'Workshop addressing the Use of Oil Spill Dispersants following the Deepwater Horizon incident'

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List of Abstracts

1. DWH spill – The facts and operational remarks from the US Coast Guard perspective (Mr Robert Pond, US Coast Guard)

   The Deepwater Horizon incident called for significant and novel response approaches to mitigate the impacts of millions of barrels of oil discharged into the Gulf of Mexico. This presentation considers only one response method, dispersants, and their use at the surface and subsurface. Almost 2 million gallons of dispersants were applied by planes and vessels on the surface of the water, in a novel, point-of-source subsurface technique. The presentation will discuss the decision to use dispersants during the spill and their effectiveness; short- and long-term monitoring methods; risk communications. The presentation will also briefly explore the future of dispersants.

2. Operations, logistics, technology used and limitations/challenges of dispersant applications on the sea surface and sub-surface during the DWH spill response (Mr Arden Ahnell, BP)

   This presentation provides an overview of dispersant evaluation and use during the response to the Deepwater Horizon (DWH) accident in 2010 under the direction of the Unified Command, during which approximately 1.8 million gallons of dispersants were used as part of the overall response effort. The decision to use dispersants by aerial, vessel, and sub-sea applications reduced shoreline oiling and suppressed vapors at the Mississippi Canyon 252 well site. Extensive monitoring documented rapid dilution of dispersants and oil in the marine environment. Laboratory and field data showed high biodegradation rates of dispersant-oil mixtures.

   After dispersant use was initiated in the DWH Response, the US EPA directed BP to evaluate alternative dispersants to the Corexit product(s) being used. BP developed a screening strategy to consider all dispersants listed on the National Contingency Plan (NCP) Product Schedule. The conclusion of detailed testing was that Corexit 9500 remained the best choice in terms of availability, effectiveness and toxicity.

   An extensive monitoring and sampling program was initiated in the field with the use of dispersants during the DWH Response. The low field toxicity and high levels of biodegradation of dispersed oil that were observed through spill monitoring activities and laboratory research suggests that use of dispersants remains an important option within an overall oil spill response operation.

3. Value of dispersants for offshore oil spill response following the DWH incident (Mr Tom Coolbaugh, ExxonMobil)

   Oil spill response strategies are designed to minimize environmental impacts to the extent possible. Each response option must be evaluated for operational limitations (e.g., sea state), potential effectiveness, environmental impacts of the response option itself, and applicability under various oil spill scenarios (e.g., size and location of the spill) in addition to health and safety of the responders.

   This presentation provides a review of the primary oil spill response options with focus on dispersants and their use, including the important health and safety aspects of subsea dispersant injection. The information provided will support the use of dispersants as a primary response tool for large offshore oil spills when the goal is to minimize environmental harm.

4. Sampling techniques and the modelling used to support and direct the sampling efforts, including lessons learned from the modelling analyses (Ms Deborah French McCay, RPS ASA)

   The application of dispersants can reduce adverse impacts to biota from floating oil and shoreline oiling, but with the trade-off that the dispersed oil may increase adverse effects on water column organisms. Dispersant use can increase the amount of oil entrained into water; skew the oil droplet size distribution toward smaller droplet sizes, increasing the rate of dissolution and concentrations of soluble and semi-soluble components; increase the duration of exposure for water column biota; and change the overall fate of the oil. The Deepwater Horizon blowout in the north-eastern Gulf of Mexico is not only the largest oil spill in US history, but unprecedented amounts of dispersants were applied both at the wellhead release-point and in surface waters to reduce exposure of wildlife to floating oil and shoreline oiling. Thus, evaluation of impacts to water column biota is of particular interest for this spill and in consideration of the risks associated with future deepwater blowouts.

   During the time of the oil release, water chemistry samples and oceanographic sensor data were collected to test for the presence and characterize the droplet sizes of subsurface dispersed oil. The sampling of subsurface oil in deep offshore waters was adaptive, i.e., focused in areas and depths where oil and contaminants were expected to have moved from the wellhead area, in addition to sampling other areas at a lower level of effort. The sampling locations were guided by oil fate modelling predictions. The approach for field sampling and supportive modelling will be discussed.

