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Hearing: *Turning Ideas into Action: Ensuring Effective Clean Up and Restoration in the Gulf*

Chairman Cantwell, Ranking Member Snowe, and distinguished members of the Committee on Commerce, Science and Transportation's Subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard , thank you for the opportunity to appear before you today on behalf of the Coastal Response Research Center and the Environmental Research Group at the University of New Hampshire. My perspective on the use of the applied research during the Deepwater Horizon (DWH) spill response, and obstacles that impede transforming research results into practice, is highly influenced by my work with the Coastal Response Research Center (CRRC). In order to make that perspective clear, I will first give you an overview of the Center's history, mission, activities and its approach to oil spill research and development (R&D).

1. Overview of Coastal Response Research Center

In 2002, NOAA's Office of Response and Restoration (ORR) became increasingly aware of the lack of oil spill R&D in its areas of primary responsibility: fate and behavior of spills and their impacts on natural resources and human activities. ORR recognized the role that a research university could play in addressing these needs, and started working with the University of New Hampshire to address this problem. The CRRC (http://www.crrc.unh.edu), a partnership between NOAA ORR and the University of New Hampshire, was created to address the need for improved spill response and restoration. The Center oversees and conducts independent research, hosts workshops, and leads working groups that address gaps in oil spill research in order to improve response, speed environmental recovery, and reduce the societal consequences of spills. In 2004 the partnership was codified by a memorandum of agreement between the University of New Hampshire and NOAA. CRRC acts as an independent, non-partisan entity to bring together members of the oil spill community, as well as those in relevant fields outside the spill community, including industry, local stakeholders, and state, federal and international agencies to address the many technical, economic, social, and environmental issues associated with oil spills in marine environments. Funding for the Center has been largely by Congressional appropriation (Table 1) with some allocations from ORR's base budget.

Table 1
CRRC Funding History

Fiscal Year	Appropriation	Grant to UNH	*[Other funding; specify]*
2002	$750,000	$701,997	
2003	$750,000	$714,580	
2004	$2,000,000	$1,978,955	
2005	$2,000,000	$1,694,312	
2006	$3,000,000	$2,481,900	$75,000 (Marine Debris/NOAA, ORR)[1]
2007	$1,800,000	$1,435,249	
2008	0	0	$49,000 (eSCAT/NOAA, ORR)[1] $60,000 (ERMA®/NOAA, ORR)[1] $36,000 (In-situ/API)[2] **$145,000 (2008 Subtotal)**
2009	0	0	$25,000 (Workshop/ExxonMobil)[2] $63,000 (Workshop/NOAA OCRM)[3] $162,000 (ERMA®/NOAA, ORR)[1] **$250,000 (2009 Subtotal)**
2010	0	$200,000	$220,000 (ERMA®/ for Gulf/NOAA)[1] $30,000 (eSCAT for Gulf/NOAA)[1] $65,000 (NOAA, OCRM)[3] $139,000 (NOAA, ORR)
TOTAL 02-10	**$10,300,000**	**$9,206,993**	**$924,000** **($139,000 for CRRC's Direct Oil Spill R&D Use)**

[1]eSCAT and ERMA® funding is primarily for the UNH Research Computing Center to work on computer programming. Marine Debris funding was for an Environmental Research Group project.
[2] $61k to the Center for Spills in the Environment from API ($36k for In Situ Burning) and $25k from Exxon Mobil for partial support of the 2009 R&D Workshop)
[3] Funding for workshop on Ocean Thermal Energy Conversion (OTEC) from NOAA OCRM - not oil spill related.

The Center is served by a multi-agency advisory board, comprised of members from U.S. EPA, NOAA, USCG, state-based R&D programs, and industry that provide guidance on program direction. The board, in conjunction with the UNH and NOAA co-directors, developed five objectives for CRRC: (1) funding and oversight of relevant, peer-reviewed research that is able to be developed into practical improvements in oil spill response; (2) hosting topical workshops and working groups that include representatives of all spill community stakeholders to focus research efforts, and ensure that crucial real-world experience from oil spill practitioners is considered; (3) educating the next generation of spill responders through outreach and support of undergraduate and graduate student projects; (4) involving members of the international oil spill community to tap into expertise from around the world; and (5) develop response tools to aid responders.

