

Coastal Response Research Center

Annual Report

2008



Greetings from the Center's Co-Directors

This spring, the University of New Hampshire (UNH) Coastal Response Research Center celebrates its fifth year of operation and partnership with the National Oceanic and Atmospheric Administration's (NOAA) Office of Response and Restoration (ORR). In this time, the Center has received great support from NOAA and UNH, and had many exciting opportunities to collaborate with state, federal, and international entities, academic institutions and industry. Like many organizations facing financial challenges, the Center has made the most of its available funds by leveraging resources and establishing partnerships. Unfortunately, we have also had to reduce our staff. As of July 2009, Kimberly Newman and Kristin Bailey-McCarthy are no longer with us. Kimberly has been a Research Scientist with the Center since its inception. Kristin, a Program Support Assistant, has been on staff since 2006. We will miss them both very much and are very grateful for their dedicated service to the Center. We wish them both the very best.

In 2008, the Center convened an international "think tank" to address potential Arctic marine disasters in partnership with the United States Coast Guard and the U.S. Arctic Research Commission. The findings of the workshop, released in January 2009, were an integral feature in the 2009 Arctic Marine Shipping Assessment Report published by the Arctic Council.

In collaboration with its NOAA partners, the Center focused efforts on the development of practical applications and tools for the spill response community: developing and implementing a spill communication protocol between NOAA responders and Sea Grant agents in coastal Louisiana; synthesizing oil toxicity data and creating a practical tool to aid spill response decision-making; and initiating the transition of the Environmental Response Management Application (ERMA) from a research and development (R&D) prototype to a fully operational product.

In 2009, the Center will host its second *Research and Development Priorities: Oil Spill Workshop* to identify current applied science needs that will improve decision-making across the continuum of oil spill preparedness, response and restoration. The Center will also host a one-day workshop entitled *Response to Liquid Asphalt Releases in Aquatic Environments* to address topics related to asphalt spills, detection, response, and recovery. Late in the year, the Center will convene an R&D workshop on biological issues associated with oil spills in the Arctic.

Through these and other endeavors, the Center will continue to serve NOAA and the spill response and restoration communities with high quality research, education of the next generation of the oil spill community, and outreach. For more information on these and other Center initiatives, visit the Center's website at www.crrc.unh.edu.

We hope you enjoy reading about the Center's 2008 activities and initiatives. We look forward to continuing our service to NOAA and the oil spill community.

Best regards,



Nancy E. Kinner, Ph.D.
Professor, Civil/Environmental Engineering
UNH Co-Director



Amy A. Merten, Ph.D.
Environmental Scientist
NOAA Co-Director



Center Announcements

UNH Co-Director Receives 2008 Faculty Excellence Award in Public Service

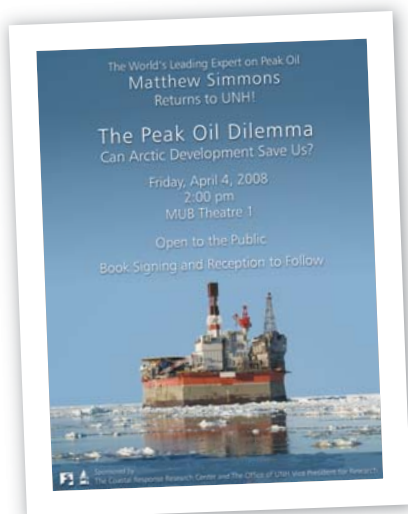
Center Co-Director Dr. Nancy Kinner was one of ten recipients of UNH's University-wide Faculty Excellence Awards. Nancy was recognized for her Public Service, Outreach and Scholarship and especially her leadership of the Center. Congratulations, Nancy!



Center Initiative Updates for 2008

Arctic Workshop

In March, the Center partnered with the U.S. Coast Guard Office of Spill Planning and Preparedness and the U.S. Arctic Research Commission to host *Opening the Arctic Seas: Envisioning Disasters and Framing Solutions* at UNH. The workshop was held to address the risks to human health and safety, the environment, and Arctic communities following various potential major marine incidents in the Arctic Seas. During the workshop, participants from a range of disciplines discussed the most probable threats for the fragile Arctic regions; strategies for coordinating and funding a holistic risk assessment in the Bering, Beaufort and Chukchi Seas; potential resources at risk and other baseline needs; international coordination and governance; and research and development needs. The Center worked with a dedicated organizing committee of Arctic nations' representatives to plan the event. Read more about the Arctic workshop beginning on page 6.



The Peak Oil Dilemma

In April, the Center and the University of New Hampshire's Office of the Vice President for Research co-sponsored an appearance by energy analyst Matthew R. Simmons, one of the world's leading experts on peak oil and author of *Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy*. Simmons' presentation entitled, "The Peak Oil Dilemma: Can Arctic Development Save Us?" was presented to a full audience at UNH's Memorial Union Building theater. The event was free and open to the public.