5. Current status of the analysis and on-going assessment of the Dispersed Oil Monitoring and DWH Oil Spill Impacts (Ms Deborah French McCay, RPS ASA)

   Oil fates and effects modelling is being used to quantify the impact of the Deepwater Horizon spill on water column biota in support of the US government's natural damage assessment claims against the responsible party (BP). The modelling approach includes hydrodynamic modelling for currents; oil fate modelling, exposure and toxicity analysis, and determination of lost future production. The data collections and analyses to support and verify the modelling involve an unprecedented field effort;

sampling environmental conditions, chemistry, oil and particulates, and biota in multiple trophic levels and parts of the offshore ecosystem. Ichthyoplankton, invertebrate plankton, and several size ranges of fishes and invertebrates were sampled from the water surface to 1500m in the Gulf of Mexico. The approach and data collections will be discussed; preliminary findings based on publically-released data and analyses may also be included.

6. What could have happened if dispersants had not been used in the DWH spill? (Mr Alun Lewis, Oil Spill Consultant)

An enormous oil spill response operation was conducted at the Deepwater Horizon / Macondo incident. This involved over 50,000 people, 10,000 vessels, 150 aircraft, over 4,000 kilometres of booms (of various types), over 400 controlled in-situ burns and almost 7,000m^3 of dispersant (3,696 m^3 sprayed from aircraft, 364 m^3 sprayed from vessels and 2,920 m^3 added sub-sea). How effective were these response actions? How much damage was prevented from happening?

Studies conducted during and after the DWH incident demonstrated that dispersant use would be effective on the MC252 oil that was being released at the sub-sea source. The oil that reached the surface was amenable for a period of time before it became emulsified and resistant to dispersant use. Sub-sea dispersant use was observed to cause elevated concentrations of dispersed oil in the water column in addition to the oil that was being mechanically dispersed by the intense turbulence at the oil release. A great deal of concern was generated by the sub-sea use of dispersant as the method had never been used before. Research cruises eventually established that the very dilute plumes of dispersed oil were being rapidly biodegraded by naturally occurring organisms in the Gulf of Mexico.

If sub-sea dispersant use had not been undertaken more oil would have reached the sea surface. Could the other response methods used (booms and skimmers, in situ burning and dispersant spraying on oil on the sea surface) have 'dealt with' the additional amount of oil while it was at sea? Would the oil that reached the sea surface have drifted ashore? If sub-sea dispersant use had not been undertaken less oil would have been dispersed into the water column, although a significant proportion of the released oil was already being mechanically dispersed. Did the oil dispersed by dispersant use add to any negative effects already being caused by the mechanically dispersed oil? Were there any negative effects caused by the dispersed oil?

Dispersant spraying from aircraft faced a difficult task. The oil on the sea surface was not present as an enormous coherent slick (as often portrayed in computer-generated graphics), but consisted of very large number of individual oil slicks or 'streamers, of oil. The currents and prevailing winds caused the oil to circulate with older, more weathered and emulsified oil (evident by the orange/reddish colour) becoming mixed with the fresher, darker coloured oil. How effective was the use of dispersant sprayed from aircraft as compared to other response methods?

The presentation will consider all these issues in the light of currently available evidence.

7. Regulatory and policy concerns and developments regarding surface and sub-sea dispersant application in the US (Mr Robert Pond, US Coast Guard)
In light of the unprecedented application of dispersants during the Deepwater Horizon oil spill response, the US National Response Team (NRT) has drafted guidance for the Environmental Monitoring of Dispersant Operations. This guidance document specifically addresses the monitoring and assessment of subsurface and prolonged surface dispersant application. These draft interim guidelines are intended to remain in place until revisions to Subpart J of the National Contingency Plan, which covers the approval and use of chemical and other countermeasures, are completed.
This presentation provides a basic overview of these draft NRT guidelines and how they will be used by decision makers during a response.

8. Global dispersants regulations (Mr Alun Lewis, on behalf of IPIECA)
National governments have the right and responsibility to introduce laws and regulations as they see fit to protect their citizens and the environmental and ecological resources within their territories from the effects of pollution.
The aim of using oil spill dispersants is the same as the use of any other oil spill response method; to minimize the damage that could be caused by the spilled oil. Successful dispersant use transfers the spilled oil from the sea surface and into the water column. Provided that the dispersant is used on spilled oil in appropriate circumstances, any negative effects caused by the dispersed oil are likely to be localized and short-term. Dispersant use requires careful consideration of the circumstances of the oil spill, but can be a rapid and effective response to many oil spills.

