from surface dispersant application (fluorescence methods)

Their recommendations included:

1. Surface application of dispersants is acceptable. Transferring the risk from the surface to the top 10 m is the lesser of the many evils.

2. Additional monitoring is required to better model where dispersed oil is going. Long term (monthly) monitoring is required at a minimum, and should be conducted in a grid formation

inshore to open ocean. Passive samplers (i.e., SPME) should be used in selected areas, while a active water sampling program should be implemented to measure dispersant and dispersed oil, dissolved oxygen, and standard CTD + chlorophyll concentrations, as well as selected bioassays.

The report has 26 references, some of which are web accessible, and several appendices, listing the agenda, those present, and those in each group.

If you have further questions the report is available.