Funding of relevant, peer-reviewed research is accomplished through a periodic request for proposal (RFP) process. Proposals are reviewed by three to four experts in the area of the proposed research. They are ranked by their scientific validity and how well they address key research needs related to the fate, behavior and effects of oil in the environment, and is likely to lead to practical improvements in oil spill response and restoration. A panel of leading scientists and practitioners then review the peer-reviewed and ranked proposals and recommend which should be funded. Each funded research project is assigned a NOAA liaison to ensure the research can be transformed into practice, and, in addition, CRRC's Science Advisory Panel meets annually to review progress of the research and provide feedback to improve the quality and efficacy of the research.

2. Use of Applied Research Available and Implemented During DWH Incident

There are numerous examples of information and technology created during applied oil spill R&D being used during the DWH incident. I will highlight a few that CRRC has been involved with.

A. <u>CDOG/GNOME Model Linkage</u>

One of the first projects that the Center funded was conducted by Dr. Poojitha Yapa of Clarkson University. Dr. Yapa developed a computer model to predict the fate and behavior of oil and gas as it rises to the surface from a deepwater well blowout. The development of the Clarkson Deepwater Oil and Gas (CDOG) model was funded by the Minerals Management Service (MMS). NOAA's Office of Response and Restoration (OOR) uses its GNOME model to predict the fate and behavior of oil in surface water. A key issue, identified by NOAA modelers, was the inability to input data from the CDOG model into the GNOME model. This link is essential to the understanding of the fate, behavior and trajectory of the oil from a leaking deepwater well, as well as developing impact predictions (i.e., where the oil from a leaking deepwater well would appear on the surface and what resource it would potentially impact). With this information, responders can determine the best response strategy to protect these critical resources. During the DWH response, ORR modelers used the CDOG/GNOME predictions to generate daily trajectories for the Unified Command to aid in decision-making.

B. <u>Environmental Response Management Application (ERMA)®</u>

In the spring of 2006, the Center began funding a collaboration between NOAA ORR scientists and UNH computer researchers to display spill related information in a graphical and user-friendly manner. Data visualization can increase situational awareness during a large spill, especially when many of the decision makers are in different locations (e.g., for the DWH incident: Houma, LA; Mobile , AL; Tyndall, MS; St. Petersburg, FL; Washington, DC). In addition, it is important that the application is in a common format that allows most individuals to easily use it. The common way to display geographical data (referenced by its latitude/longitude) uses GIS software that requires special expertise and high-end computers to operate.

The NOAA/UNH collaboration resulted in the Environmental Response Management Application (ERMA) ®, a web-based platform that displays data (e.g., spill trajectories, current and predicted wind direction and strength) on a map that is familiar to most people. In this way, data can be overlaid on a common geospatial grid (e.g., the Gulf of Mexico) to see resources at risk of oiling, the predicted trajectory, and the assets available to protect oil from contacting the sensitive resources.

ERMA® is a good example of how a data management and visualization tool used in one field (wastershed management) can be applied to another (oil spill response) as a result of interactions between scientists and spill response practitioners. The method in which ERMA® evolved was crucial to its development and successful transfer from academia to the DWH Incident Command systems. In June 2006, after a very basic prototype was developed for Portsmouth, NH harbor. CRRC hosted a workshop that brought together Region I spill responders to demonstrate how ERMA® could aid in spill response. The workshop helped identify a team of practitioners who were willing to work with ORR and UNH researchers to develop a more detailed version of ERMA. During the next several months, development continued, as did demonstrations of ERMA's® capabilities to various agencies and the private sector. EPA Region II then funded an ERMA® for the Caribbean which was fully developed and used in a spill exercise in 2009.

When the DWH blowout occurred, the base platform of ERMA® was used to create and populate a Gulf of Mexico ERMA (GOMEX ERMA) specific to the incident, and has been in use ever since. A public site (www.geoplatform,gov) was created, and much of the information is also available to the public.

C. Other Applied Research Being Used During the DWH Incident

CRRC facilitated a webinar the third week of June hosted by the Interagency Solutions Group (IASG) of the National Response Team (NRT). The purpose of the webinar was to determine what data is available and being collected regarding the efficacy and effects of surface and subsurface dispersant use during the DWH incident. Over 70 representatives from federal and state partners participated, and data was presented by USGS, USCG, NOAA, U.S. EPA, and DOE scientists and practitioners. Much of the data was being collected using techniques developed and modified for use in oil spills during the last decade (e.g., Tier II/III SMART dispersant monitoring protocols, LISST particle counter, holographic imagery to determine particle size and distribution). While many of these tools are in use, they are not at a stage where the interrelationships among them and the ability to use their output in a quantifiable manner are possible. This is in large part because the resources to fund such research and development have not been available.