ERMA Used in Spill Drill

The Center's UNH and NOAA Co-Directors, Nancy Kinner and Amy Merten; Center Affiliate and NOAA collaborator, Michele Jacobi; and NOAA contractor, Jill Bodnar participated in Sprague Energy Corporation's National Preparedness for Response Exercise Program (PREP) drill in Portsmouth NH, in June. The Center's Environmental Response Management Application (ERMA) prototype, a web-based, geographical information system platform developed specifically for environmental response activities, was employed during the drill to access response plans, deliver real-time data, compile information on resources at risk, and provide an operational picture of the response in progress. Read more about ERMA beginning on page 16.

Oil Spill Modeling Working Group

In September, the Center hosted a meeting of the Oil Spill Modeling Working Group at UNH. During the meeting, Working Group members reviewed the state-of-the-art in modeling relative to spill response, physical transport, physical fate and behavior, and biological effects; identified gaps and weaknesses in capabilities; prioritized research needs; and discussed future steps toward improving the state-of-the-art in these areas. The gathering was a first step toward developing algorithms to better predict the 3D behavior of spills. These efforts will continue in 2009.

North by 2020 Forum Workshop

The Center's UNH Co-Director, Nancy Kinner, participated in the University of Alaska International Polar Year (IPY) – North by 2020 Forum Workshop entitled *Reducing Environmental Risks and Impacts in Arctic Coastal and Offshore Oil and Gas Exploration* in Barrow, Alaska on November 12-14. The workshop addressed key questions centering on how technological advances, local knowledge, science, and adaptive management can together minimize the environmental risks and impacts of offshore oil and gas, particularly during exploration. The workshop convened approximately 90 participants from the North Slope, industry, government, academia, Canada, and Norway, with expertise in Inupiat environmental knowledge, Arctic technology, spill response, management regimes, stakeholder involvement, and natural and social sciences. Dr. Kinner served as moderator for the workshop session on Oil Spill Response and Clean-up in Arctic Waters. The workshop was sponsored by the University of Alaska, U.S. Department of State, North Slope Science Initiative, Coastal Response Research Center, BP, Shell, Arctic Slope Regional Corporation, and Alaska Ocean Observing System.

Outreach

International Oil Spill Conference

In May, the Center participated in the International Oil Spill Conference (IOSC) in Savannah, GA. Center Co-Directors, Amy Merten and Nancy Kinner, ran a pre-conference short course entitled "Efficacy and Effects of Dispersants in Oil Spill Response: Progress Since the 2005 NRC Report." Course topics included a history of dispersants and dispersants use, an overview of dispersants research needs (as identified in the Center's 2005 Dispersants Use Research Needs Workshop), the fate of dispersants, effects of

dispersants on organisms, and dispersant modeling. The Center had an information booth at the Conference Exhibition. Materials on Center-funded research and initiatives were available at the booth, and Center staff and graduate students were on hand to provide information and answer questions for interested visitors.

NOAA ORR's Michele Jacobi presented a paper entitled "Environmental Response Management Application" in the Modeling/GIS conference session at IOSC. The paper provided an overview of the Center's ERMA prototype. Jacobi also demonstrated ERMA at the Center's information booth.



ERMA

The Center's UNH Co-Director gave an overview presentation on ERMA to the Regional Response Team (RRT) III meeting in Rehoboth Beach, DE in May and the Louisiana State University Sea Grant office in July. The Center's NOAA Co-Director, Amy Merten, and Michele Jacobi conducted demonstrations of the ERMA platform for the National Response Team/Regional Response Team Co-Chairs meeting in June and the U.S. Environmental Protection Agency (EPA) Region II in Edison, NJ in August 2008. ERMA is being deployed in the Caribbean and the project was kicked off at the Nov 2008 Caribbean RRT meeting in San Juan, Puerto Rico.

Clean Gulf Conference

In October, the Center participated in the Clean Gulf Conference and Exhibition in San Antonio, TX. The Center's information booth featured materials on Center-funded research and initiatives. The Center also sponsored, in partnership with the Texas General Land Office (TX GLO) and the Louisiana Oil Spill Coordinator's Office (LOSCO)/Louisiana Applied and Educational Oil Spill Research and Development Program (LA OSRADP), the *Applied Research for the Spill Response Community* pre-conference workshop. The workshop welcomed more than 100 attendees for presentations on a broad range of topics relevant to spill response, including these Center-sponsored presentations:

- *Mitigation of the Human Dimensions of Spills in Coastal Louisiana: Collaboration between NOAA's Office of Response and Restoration and Louisiana Sea Grant*, Heather Ballestero, UNH Master's student
- *Guidance for Dispersant Decision-Making, Potential for Impact on Aquatic Biota*, Deborah French McCay, Applied Science Associates, Inc.
- *Investigation of Physical and Chemical Causes of Heavy Oil Submergence*, Bruce Hollebhone, Environment Canada
- *Competing Perspectives about Oil Spill Response Objectives: A Comparison of Stakeholders' Views in Four Regions*, Seth Tuler, Social and Environmental Research Institute



U.S. and Canada Northern Oil and Gas Research Forum

In October, NOAA Co-Director, Amy Merten, presented ERMA and the Center's oil-in-ice project at the *U.S. and Canada Northern Oil and Gas Research Forum: Current Status and Future Directions in the Beaufort Sea, North Slope and Mackenzie Delta* in Anchorage, AK. Dr. Merten also briefed several oil companies on the use of an Arctic ERMA.