The international oil industry and its specialist response contractors need to know what response methods will be permitted in responding to oil spills that may occur in the national waters of many countries. With respect to the use of oil spill dispersants, there are a series of questions that often need to be asked and answered during the pre-planning stages when undertaking offshore oil exploration and production in a nation's waters:

- Is dispersant use on spilled oil permitted in the waters of the host country?
- Do dispersants have to be approved by the government?
    - Which dispersants have already been approved?
    - Does the national government accept dispersants approved in other countries or are there specific national dispersant approval procedures?
    - How is the national dispersant approval process organized?
- Where and when can dispersants be used, and where and when dispersants cannot be used on spilled oil in national waters?
    - Which national governments regulate dispersant use?
    - In what form is this information presented?

Some, but not all, countries have introduced regulations about dispersant use. These vary in scope and complexity. The international oil industry, which operates in many different countries worldwide, has to conform to a wide variety of dispersant regulations or, in some places, no existing regulations at all. While the existing dispersant regulations often share the common aim of ensuring that the dispersants used are reasonably effective, not too toxic and should not be used on spilled oil in shallow waters, the specific requirements of the regulations are often different. A variety of different testing protocols are used in different countries to assess dispersant effectiveness and toxicity. Are some procedures inherently better than other procedures? Does any of the required testing (effectiveness and toxicity) even remotely simulate actual dispersant use on spilled oil at sea?

The presentation will be accompanied by a “mini-paper” that is intended to be circulated to delegates before the Workshop.

9. Main results of DWH-related research and current priorities and projects in the US (Mr Robert Pond, US Coast Guard)

   For over forty years, dispersants have been researched and implemented as an important oil spill response tool. However, the 2010 U.S. Deepwater Horizon spill has generated a call to revisit the background and understanding of dispersant formulation and application. This presentation reviews some of the major initiatives currently underway in the U.S. that are focused on studying the efficacy and toxicity of dispersants in relation to results produced from past research. Research championed by the Interagency Coordinating Committee on Oil Pollution Research, the American Petroleum Institute, and within industry and academia at large will be discussed.

10. Current status of industry led dispersant research activities (Mr Tom Coolbaugh, ExxonMobil and Mr Arden Ahnell, BP)

    Before and after the Deepwater Horizon (DWH) incident, a number of research-oriented efforts were undertaken by industry to better understand the fate and effects of dispersed oil, whether dispersed at the water’s surface or as part of a sub-sea response. The presentation will provide a summary of key dispersant-related research activities currently being coordinated by the International Oil and Gas Producers Association (OGP) and the American Petroleum Institute (API).

11. Sub-sea oil spill dispersant effectiveness. A new evaluation methodology (Dr Nicolas Passade-Boupat, Total Petrochemicals France)

    During the Macondo oil spill accident, oil dispersants were injected sub-sea next to the oil plume exit for the first time. This new type of injection seemed to be very efficient, but it also showed that a lack of knowledge existed, as it was not known how effective dispersants formulated for surface application would be for sub-sea injection or if the formulation rules and phenomena involved in sub-sea dispersion were the same as for surface applications. Additionally, no standard test existed that enabled the qualification of additives for this type of injection.

    This presentation presents our results relevant to these different aspects including the description of a new experimental set-up and test protocol developed to simulate conditions closer to sub-sea injection. This protocol allows the screening of several additives in a minimum time. The analysis of the mechanisms at play, based on oil/water/surfactant formulation rules, allows understanding the sub-sea dispersion phenomenology. It also describes how using this experimental set-up and performing water/oil/additive screenings have allowed us to establish the link between the physical chemistry behavior of the system and the quality of dispersion. Finally, the proposed methodology allows not only the screening of several additives in order to chose the more appropriated for a given physical chemistry environment (type of oil, water composition) but also the optimization or development of new dispersants for the sub-sea application.

12. Subsurface releases of oil – Results from experimental basin studies of oil releases and injection of dispersants (Mr Per Johan Brandvik, SINTEF)
SINTEF has performed extensive tank studies of subsurface oil release and the effectiveness of various dispersant injection techniques. These studies have been performed in SINTEFs Tower basin which is a six meter high cylindrical basin holding 40 000 liters of sea water. This tank is equipped with an advanced system for releasing oil & gas, and monitoring oil droplet size distributions and oil/dispersant concentrations in the released plume. The droplet size distributions are measured with three independent in-situ methods (laser particle sizer, particle visual microscope and a macro camera with a blue-laser focusing plane). Different techniques to inject dispersants into the hydrocarbon stream are also studied.

SINTEF has also established a 100 liters bench-scale apparatus (MiniTower), which is used for small-scale studies where a wider range of parameters can be studied at lower costs.