I would be remiss if I did not also acknowledge that as is typical during most prolonged environmental events, technology has also been developed and applied during the spill. Some noteworthy examples include the work of the Flow Rate Technical Group (FRTG) where members used mass balance, plume analysis, and nodal and reservoir analyses methods to estimate the flow of oil from the wellhead. Their work has refined the estimate of the size of this leak from its initial estimated 1,000 to 5,000 barrels/day (BPD) to the range of 35,000 to 60,000 BPD. Additional post-spill R&D will improve the ability to predict the flow and yield a more precise estimate. Another example is the Oil Budget tool being developed by USGS, NOAA, and the USCG which will help estimate the mass of oil that is naturally weathered (e.g., evaporated, biodegraded, dispersed) as well as that mechanically recovered and chemically dispersed or burned. Again, the tool is a prototype and will need further development, testing, and refinement before it is part of the standard package of a response, but it is well on its way.

Obviously, it is not desirable to have to build tools or response /restoration technologies during a spill, but as has been demonstrated over history, “necessity is the mother of invention.” This is especially true because oil spill R&D has been typically under-funded since the mid-1990's.

3. Obstacles that Impede Transformation of Research into Practice

There are several obstacles that impede the transformation of research results into practice, but the most significant among them is that much of the necessary oil spill response and restoration research is not funded. I was delighted to read the two pieces of legislation that accompanied the invitation from Chairman Rockefeller to speak before you today. The establishment of a Federal Oil Spill Research Committee and improvement of NOAA's, USCG's, and the coastal states' abilities to sustain healthy ecosystems through the spill preparedness, prevention, response, restoration, and research will help address the lack of adequate resources to do the R&D needed. As you clearly know, the existing R&D structure codified in OPA 90 has not been adequate to address the gaps in data, tools, and techniques that have been highlighted in the DWH incident and in many of the workshops the CRRC has held since 2003. (Table 2).

Table 2: CRRC-led R&D Needs Workshops.

U.S. Coast Guard Arctic Response - April 23, 2010
NRDA in Arctic Waters: The Dialogue Begins - April 20-22, 2010
Sea Grant & NOAA ORR Collaboration - January 25, 2010
Ocean Uses Atlas - January 12-14, 2010
Response to Liquid Asphalt Releases in Aquatic Environments - October 21, 2009
2009 Research & Development Needs - March 17-19, 2009
Oil Spill Modeling Working Group Meeting - September 16-17, 2008
Opening the Arctic Seas: Envisioning Disaster & Framing Solutions - March 18-20, 2008
HEA Metrics Workshop - December 4-6, 2007
Environmental Response Data Collection Standards - September 25-27, 2007
Modelers' Summit - June 26, 2007
Submerged Oil Workshop - December 12-13, 2006
Innovative Coastal Modeling for Decision Support: Integrating Physical, Biological, and Toxicological Models - September 26-28, 2006
Toxicology Working Group Summit - August 15 & 16, 2006
Workshop on Research Needs: Human Dimensions of Oil Spill Response - June 13-15, 2006
Research & Development Needs for Making Decisions Regarding Dispersing Oil - September 20-21, 2005

In fact, the Center, in its workshop reports has outlined consensus R&D plans for dispersants, dispersed oil, submerged oil, modeling, Arctic response, National Resource Damage Assessment (NRDA), and human dimensions, as well as a 5-year overall R&D plan that includes proposals for oil forensics, geospatial data management, and spill response during disasters. These workshops have included participants from federal, state and international agencies, NGO's, industry, academia, and private sector researchers. The issue is not identifying the needed R&D, but rather it is having the funds to support this work. The Center maintains five working groups (Table 3) that consist of members of oil spill R&D community. These working groups coordinate which agency funds specific R&D projects to help avoid duplication of effort and best use of scarce financial resources. In addition, these working groups help to disseminate results among practitioners and monitor which research needs have been addressed. The CRRC typically works in concert with other working group members to hold educational sessions at conferences such as Clean Gulf where practitioners meet to learn about recent developments in oil spill R&D. Some examples are found in Table 4.