Dave Westerholm

Director, NOAA's Office of Response and Restoration

CRRC Board of Advisors

Dave Westerholm, the Director of NOAA's Office of Response and Restoration, has provided unique and valuable insight to the Coastal Response Research Center's Advisory Board. He came to NOAA in 2008 from an executive position in the corporate world and prior to that had a 27 year Coast Guard career. In the Coast Guard, he specialized in marine safety, security and environmental protection, where he served on the front lines as a responder, coordinated operations as a Federal On-Scene Coordinator (FOSC) and culminated his career as the Chief of the Office of Response. He also served as Vice Chair of the National Response Team and co-lead of the interagency group for Oil Spill Research and Development.

As Westerholm points out about his experience on the Board, one only has to look back a few years to understand the importance and impact the Center has had on the response community. "The Center's practical approach to finding today's solutions to tomorrow's problems is imperative to the success of the public-private partnership that is necessary in oil spill preparedness, response and restoration. Recent efforts in developing ERMA (an environmental management tool) as well as the *Oil Toxicity Field Guide* are just two examples where the efforts of the Center will pay great dividends in our nation's future." He notes that of equal and possibly greater value has been the Center's ability to host and facilitate meaningful conferences that bring together leading researchers and policy experts to deal with some of our nation's most challenging oil spill issues—including response in the Arctic. Westerholm says he is proud to be part of the Advisory Board and is working with other Board members to develop the best strategy forward for the Center.

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Opening the Arctic Seas: Envisioning Disasters and Framing Solutions

Sea ice coverage in the Arctic reached record lows during the summers of 2006 and 2007. According to data from the U.S. National Snow and Ice Data Center (NSIDC), ice coverage in September 2007 represented the lowest September extent on record and a 39% reduction from the 1979-2000 mean value. While some inter-annual variability exists in seasonal sea ice coverage, the overall trend is downward. Recent modeling by the NSIDC suggests that the Arctic will be consistently ice-free during the summer as early as 2030.



The decline of Arctic sea ice has resulted in increased activities such as oil and gas exploration, mineral speculation and exploration, northern-moving fisheries, and tourism in sub-Arctic and Arctic waters. As these activities increase in frequency, the risk of significant maritime disasters is also on the rise. While reduced ice cover during the summer months has allowed a small number of sub-Arctic vessels to transit the region safely, the risk of an incident is greater due to the dynamic nature of the region, as well as the lack of understanding and preparedness of crews untrained for Arctic operations.

Ships operating in the Arctic environment must contend with harsh weather and variable ice conditions that require ice-hardened hulls. Vessels are coated with ice that can alter their stability, and difficulties arise from navigating through ice and broken-ice with poor navigational aids and outdated charts. "Ice formation and break-up are critical times," notes Scott Pegau, Research Program Manager for the Oil Spill Recovery Institute in Cordova, AK and member of the Center's Science Advisory Panel. Ice is unpredictable, and conditions can change quickly. The Arctic marine environment presents unique challenges for incident response, assessment, and restoration activities. Limited response resources, challenging environmental conditions and the remote location of Arctic incidents considerably hamper these efforts. Unlike many other parts of the world, the Arctic is under-prepared for substantial marine disasters; search and rescue (SAR) efforts and spill response activities may be delayed as responders try to arrive from the lower latitudes. "In some areas, there are no roads and no power for hundreds of miles. In the best case scenario," notes Pegau, "it could take six hours for responders to arrive on the scene."



The Center, in collaboration with the U.S. Coast Guard Office of Spill Planning and Preparedness and the U.S. Arctic

Research Commission, hosted a workshop entitled *Opening the Arctic Seas: Envisioning Disasters and Framing Solutions* on March 18-20, 2008 on the University of New Hampshire's Durham campus. The goal of the workshop was to identify current international incident response capabilities, assess future needs, and identify research gaps and action items to improve the ability of Arctic nations and indigenous communities to prepare for and respond to marine incidents and disasters. Invited participants included experts in spill response, SAR, maritime shipping, fisheries, ice dynamics; representatives of the oil and gas and cruise ship industries; and members of the indigenous Arctic communities of the U.S. and Finland. The workshop included presentations on Arctic issues including shipping, indigenous peoples, SAR, tourism, biological consequences and implications, and oil and gas exploration, as well as plenary and small group break-out sessions in which participants discussed the most plausible threats for the changing—and especially challenging—Arctic region.

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The workshop was organized around five potential Arctic marine disaster scenarios based on the collective expertise of the international organizing committee. Scenarios were designed to exercise spill response, SAR, fire fighting and salvage, communications, and governance and legal issues. They were based on current and predicted Arctic activities and, in some instances, bore resemblance to historic incidents, such as the Antarctic sinking of the M/V EXPLORER cruise ship in 2007. Scenarios included the following:

- a 1,500 passenger cruise ship grounding,
- an ice-trapped and damaged ore carrier,
- an explosion on a fixed drilling rig north of Alaska,
- a collision between a tanker and fishing vessel that resulted in a large oil spill, and
- the grounding of a tug towing a barge of supplies in an environmentally-sensitive area near the Bering Strait.



