Coordinating R&D on Oil Spill Response In the Wake of Deepwater Horizon
Workshop Summary Report
March 22-24, 2011, Baton Rouge, LA
April 11, 2011

1.0 SUMMARY

A workshop titled "Coordinating R&D on Oil Spill Response in the Wake of Deepwater Horizon" was held on March 22-24, 2011 in Baton Rouge, LA on the Louisiana State University campus. This workshop was organized and facilitated by the Coastal Response Research Center (CRRC), in collaboration with an organizing committee comprised of members from Gulf coast universities, federal agencies and the private sector. The purpose of this 2.5 day meeting was to bring together experts from across a broad spectrum of organizations to address the state of future oil spill response research and practices. The overarching goals were to: (1) develop an updated list of research and development (R&D) needs for response related to: dispersant efficacy and effects, spill trajectory modeling, detection of surface and subsurface oil, human dimensions in spill response, seafood safety monitoring and information management; and (2) create a dialogue between researchers and responders in order to ensure transfer of research results into practice. Seventy researchers and oil spill practitioners took part in the in-depth discussions addressing these goals and ultimately creating a list of R&D needs to improve spill response with respect to each topic. This report summarizes the most salient discussions and conclusions and includes the R&D needs lists. A more detailed report on the workshop will be publically available in May 2011 and will include all documents (e.g., presentations, notes). Some recurring themes arose across topics and stakeholders and were seen as the most pressing response R&D needs and issues of the Deepwater Horizon incident. These include:

- Improve crisis communication and the public's understanding of spill response
- Develop protocols for decision-makers to use rapid environmental risk assessment to weigh trade-offs associated with various response activities (e.g., dispersant use)
- Improve the link between information management, data collection, and modeling of response activities
- Incorporate human dimension issues into the response framework (e.g., Incident Command System (ICS))

2.0 INTRODUCTION

In the years prior to the Deepwater Horizon (DWH) oil spill, the Coastal Response Research Center (CRRC), a partnership between NOAA's Office of Response and Restoration and the University of New Hampshire, developed several plans that prioritized research and development

(R&D) needs on a range of spill response topics including: dispersants, modeling, human dimensions, and acquisition synthesis and management of information. In response to these R&D plans, many projects were conducted by coordinating funding among state, federal and private sector entities. The total amount of funding directed towards oil spill response R&D between 2000 and April 2010 was ~$60M including all federal, state and private sector entities.

During and immediately after the DWH oil spill, R&D projects were rapidly solicited and funded by several entities. Some examples are the initial projects funded under the British Petroleum (BP) Gulf Research Initiative (GRI) and the $19M in RAPID grants funded by the National Science Foundation (NSF). GRI awarded a total of $50M to Gulf Coast universities and institutes and the National Institutes of Health for 1 year starting June 2010. The GRI is preparing to release a request for proposal (RFP) for an additional $150M. Over a 10 year period, BP has committed $500M to GRI. While GRI and NSF account for the vast majority of funding towards general oil spill research, there are other entities (e.g., U.S. EPA, BOEMRE, and the private sector) that have either begun or are preparing to fund R&D projects in the aftermath of the DWH spill. For example, the Marine Well Containment Company funded by several oil industry partners is developing new well capping strategies. In addition, there have been several meetings convened and reports published by universities, government agencies, and the private sector that have identified R&D needs for response technologies and on the effects of the oil on ecosystem services. For example, the Joint Industry Oil Spill Preparedness and Response Task Force released a report in September 2010 detailing, among other things, R&D needs for improving future oil spill response practices.

Oil spill response research funding has once again significantly increased, as it did in the years immediately following the *Exxon Valdez* spill. With this large increase in funding there is clearly the potential for overlap in research activities. It is also important to address how R&D needs have changed in the wake of the DWH spill and whether previous studies have addressed these needs. In addition, we must ensure that the newly funded R&D projects provide relevant results that can be transferred into practice as soon as possible.