Table 3: CRRC-led Working Groups

Dispersants Working Group
Modeling Working Group
Submerged Oil Working Group
Toxicity Working Group
Ephemeral Data Working Group

Table 4: Conferences Where CRRC Hosted/Co-Hosted 1/2 Day Technology Transfer Sessions for Practitioners

Conference	Date	Title of Session	Sponsors
Clean Gulf	November 17-19, 2009	Applied Research for the Spill Response Community	LOSCO, OSRADP, TGLO, and CRRC
Clean Gulf	October 28-30, 2008	Applied Research for the Spill Response Community	LOSCO, OSRADP, TGLO, and CRRC
International Oil Spill Conference	May 4-8, 2008	Efficacy and Effects of Dispersants in Oil Spill Response: Progress since the 2005 NRC Report	CRRC
Clean Gulf	Nov 15-16, 2007	Applied Research for the Spill Response Community	LOSCO, OSRADP, TGLO, and CRRC

Another key issue with R&D funding is that it follows a “boom and bust” cycle, usually centered only spurred by major oil spills. A large infusion of funding for oil spill preparedness, prevention, and response came after the Exxon Valdez in 1989, encouraged in part by implementation of OPA 90. While R&D funding was authorized and appropriated for USCG, MMS, and EPA, as well as the two Alaska regional citizen’s advisory councils (RCACs) and the Oil Spill Recovery Institute (OSRI), the budgets have not grown commensurate with inflation, resulting in less R&D as time goes on. For example, the MMS full-scale oil spill research tank in Leonardo, NJ (OHMSETT) has run a number of equipment and training studies with mechanical recovery devices and dispersants. However, these tests are expensive and maintenance on such a facility is high. A fixed budget has diminished what can be tested at OHMSETT, and many research and development budgets cannot accommodate the costs of doing full-scale testing there, even though it would be desirable.

Technology transfer is an arduous process and is often very costly and time consuming. It requires linking the researcher and the end user together, so that the goals and capabilities of each party are identified clearly so that the technology can be best adopted to meet their final goals. It is not only the researcher who must continually modify and adapt, but often also the practitioner who begins to "see" the potential and weaknesses of the new technology and revises his/her understanding of its application. The CRRC addresses this by assigning NOAA liaisons to each funded project to help ensure the project remains focused on the end user. As with ERMA®, this may evolve into interactions with teams of end users as the technology matures. For example, several CRRC staff and students worked with NOAA Assessment and Restoration Division (ARD) scientists/practitioners to develop a field manual on acute toxicity data for polycyclic aromatic hydrocarbons (PAH), a common contaminant during release of oil to the environment. The information and format of the manual was presented to a cross-section of private sector and federal and state end users on several occasions via webinar. Each time, the end users have excellent recommendations for improving the product, some of which were addressed in subsequent editions of the manual. The toxicity manual is currently being used as a source of toxicity information during the DWH incident because each data point included has met the most rigorous quality control standards (i.e., the data have all been carefully validated) and it is in format available and useful to practitioners.

A significant obstacle to continued oil spill R&D is the infrequent nature of oil spills. The last major well blowout in the Gulf of Mexico was the IXTOC in 1979. In the interim, drilling and production technology for offshore oil and gas has grown tremendously and allowed work to proceed at water depths greater than 5,000 feet, tapping reservoirs many miles below the sea floor. R&D for the requisite response technology needed to address such a deepwater accident as the DWH has <u>not</u> occurred.

The Center is currently involved in organizing a series of meetings with a broad spectrum of stakeholders on the R&D issues identified during the DWH incident, using models we have used for similar topics in the past (e.g., dispersants R&D workshops followed by working groups) including federal, state, and local stakeholders, NGO's and the private sector. These workshops will also involve a commensurate effort to identify and collect existing literature on related topics to ensure research efforts are not being duplicated. The stakeholders involved in the spill as a result of BP's funding of LA, MS, AL, and FL researchers at universities and institutes will also be included. This is absolutely necessary and must be done immediately to avoid duplication of effort, insure that the practitioners' research needs are addressed and the research is transferred to end users for incorporation in future spill response and restoration.

Even if the needed spill response or restoration technology is developed as a result of an R&D effort, the incentive for a private sector partner to produce it for commercial sale is minimal. This is less true if use of the technology is mandatory. For example, if the DWH incident results in regulations requiring caps to be available for immediate deployment in case of a blowout, there will be a fairly major incentive to manufacture the caps (i.e., there are roughly 4,000 platforms of production platforms alone in the US waters of the GOM). The incentive to manufacture large numbers of technology-enhanced skimmers and booms is less clear. The reality is that a fleet of such devices is expensive to maintain, especially when the likelihood they will be used more than a few times, if at all during their useful life. Even then, the "fleets" will likely be regional and not site specific as it is almost impossible to predict where and when a spill will occur. In this regard, the Arctic poses an even more difficult challenge, as assets may only need to be deployed seasonally when there is open water.