“The workshop convened high level representatives from several countries who could really speak to the response capacity in the Arctic,” notes John Whitney, NOAA Scientific Support Coordinator in Anchorage, AK and workshop participant. “The fact that response efforts are so much more challenging in the Arctic was really driven home. It truly opens your eyes to the possibilities we have to prepare for in this region.” According to Larry Trigatti, Superintendent of Environmental Response for the Canadian Coast Guard’s Central and Arctic Regions and workshop participant, we’re on a frontier in the Arctic. “There’s a renewed interest in the region due to climate change and exploration interests. Traditional Arctic Nations have been trying to get the message out, and now there’s more of an international effort,” Trigatti says. “These types of forums make sure we’re all starting out on the same foot,” he notes. “The more eyes we have looking at a problem, the better the solutions. New people at the table bring new perspectives and more focus.”

In January 2009, the Center released its workshop report, which provides incident-specific summaries and recommendations as well as 17 overarching workshop recommendations aimed at preventing accidents from happening, decreasing the severity of accidents that do happen, and increasing response preparedness for incidents that do occur. Some of these recommendations include:

- strengthening multinational plans and agreements for all types of responses,
- improving baseline information for Arctic resources that could be affected by potential incidents,
- improving logistical support capabilities for disaster responders,
- updating weather data and navigational charts for the Arctic,
- studying the behavior of oil in cold water and improving technologies for spill response in Arctic conditions, and
- designating potential ports in the Arctic where damaged vessels can be taken to safeguard them against the Arctic’s harsh environmental conditions and reduce the risk of harm to the environment.

To access the complete workshop report, visit the Center’s website at www.crrc.unh.edu. The workshop findings are included as part of the Arctic Marine Shipping Assessment (AMSA) Report, published in April 2009 by the Arctic Council.

Whitney credits the workshop, in part, for a recent resurgence in activity related to U.S.-Canadian joint response—an effort in which both Whitney and Trigatti are involved. This effort involves numerous stakeholders, including U.S. and Canadian Coast Guards, Transport Canada, Canadian National Defense, NOAA, native communities, and key oil companies in the region—to name a few. Plans are underway for a joint response table top exercise in 2009 and a possible field exercise in 2010. “The key is that people are talking—sharing information, discussing capabilities, making and revising contingency plans,” says Center Co-Director Amy Merten. “That’s one of our objectives, to bring people together and get them talking. The workshop report has been an impetus for preparedness activities within NOAA, thus it was a great catalyst to move the discussion forward within the agency.”

Science On Ice



Whitney Blanchard goes in search of clues in the frozen waters of the Arctic.

Norway is dark in the winter months, when the sun rises at 10 in the morning and sets around 2:30 in the afternoon. But it's magical, too. Cities are aglow with lights and lanterns, and illuminated ski trails twist like shimmering ribbons through the darkness. Whitney Blanchard '06, '08G, who went to Norway last year on a Student Fulbright Scholarship, lived and worked along the Trondheim Fjord, just south of the Arctic Circle. She loved discovering a new culture, but she went because of the ice—the sea ice, in particular.

She knew that if she wanted to study ice and the oil that might become trapped in its cold layers, she had to go north, to a part of the world where cold and frozen waters and the darkness of winter were interwoven with the fabric of life.

"They are experts on oil and ice," says Blanchard of the scientists she worked with at the Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (SINTEF). The largest research organization in Scandinavia, SINTEF is known for its expertise in petroleum oil spills. They are also partners with UNH's Coastal Response Research Center, whose Ph.D. advisor is Center Co-Director Nancy Kinner. "I'm looking at how the contaminants from an oil spill, if encapsulated in ice, would move through ice during spring break-up," says Blanchard.

She describes a worst-case scenario. "Let's say we're looking at an ice sheet in the Arctic Ocean and it's growing downwards, getting thicker as it freezes," says Blanchard. "Then let's say a pipeline bursts or there's a tanker spill, and the oil goes under the ice, which then continues to freeze. So now the oil is frozen into the ice sheet—a sort of oil sandwich." She goes on to explain the complications that arise because of brine channels and how arctic ice is not so much an ice cube as it is an ice matrix, full of vertically elongated channels. There's permeability and porosity to consider. And salt concentration and warming, which causes migration of the oil. There are also dissolved components of crude oil, particularly PAHs (polycyclic aromatic hydrocarbons), which are known for their toxicity. "At the interface between the ocean and the ice, there's a lot of biological activity," says Blanchard.