In order to continue coordination between researchers and oil spill response practitioners, the CRRC convened a workshop titled "Coordinating R&D on Oil Spill Response in the Wake of Deepwater Horizon" in Baton Rouge, LA on March 22-24, 2011. This workshop brought together approximately 70 oil spill practitioners and researchers from the public and private sectors and academia to discuss R&D needs and projects. The workshop included seven focus groups:

- Dispersant and Dispersed Oil Effects
- Dispersant Efficacy
- Detection of Oil In the Surface and Subsurface and Fate
- Modeling Oil Transport
- Human Linkages and Spill Response
- Seafood Safety Monitoring
- Acquisition Synthesis and Information Management

The goals of the workshop were to: (1) develop an updated list of R&D needs for response related to: dispersant efficacy and effects, spill trajectory modeling, detection of surface and subsurface oil, human dimensions in spill response, seafood safety monitoring, and information management; and (2) create a dialogue between researchers and responders in order to ensure transfer of research results into practice. This meeting did NOT cover any natural resource damage assessment (NRDA) activities, response issues specific to the Arctic, or research focusing on the impacts of the DWH spill on the Gulf of Mexico.

3.0 MEETING ORGANIZATION & STRUCTURE

The workshop was held at the Lod Cook Alumni Conference Center on the campus of Louisiana State University in Baton Rouge, LA. Participation was by invitation only and included representatives from state and federal agencies, academia and the private sector. Seventy participants attended a mix of plenary and breakout sessions. Participants were assigned to breakout groups that best represented their expertise with respect to oil spill response. The breakout groups each included a group leader who facilitated discussion and a note taker who captured relevant information. Every group was tasked to answer questions designed to focus the discussion around the two overarching tasks. These questions, along with the invitee list and the agenda, were developed by the CRRC in collaboration with an organizing committee (OC). The OC was comprised of representatives from the U.S. Coast Guard, NOAA, Dauphin Island Sea Laboratory (Alabama), Florida Institute of Oceanography, HARTE Institute, Mississippi-Alabama Sea Grant Consortium, Northern Gulf Institute and the private sector. The CRRC also consulted with Louisiana State University, BOEMRE, and U.S. EPA representatives for assistance with compiling the invitee list.

4.0 R&D NEEDS

Ultimately, each breakout group compiled a list of R&D needs to improve and inform oil spill response going forward. A list of prioritized (i.e., first, second, third, etc.) research and development needs to improve oil spill response for each topic is given below. These lists were compiled by each group based on previous R&D plans for oil spill response and new R&D needs that became apparent in the wake of DWH spill. A complete list of R&D needs will be included in the detailed workshop report (May 2011).

4.1 Dispersant and Dispersed Oil Effects

The group concluded that the main goal of R&D under this topic should help inform response decision-makers on the trade-offs of using or not using dispersants. It identified three overarching R&D needs and categorized more detailed needs into several subtopics in order of priority: deepwater subsurface, non-deepwater subsurface, and surface application.

Overall:

1. Improve decision-making by developing protocols for net environmental benefit analysis (NEBA) and ecological risk assessment (ERA), specifically tailored to dispersant and dispersed oil efficacy and effects

2. Evaluate dispersant and dispersed oil chronic and sub-lethal effects on key species for varying, real-world exposure scenarios and durations
3. Develop appropriate chemical (analytical) methods for detecting and quantifying dispersant constituents in environmental samples to assess biodegradation and bioaccumulation

Deepwater Subsurface:

1. Develop criteria for classifying physical, chemical and biological characteristics of dispersants and dispersed oil in deepwater
2. Determine whether current surrogate species used to evaluate dispersant and dispersed oil toxicity are sufficient to evaluate risk in deepwater subsurface environment
3. Develop test protocols (e.g., toxicity dose curves, biodegradation, exposure methods) for assessing the effects of dispersants and dispersed oil recognizing different exposure regimes in various mixing systems
4. Determine optimal dispersant application rates [N.B., this is an efficacy issue, however it relates to effects test protocols.]