The following topics are included in the presentation:
1. Principles and capabilities of the SINTEF Tower basin and MiniTower for both large-scale and bench-scale studies.
2. Summary results from droplet size distributions as a function of release conditions (release diameters, rates and oil properties) from the Tower basin. How this data is used to improve existing algorithms for predicting droplet sizes for subsurface release (improved Weber scaling).
3. Summary results of experimental studies of subsurface dispersant injection techniques.

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Speakers’ Biographies

Arden David Ahnell: Director, Environmental Technology & Knowledge Management, Production Safety & Operational Risk, BP. Recently appointed to a role directing technology and learning for BP’s upstream environmental community, Arden is involved in all aspects of the upstream environmental agenda from exploration to production over many regions in the world reporting the BP’s upstream’s Vice President for Environment. This assignment comes after two years supporting the Deep Water Horizon Spill Response and Gulf Coast Restoration efforts, first as BP’s senior science response advisor and then as Deputy Natural Resource Damage Assessment Director managing a BP science program charged with understanding many key aspects of the spill’s environmental impact. During the DWH incident he answered EPA challenges regarding dispersant choice and use, coordinated environmental efforts across the operation for BP.

Previous roles include Director of Product Stewardship, providing policy, product regulatory and product safety communication expertise and support across the BP Group; various roles involving contaminated land clean-up management nationally and internationally and External Affairs where he was active on climate change issues. Other assignments included Manager of the Health, Safety, and Environmental (HSE) international team providing support across BP world-wide and managing HSE divestment/acquisition issues. Early in his career he was a division manager in BP Research and prior to joining BP, he held various positions in US state government. He is a University of Illinois graduate with a M.S.in Environmental Engineering.

Dr. Per Johan Brandvik is a Senior Research Scientist at SINTEF, Marine Environmental Technology in Trondheim, Norway and a professor at the Norwegian University of Science and Technology, NTNU. His PhD work was on optimization of surfactant composition in dispersants as a function of oil composition and weathering degree. Professor Brandvik has worked with fate and behaviour of marine oil spills and their influence on operational oil spill contingency for the last 25 years. His research focus has the last years been on sub-surface releases and experimental studies of oil droplet size distributions versus release conditions. Effectiveness of different dispersant injection techniques has also been an important part of his late research.

SINTEF was called upon already in the initial phase of the DWH accident. SINTEF did initial 3D modelling of the fate of the sub-surface release for NOAA and later field studies of weathering and dispersibility of the surface oil slicks for BP. After the oil release stopped SINTEF has performed extensive studies of weathering, fate and effect of sub-surface oil releases and injection of dispersants for both individual oil companies and GOMRI, API, OGP and IPIECA.

Dr. Peter Collinson. Peter’s current role is as BP’s Global Environmental Response Expert. He is responsible for embedding environmental and socio-economic ‘lessons learned’ from the Deepwater Horizon incident into new Oil Spill Preparedness and Response corporate policies, practices and advocating these lessons to industry, partners and governments globally. During the Deepwater Horizon incident, Peter’s role was ’BP Marine Scientist’ at the Unified Command Centre, New Orleans, where he was responsible for developing and managing BP’s scientific research fleet that monitored and characterised the sub-sea dispersant injection response, in collaboration with US regulators and agencies. Peter’s background is Marine Ecology, Corporate Crisis Management, Enterprise Risk Management and Oil Spill Preparedness and Response.

Thomas S. Coolbaugh: Dr. Coolbaugh is a Distinguished Scientific Associate with ExxonMobil Research & Engineering. He earned a B.A. in Chemistry from Amherst College in Massachusetts, and a Ph.D. in Chemistry from the California Institute of Technology with Prof. Robert Grubbs, 2005 Nobel laureate in Chemistry. Dr. Coolbaugh also earned an M.S. in Management of Technology from Polytechnic University in New York. Dr. Coolbaugh has extensive experience in a variety of research settings as a research scientist and research leader. He currently leads ExxonMobil’s downstream oil spill response technology group and had a role of evaluating the effectiveness of commercial dispersants in support of the DWH spill response.

Dr. Deborah French-McCay. Director of Impact Assessment Services, RPS-ASA, South Kingstown, RI. Dr. French McCay specializes in quantitative assessments and modelling of oil and chemical releases for impact, risk, and natural resource damage assessments (NRDA); evaluating transport and fates, exposure, and effects of pollutants on individual organisms, populations and aquatic ecosystems.

As part of the BP Gulf of Mexico spill NRDA and under contract to the US government (National Oceanic and Atmospheric Administration, NOAA), Dr. French-McCay is co-leading the technical working groups analysing pathway, exposures and injuries to water column and to offshore fish and invertebrates; as well as leading oil fates and effects modelling for quantification of the impact of the Deepwater Horizon spill on water column biota.