The Center is funding a project that includes SINTEF scientists, Rainer Lohmann of the University of Rhode Island, and Hajo Eicken and Chris Petrich of the University of Alaska Fairbanks to understand the fate and transport of the dissolved and particulate-associated contaminants of oil—where they're going to go with respect to space and time. When the ice starts to break up in the spring, will these components move upward toward the surface with the rest of the oil? Will they advect downward in the brine channels? If pollutants move to the water/ice interface, will they affect sea organisms that exist at the interface where the ocean and ice come together? "The goal of the Center-funded project is to look at the concentrations and how long they will be there," says Blanchard.

This research has taken on a real urgency as interest in the Arctic regions has intensified. "We now have melting sea ice up there, which in just the last few years has allowed access to the high north," says Blanchard. "People are not necessarily as prepared as they should be for the spills we know will happen." Which is why the joint oil-in-ice project is so important. It offers one small piece of a complex puzzle that could, ultimately, help to protect a part of the world that is as hazardous as it is beautiful—and fragile.

Story by Suki Casanave

Jim Clark

**Senior Engineering Advisor
ExxonMobil's Oil Spill Research Program**

Science Advisory Panel

According to Jim Clark, Senior Engineering Advisor with ExxonMobil's Oil Spill Research Program, the Coastal Response Research Center has made a niche for itself in the oil spill community. "Since its inception, the Center has really filled a void," notes Clark. "It's provided a forum for stakeholders to come together to exchange ideas," he adds, referring to the Center's research and development (R&D) needs-focused and "hot topics" workshops. "The Center has been instrumental in pulling all the parties together to address important issues," he notes. Important issues, such as the use of chemical dispersants, oil toxicity, the human dimensions of spills, and Arctic disaster risks and response, to name a few.

"The Center is very inclusive and has demonstrated its ability to identify the right people—the appropriate technical experts—for these discussions," adds Clark, who first worked with the Center as a participant and oil industry representative in the Center's 2003 R&D Priorities: Oil Spill Workshop. "They always welcome industry organizations that are willing to participate in the discussion," he says.

Clark's involvement with the Center also includes participation in the Center-led Dispersants Working Group; work on the organizing committee for the Center's 2009 R&D Priorities: Oil Spill Workshop; and continued service on the Center's Science Advisory Panel (SAP). Of his experience on the SAP, Clark says, "it's been eye-opening to learn about other research areas and activities." The Center, with its emphasis on rigorous, peer-reviewed science, he adds, "has elevated the standards and quality of the research beyond the grey literature," which was once more typical in the oil spill community.

And Clark should know. He's been involved in oil spill research throughout his distinguished career, examining such issues as dispersants and the fate and effects of dispersed oil, *in-situ* burning, the biodegradation of oil, and oil toxicity. Clark started as a research biologist with U.S. Environmental Protection Agency, and after the 1989 Exxon Valdez oil spill he worked on a joint EPA-ExxonMobil project conducting environmental assessments of the bioremediation technology developed and applied during the Exxon Valdez oil spill clean-up program. Clark began working for ExxonMobil in 1992 and has been part of their Oil Spill Research Program—initiated in the wake of the 1967 Torrey Canyon Supertanker disaster—for the last 17 years. "I wanted to work in a larger arena—focused on corporate issues, on a global scale," he notes, and feels "very fortunate it was realized." Clark heads ExxonMobil's Oil Spill Research Program for Refining and Supply and is an internationally recognized expert in the development and evaluation of environmentally relevant methods for oil and chemical spill response.

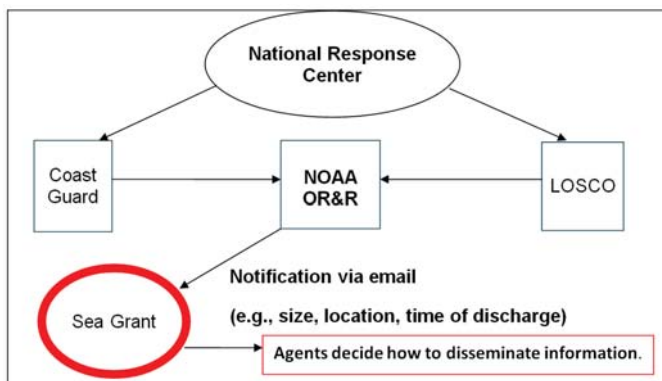
Clark commends "the Center's ability to get students involved and to expose them to oil spill R&D and the oil spill community," referring to undergraduate and graduate student participation in Center workshops, internships, and research. "I enjoy watching young scientists and engineers get involved," Clark adds, "and I look forward to seeing where these students go with their careers."



Communication Protocol in Use in Louisiana

What began as an internship opportunity for UNH Master's and Center-funded student Heather Ballestero has resulted in a valuable spill communication protocol now being used in coastal Louisiana. Louisiana is the fourth highest oil producing state in the U.S. and is a major port through which much of the crude oil entering the U.S. travels. The large volumes of crude oil transported, extracted, and refined in coastal Louisiana pose a constant threat of spills in sensitive habitats, home to numerous species of cultural and economic importance.