Non-deepwater Subsurface:

1. Evaluate existing toxicity data for use in ecological risk assessments
2. Improve understanding of efficiency of dispersion into the water column and plume transport dynamics to inform exposure and risk assumptions

Surface:

1. Compile and summarize all existing data on the effectiveness of dispersion of surface oil, dispersant and dispersed oil toxicity, and biodegradation and bioaccumulation of dispersants and dispersed oil
2. Develop appropriate measures of success for dispersant operations
3. Improve environmental and public health risk communications related to dispersant and dispersed oil issues

4.2 Dispersant Efficacy

It is important to better understand the conditions (e.g., sea conditions, physical chemical characteristics of dispersed oil, dispersant physical and chemical characteristics, dispersant application methods and rates) under which dispersant use is most useful and beneficial. The group reached consensus on four R&D needs for dispersant efficacy (shown below in order of priority) and concluded that past studies and knowledge gained during the DWH spill must be recognized and used to inform future efforts to improve dispersant efficacy for oil spill response.

1. Revise and update dispersant use operation guidelines based on fundamental science
2. Review current knowledge and past R&D on surface dispersant use to determine if existing information is useful for evaluating dispersant efficacy in other environments (e.g., deepwater subsurface, Arctic)
3. Improve models predicting dispersability using information on the physiochemical properties of oil

4. Conduct studies to elucidate the factors influencing droplet size distribution, especially in a deepwater release scenario

The group also identified several other R&D needs of importance.

- Determine mixing energy requirements for various dispersants
- Develop standardized methodology and reference oils to replicate environmental metrics for comparative studies
- Investigate deepwater fate and transport modeling for dispersant and dispersed oil at different temperatures and pressures
- Determine how dispersed oil transport mechanisms relate to oil migration to the benthic environment
- Evaluate the efficacy of dispersant alternatives (e.g., solvent-free formulations, alternate delivery mechanisms, subsurface application)
- Optimize dispersant to oil ratios (DOR) for various conditions, specifically for subsurface application
- Determine the usefulness of Special Monitoring of Applied Response Technologies (SMART) protocols and alternative detection and monitoring platforms and technologies for detecting and tracking dispersants and dispersed oil

4.3 Detection of Oil in the Surface and Subsurface

This group focused on methods and technologies for detecting oil in the environment, specifically on the surface and in the subsurface and benthic zones. They determined five major R&D needs to improve spill response going forward. The group noted that the most important factor for detection of oil is the ability to rapidly detect oil and inform responders of the location of large collections of oil to optimize recovery efficiency and mitigate environmental damage.

1. Improve methods for detecting thick oil (i.e., large collections of oil) to assist in recovery operations
2. Optimize rapid data fusion and sharing (i.e., rapid transfer of data from field to command post)
3. Investigate emerging technologies for 24 hour operations
4. Develop a robust optical detection method that can sufficiently determine locations of thick oil and eliminate false alarms (e.g., multi-channel fluorometers, particle analyzers, oxygen sensors) including retrievable and expandable sensors
5. Improve techniques for locating and sampling contaminated sediments, including both on shore and offshore

4.4 Modeling Oil Transport and Fate

Spill response models provide trajectories relative to transport and fate to assist responders in predicting the location of the oil. The group focused on research needs for improving trajectory models where output can be used by responders and decision-makers. The group identified many R&D needs, however, seven were seen as major priorities for future spill response.

1. Conduct studies investigating oil droplet size distribution from well heads under various conditions, including natural and chemical dispersion scenarios

2. Optimize methods for stitching together small-scale and large-scale hydrodynamic models
3. Improve ensemble modeling and adjoint techniques
4. Perform observing system simulation experiments (OSSE) with the DWH data to inform future response models
5. Improve oil weathering and fate information for models (e.g., solubilization, emulsification, biodegradation)
6. Determine methods for leveraging field observations:
    a. Improve methods for assimilating observational data (e.g., satellite information, social media, drifting buoys)
    b. Understand the connection between field observations and operational models
    c. Improve visualization and command/control of the models
7. Improve access to existing hydrodynamic models

4.5 Human Linkages and Spill Response

The human linkages (dimensions) group focused its discussion on risk and crisis communication, incorporating social linkages into the spill response framework, developing rapid assessments of socioeconomic impacts to inform response and examining how policy and politics can influence response. The DWH spill response was often portrayed by the media and perceived by the public in a negative light. This was seen as one of the greatest flaws in the response. The group concluded that it is crucial to include methods for improving communication of spill response activities within the regulatory framework. The oil spill community must also ensure that societal impacts and perceptions are adequately incorporated into the decision-making components of the response process, without compromising response efficiency and safety. The group compiled an extensive list of R&D needs. Four prioritized categories were identified and research needs were grouped into these categories.