While R&D can develop solutions to address a variety of oil spill response and restoration issues, there is always the problem of adapting those technologies to a specific spill and the prevailing environmental conditions. Each spill is unique in its timing, location (e.g., water depth), and variables (e.g., flow rate, type of oil) as well as the habitats and resources that must be protected. While this dictates some direct investment in site-specific technologies (e.g., skimmers designed to collect and process oil in broken sea ice), it often can be addressed by building in flexibility in devices or developing robust templates, as with ERMA®, that can be used and adapted quickly to a given spill. These are details that must be addressed in the initial stages of an R&D project.

Finally, it is important to address human dimensions-related issues, a topic that, with the exception of how to incorporate volunteers in response, has been largely under-funded for oil spill response and restoration. Human dimensions R&D relates to risk communication, valuing natural resources, social impacts, coordination in response and restoration, subsistence, and environmental ethics. It is a factor in every spill. It involves regional and local culture and can render a "successful" spill response in the perspective of the local community a "disaster." One major problem is the frequent disconnect between the metrics used by responders to assess success of a clean-up vs. those used by the local community. For example, the number of gallons of oil recovered per day in on-sea activity by skimmers and in-situ burning may be meaningless to local residents or fishermen if the beaches are fouled or commercial fisheries are closed. Likewise, in Alaska, responders who do not incorporate local knowledge of currents and seasonal migration may find that they are greeted suspiciously. Indeed, this may turn to scorn if generated oil trajectory is incorrect and the oil goes where the local fisherman predicted it would. Going forward, human dimensions research, such as that conducted by Tuler and Webler for CRRC, must become a R&D priority (Table 5).

Table 5: Socio-economic research by SERI (Thomas Webler, Seth Tuler)

"Establishing Performance Metrics for Oil Spill Response, Recovery and Restoration"	$229,362	Completed 2007
"Social Disruption from Oil Spills and Spill Response: Characterizing Effects, Vulnerabilities, and the Adequacy of Existing Data to Inform Decision-Making"	$239,335	Fall, 2010

Conclusion

- There are several impediments to translating oil spill R&D into practice:
  - The lack of adequate, sustained, funding for R&D on a long-term basis
  - The need for rigorous peer review at all stages of the R&D process
  - The need for coordination between federal, state, and international governmental agencies and other critical stakeholders (e.g., NGOs, industry) regarding oil spill R&D
  - The need to facilitate the translation of the results of spill R&D into practice
  - The infrequency of major spill events and the resulting disincentive for the private sector to produce technologies that may be in low demand
  - The site specific nature of most spills that dictates specialized technologies (e.g., for use in the Arctic) and/or robust templates that can be adapted quickly to a given spill
  - The issues of diverse and specific human dimensions related aspects to a given spill involving: (a) the ecological role of humans as proximate *causes* of ecosystem stress, and underlying social drivers of those causes, (b) *consequences* of ecosystem stress for the achievability, sustainability, and trade-offs among diverse societal objectives, and (c) human mitigation and adaptive *responses* to ecosystem stress, that must be addressed to insure productive interactions with local and regional stakeholders.
- Going forward, R&D needs can be identified using an inclusive stakeholder approach with specific R&D workshops and coordination of subsequent efforts by working groups.
- R&D must incorporate rigorous peer review by scientists, engineers and practitioners and end users as well as human dimensions related stakeholders to ensure the technologies developed will meet the needs identified. This may include assigning practitioners as liaisons during R&D and in using the team approach to review as the technology matures.
- There must be coordination of R&D across the stakeholder groups for the U.S. to succeed in spill response and restoration technology development and implementation. This requires cross-agency federal coordination, as addressed in legislation being considered in Congress, but must also encompass other governmental agencies (e.g., state, local, international), as well as NGO, academia, industry and the private sector.
- Federal R&D funding must be authorized and appropriated on a consistent, long-term basis.
- Federal R&D funding should require the research to address: existing data and appropriate literature on the topic, technology transfer by incorporating end users in all aspects of the process, flexibility to adapt to spill specific conditions, and consideration of human dimensions.

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