Sea Grant—a network of more than 30 university-based programs within the U.S. coastal and Great Lakes states, Puerto Rico, and Guam—helps citizens and coastal communities understand, conserve and better use coastal, ocean and Great Lakes resources through practical research, education and outreach. Their goal is to share research results with those who need it most and in ways that are timely, relevant and meaningful. Sea Grant programs are administered nationally through NOAA and implemented at the local level. While Sea Grant and NOAA's Office of Response and Restoration (ORR) both operate in the coastal states, prior to this Center-funded pilot project there was little intra-agency collaboration because such interaction has never been mandated within NOAA. This project, spearheaded by Ballestero, was initiated to enhance communication between local Sea Grant agents and ORR responders as a means to help mitigate the socioeconomic effects of spills in coastal Louisiana by providing coastal communities and stakeholders with timely information about oil spills, spill response, and restoration and by integrating a local perspective into the spill response Incident Command System (ICS). Louisiana was chosen for the location of this pilot project because of the high frequency of spills and the support of Don Davis in his role coordinating R&D for the Louisiana Oil Spill Coordinator's Office (LOSCO).



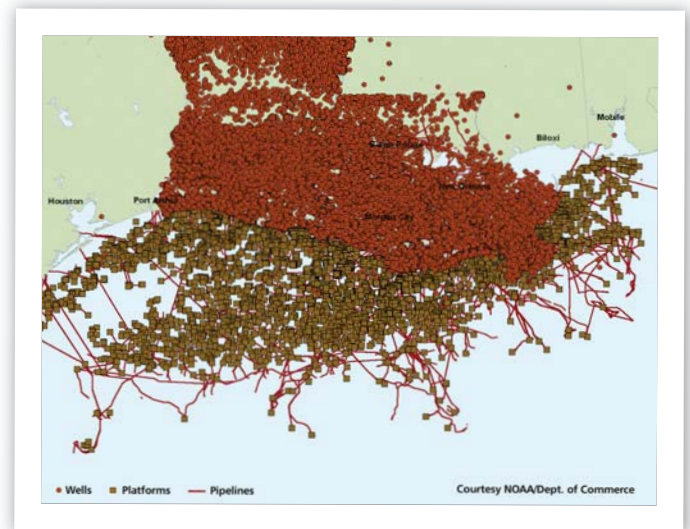
Initial meetings with Sea Grant agents and ORR responders were held in 2007 (see related article in the Center's 2007 Annual Report) to introduce the pilot project; gather feedback and information from agents on coastal resources, economics, and culture; solicit feedback on existing communication practices; and discuss the direction of the project. Because there is no mandate for collaborations, participation was voluntary. During the initial meetings, it was agreed that any spills affecting crawfish, alligator, wildfowl, shrimp, crabs, oysters, or fish would have a significant negative

socioeconomic impact on the region. A final meeting, co-hosted by the Center and LA Sea Grant, in June 2008, convened representatives from the Center, LA Sea Grant, ORR, U.S. Coast Guard, and the

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Barataria Terrebonne National Estuary Program (BTNEP) in Port Fourchon to hammer out the final details of the protocol. The meeting coincided with the Sea Grant quarterly meeting and incorporated a traditional shrimp boil and deep sea fishing voyage close to oil rigs as incentives for participation.

During the Port Fourchon meeting, an informal, unmandated agreement was established between LA Sea Grant and ORR such that, upon learning of a spill incident, ORR representatives agreed to notify Sea Grant agents of the spill via email and provide available incident details (e.g., spill size, location, time of release, type of spill). Once notified, Sea Grant agents disseminate the information to potentially impacted or interested parties (e.g., local officials, affected parishes) through the appropriate channels (e.g., Port Commission Directors), depending on circumstances of the spill. The notification protocol was agreed upon for communications before, during, and after spill events, ensuring that coastal residents and communities, many of which depend on impacted natural resources, receive accurate information in a timely fashion.



The protocol was effectively employed during two spills in 2008—the first, on June 29, a small crude oil spill in the waters off the coast of Grand Isle that fouled three to four miles of coastline, and the second on July 23, a 270,000 gallon fuel oil spill in the Mississippi River at New Orleans. David Bourgeois, Sea Grant Associate Area Agent for the Lafourche and Terrebonne Parishes, appreciates having access to accurate and timely information about the spills. “It’s beneficial to my work,” he says “to be able to receive and provide this type of information.” Bourgeois, the Sea Grant agent with jurisdiction in Grand Isle, was able to quickly notify the Port Commission Director of the June 2008 crude oil spill upon receiving the alert. The type and extent of spill information received by Sea Grant agents, Bourgeois says, is much greater with the communication protocol in place, enabling agents to get the information out quickly to those who need it.



The notification protocol, says Troy Baker, Regional Resource Coordinator for NOAA’s Assessment and Restoration Division (ARD), “is very transferable to other places, but it’s not the sort of thing you can force.” Because there is no mandate for the notification, Baker notes, there has to be a need for the protocol before it can be applied. Such was the case in Louisiana. The Center’s pilot project was a successful effort, he adds, because they asked the right questions and took the right approach, involving the end-users in the development of the protocol. The protocol, says Baker, “holds great promise for other organizations and regions to adopt the same model.” The Center and NOAA plan to expand the notification protocol to other coastal states in 2010.