1. External communications:
    a. Identify perception of risk drivers and how perception translates into action with respect to community engagement, trust, and social media
2. Investigate regulatory changes to enable the incident command to incorporate human dimensions into response and recovery:
    a. Identify regulatory barriers and opportunities for including human linkages (dimensions) issues within the response management system (e.g., incident management, area contingency planning, liability and compensation approaches)
3. Determine methods for rapidly assessing impacts, vulnerability, and resiliency for social, health, and economic impacts on the community and at the family and individual level
4. Integrate human dimensions with response and recovery:
    a. Evaluate mechanisms to incorporate local knowledge

4.6 Seafood Safety Monitoring

Seafood safety monitoring is carried out during spill response to protect human health by preventing tainted seafood from reaching the market. The seafood safety monitoring group prioritized R&D needs for oil spill response into three categories: sampling and analysis; risk assessment; and risk communication. The group also highlighted risk communication as a key element for improving spill response.

Sampling and Analysis:

1. Evaluate and improve analytical and quality assurance methodologies for monitoring seafood safety with respect to oil components and dispersants
    a. Rapid assessment techniques
    b. Direct comparison of various analytical methods
    c. Improved standard reference materials (SRM)
2. Fill background data gaps on levels of oil constituents and dispersant components in seafood
3. Build response capacity through workshops, maintain analytical equipment and expertise, the latter by agency contact lists and other reference documents

Risk Assessment:

1. Conduct toxicity testing of alkylated PAHs and dispersant components
    a. Investigate other possible constituents of concern
2. Re-evaluate oil constituents and toxicity endpoints to address public concern
3. Determine how different organisms metabolize dispersant components to inform sampling decisions

Reporting and Communication:

1. Identify ways to simplify research findings and survey results on oil and dispersants to make it understandable to the public
2. Survey the public through direct polling and focus groups to improve outreach
3. Determine best ways to communicate the difference between exposure to oil and dispersant components vs. seafood safety

4.7 Acquisition Synthesis and Information Management

The acquisition synthesis and information management group focused on practices and methods for accessing and using remote-sensing data, real-time observational data systems, electronic data collection via field surveys, and geographical information systems (GIS) to improve oil spill response decision-making. The group identified and prioritized five major research and development areas.

1. Data Standards and Interoperability:
    a. Determine best practices to adopt standards for data collection
    b. Determine best management of information practices, including QA/QC
    c. Define requirements for field data formatting and transmission of data to (and from) modeling teams
2. Oil Identification and Mapping:
    a. Calibration of sensors and integrated rapid analysis
    b. Remote sensing-based characterization of oil thickness and form
3. Incident Command System (ICS) Integration:
    a. Determine threshold for initiating an intelligence unit within the ICS framework
    b. Define roles and training for information management within ICS

4. Baseline Data and Information Needs:
    a. Create a spatially-enabled comprehensive risk assessment framework
    b. Investigate advanced ocean observing systems capability and capacity
5. Training and Awareness:
    a. Reconcile public/private responder awareness and understanding of ICS
    b. Include information process training in scenario simulations

5.0 CONCLUSION

On the final day of the workshop all participants came together to discuss the previous days' results. The goal of this final discussion was to synthesize and prioritize oil spill response R&D needs for all topics as well as identify any gaps and areas of collaboration for interdisciplinary studies.

While there are obvious links between many of the focus topics, some significant ones identified in the final plenary session were: seafood safety monitoring and human linkages; detection and dispersant efficacy; dispersant efficacy and dispersant effects; and detection, information management, and modeling. One of the major areas for improvement identified by those involved with the response to the DWH incident was risk communication and public perception surrounding response efforts. All groups identified risk communication as a major research area for their topic. The links mentioned above, especially the ones between human dimensions and other topics, should be considered in future research. Improving the way scientific and engineering information is presented to the public should be a key research area moving forward. This summary of the workshop, along with the detailed workshop report, will inform funding entities and researchers as to needs in order to improve oil spill response. While this workshop and its outcomes are not exhaustive, they provide a focused list of R&D needs that, when accomplished, will greatly advance oil spill response moving forward.

6.0 ACKNOWLEDGEMENTS

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