Alun Lewis is one of the world's leading authorities on oil spill dispersants. He has been involved in research on oil spills such as the fate and behaviour of spilled oil and aerial surveillance of oil spills since 1979. He has worked for the BP Research Centre (1967 - 1992), Warren Spring Laboratory (1993), SINTEF (1993 - 1997), AEA Technology (1997 - 1998) and became an independent consultant in 1998. As well as conducting extensive studies in the laboratory, this work has included taking part in numerous sea trials, in the North Sea (1980s), in the Beaufort Sea (off Arctic Canada) in 1986 in the Norwegian Sea (1984, 1994, 1995 and 1996). He was the manager for the largest ever oil spill sea trial involving dispersant use in UK waters that was held in the North Sea in 1997. The tests involved over 120 tonnes of oil, several ships and aircraft (both for aerial surveillance and dispersant-spraying). He also organised a small-scale sea trial off the Isle of Wight in 2003.

Since becoming an independent consultant, Alun has worked with many organisations, both commercial and government, throughout the world. He conducted many studies for the UK Maritime and Coastguard Agency and was involved in the response to various incidents including the Ever Decent / Norwegian Dream collision in 1999 and the MSC Napoli incident in 2007. He has worked closely with IPIECA (the global oil and gas industry association for environmental and social issues) and OSPRI, an oil industry initiative that encourages and supports the promotion of oil spill preparedness in the Caspian Sea, Black Sea and Central Eurasia. Alun cooperated with SL Ross from 2000 to 2007 in a series of dispersant experiments at OHMSETT in New Jersey USA, the largest wave tank in the world that has been used for dispersant testing. He still undertakes research work with SINTEF particularly on oil spill issues as they relate to the Arctic. During the DWH incident, Alun was contracted by BP to help answer the many questions raised about dispersant use by departments of the US Government, principally the US EPA (Environment Protection Agency). Together with others, he produced a series of reports and was involved with the dispersant effectiveness studies (conducted by SL Ross in Canada and SINTEF in Norway) and toxicity studies (conducted by EM&A in the USA) that were undertaken during the incident. He has been involved in some of the very many research projects that were started after the DWH incident into the sub-sea use of dispersants.

François Merlin: A master in chemistry and an experienced oil industry service engineer, François MERLIN joined CEDRE in 1979, to undertake research projects and studies on oil pollution issues, and treatment products utilized in oil spills, as well as on regulation, approval, operational procedures and application issues. In this respect he is in charge of the dispersant approval procedure in France.

He has contributed to various publications and handbooks; in particular, he led the revision of the IMO Guidelines on Dispersants, the REMPEC documentation on dispersants, and the IPIECA technical report on dispersants. He moderated many specialized workshops in different countries to define national policy on dispersants and has given many lectures on this matter. He has also been called for expertise in France and other countries to evaluate pollution incidents and advice on the selection of treatment products and methods.

As Head of CEDRE's "Research and Development" Department he is now in charge of coordinating all R&D activities conducted by CEDRE (Centre of Documentation, research and Experimentation on Accidental Water Pollution).

Dr Nicolas Passade-Boupat was born in 1973 in Pau, France. He graduated from "Ecole Superieure de Physique et de Chimie Industrielles" (ESPCI) in Paris in 1997, and received his phd in physicochemistry of polymers from University Paris VI in 2000. He began working for Total in 2001 in a research department dedicated to studying interfacial phenomena linked to industrial problems, in particular dedicated to liquid liquid systems for different E&P applications. Since 2011, he is in charge of this research department of 40 people. The main domains of expertise involve oil, brine, additives, and solids either to break stable emulsions (as in oil/water separation or water treatment for surface processing), or to make stable emulsions (as in chemical enhanced oil recovery or marine dispersants for oil spill).

Robert G. Pond is the Senior Technical Advisor to the US Coast Guard Office of Incident Management and Response, Head of US Delegation to an International Maritime Organization Technical Working Group, and US Coast Guard Lead Representative to an Arctic Council Working Group. Mr. Pond has 36 years professional experience in catastrophic incident prevention, preparedness and response. He is a nationally recognized and published leader in assessment of response capabilities, dispersant use (efficiency, effectiveness and environmental effects), response exercise standards and logistics, and personnel training and qualifications at the command and field levels. He is co-author of several influential National Policy Documents that have served to shape and define the Nation's preparedness to respond to domestic emergencies and disasters.