Oil Toxicity Field Guide

Oil spills are dynamic events that require responders to make quick decisions about where and how to deploy available assets to protect potentially impacted natural resources. To make their assessments, responders need ready access to information on the potential toxic effects of polycyclic and monocyclic



aromatic hydrocarbons (PAHs and MAHs)—the principle toxic components of oil. Traditionally, PAH/MAH toxicity data, crucial for evaluating the biological impacts of oil spills, existed primarily in obscure published papers and largely inaccessible databases. Thanks to a recent initiative, oil spill responders and assessment specialists will soon have access to a new tool to help inform decision-making during the first 96 hours of a spill, when incident-specific data and models may not be readily available. The Center, in conjunction with its NOAA partners, has developed the *Oil Toxicity Field Guide for Aquatic and Marine Habitats* to help NOAA Regional Resource Coordinators and other practitioners evaluate the potential for biological effects of oil discharged in freshwater and marine habitats. The field guide can help users evaluate resource trade-offs, understand the weathering patterns of spilled oil, inform decision-making about field sample collection, and provide training materials for oil spill responders, modelers, scientists, and natural resource damage assessment specialists.

The idea for the field guide arose from the Center's 2006 Toxicity Summit, which convened oil spill toxicity experts and practitioners to evaluate ways of transforming research results into operational strategies and tools. Participants identified the need for a tool that would help responders quickly characterize the toxicity of PAHs to aquatic organisms immediately following a release. Interest in the effort grew, and in late 2007 this proof of concept project got underway. The project's development team consists of Troy Baker and Ken Finkelstein, Regional Resource Coordinators from NOAA's Assessment and Restoration Division; Center Co-Directors Nancy Kinner and Amy Merten; Joseph Cunningham, Center Environmental Engineer; and Tyler Crowe, a Center-funded Master's student.

Finkelstein took the lead in compiling PAH and MAH toxicity data from literature and the U.S. Environmental Protection Agency's ECOTOX Database, amassing roughly 700 concentration-based data points for the initial version. Emphasis was on individual PAHs/MAHs—those found most frequently in the literature—and on the median lethal effects (i.e., LC₅₀) of these compounds on species groups or individual species. A series of standardized graphs were created by Cunningham to show the toxicity of individual PAHs/MAHs to freshwater and marine species and species groups (e.g., fish, crustaceans). With the database and graphs in hand, Baker and Crowe designed a field guide that would be informative and easy to use. To supplement the toxicity data, the team incorporated information on the three source oils most commonly encountered in North American spills—Alaskan North Slope crude oil, South Louisiana sweet crude oil, and diesel—as well as model-derived PAH/MAH weathering information on the source oils. To aid practitioners in using the field guide, a sample assessment worksheet was also included. “The toxicity database is more useable than we’ve had previously,” notes Baker, “and the supporting graphs and field guide make the information much more accessible.”

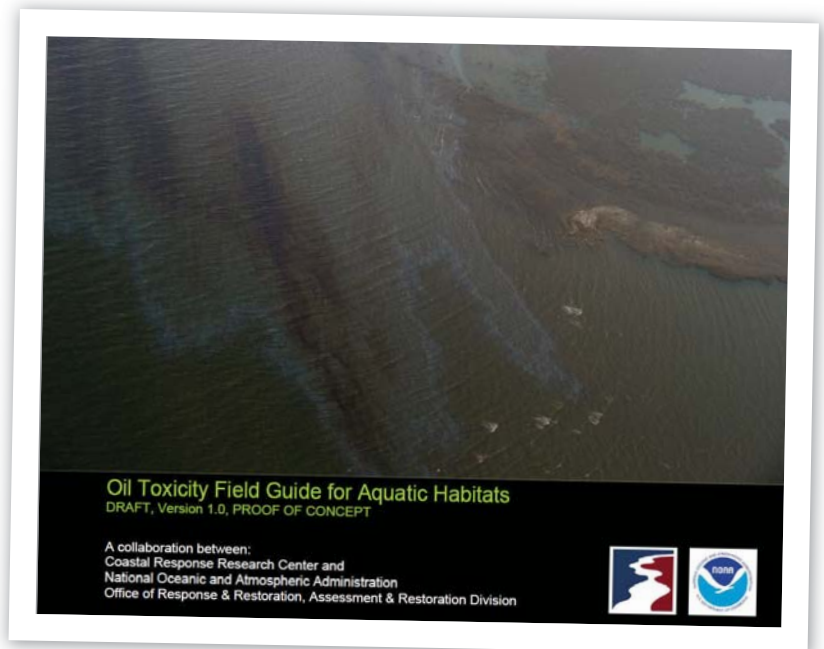
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accessible”*

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The team conducted a full point-by-point validation to ensure the accuracy of the data. “We went back to the original source literature for each data point,” says Cunningham, who spearheaded the rigorous validation effort. “Some data could not meet quality standards so it was not used, but we are much more confident in the remaining data now that the validation is complete.” According to Baker, that level of QA/QC put the project behind schedule by about a year, but the end result was well worth the effort. “We’re only using the best available toxicity data in the database,” says Baker, “and it’s all been referenced back to the original source.”

A draft version of the field guide was tested during the July 2008 fuel oil spill in New Orleans, presented to several groups within NOAA, and reviewed by toxicity experts from the spill community. The initial feedback on the field guide has been somewhat mixed—a great deal of excitement about the field guide concept and the availability of summarized and validated data, yet some concern that the LC₅₀ data is not conservative enough for damage assessment purposes. The project team is using such feedback to improve and expand future versions of the guide. Their current efforts include revising the toxicity graphs to reflect the fully validated data set and updating the technical aspects of the guide. Planning is also underway for Crowe to address the sub-lethal effects of PAHs as part of his graduate research at UNH.

“This is an evolving project,” notes Baker. “We created a template with the toxicity database, and we can use the same process to incorporate new data and species of interest in the future.” Thus far the project has been carried out without external funding. “We’ve had no direct funding except for Center support of Crowe and Cunningham for their work to date. With the next version, we hope to identify more partners and seek funding.” An expansion of the project is something the development team really hopes to see through, as additional information on source oils, chemical compounds, or oil toxicity could be addressed with more resources. The next draft of the field guide is anticipated for release in 2009 and will be circulated for additional peer review. A copy of the field guide will be held in the Office of Response and Restoration’s “war room” in Seattle, WA and serve as a new tool in their response toolbox.



Troy Baker

**Regional Resource Coordinator
NOAA ORR, Assessment and Restoration Division**

NOAA Affiliate

As one of NOAA's Regional Resource Coordinators (RRCs), Troy Baker knows that each day can bring something entirely different than the day before. Baker is one of 25 RRCs nationwide who, as part of ORR's Assessment and Restoration Division (ARD), assess the ecological risk and environmental injury from contamination resulting from spills and hazardous waste sites. While his primary responsibility is within Louisiana, Baker has also supported efforts in the Gulf Region and across America. "RRCs work as a group," says Baker, "assisting one another, as needed, for cross-regional responses and during assessments." NOAA RRCs also coordinate efforts among trustee agencies during the aftermath of a spill. The work provides "a mix of technical, legal and political challenges," says Baker, who enjoys the diversity of issues inherent in his RRC role and the people with whom he interacts.



In January 2009, Baker and his family moved from Baton Rouge, LA to Washington D.C. for a 12-month detail at NOAA headquarters. Baker is thrilled by the opportunity to contribute to NOAA in different ways and to learn more about the organization and how it functions. His detail involves a broad range of projects, including working with the U.S. Coast Guard's National Pollution Fund Center to better understand how pollution claims come together, exploring advanced web-based information sharing technologies, and improving preparedness for multiple incidents, such as San Francisco's Cosco Busan and the New Orleans Mississippi River oil spills that happened within eight months of each other. These kinds of situations place great constraints on personnel and response resources and highlight the importance of preparedness efforts on the multi-regional scale.

Baker's detail will also provide him more opportunity to pass some of his own expertise on to others—both within NOAA and beyond. "This is a great opportunity for cross-pollination—to share experiences with folks across the country," he notes. This is something that seems to come naturally to Baker, who has collaborated on several Center initiatives and activities—serving on the organizing committee for the 2007 Habitat Equivalency Analysis (HEA) Metrics Workshop; leading efforts to produce an HEA manuscript; and spearheading development of the *Oil Toxicity Field Guide for Aquatic and Marine Habitats* (see related article on page 12), to note a few. "Troy is an excellent scientist," says Nancy Kinner, the Center's UNH Co-Director, "he's a hard worker and a fantastic mentor." Baker, who is very supportive of the Center's students, helped introduce Center-funded graduate student Tyler Crowe to the oil spill arena in 2008, giving Crowe first-hand exposure to all that occurs in the Incident Command Post (ICP). "The New Orleans spill happened at the end of his internship," says Baker, "so I wanted Tyler to see what being part of the oil spill community was like—to observe how the ICP and response operated." Baker also helped Center-funded Master's student Heather Ballestero develop the first protocol that facilitates communication between Louisiana's Sea Grant agents and ORR responders during spills (see related article on page 10).

What comes across clearly, when speaking with Baker about his work, is his enthusiasm for new and challenging opportunities and his love of seeking them out. When asked about his current work detail, Baker remarks, "I'm very excited to be involved—working hard, but having a great time doing it!"

Tyler Crowe

Master's Student

During the summer of 2008, just weeks after receiving his dual degree in Civil Engineering and International Affairs from UNH, Tyler Crowe, now a UNH Civil Engineering Master's student, embarked on an internship with NOAA's Office of Response and Restoration in Baton Rouge, Louisiana. Crowe's internship involved a number of projects, most notably collaborating with NOAA scientists and Center staff on the *Oil Toxicity Field Guide for Aquatic and Marine Habitats*.



Crowe worked directly with Troy Baker, NOAA Regional Resource Coordinator, to help develop a field assessment manual from the extensive toxicity database and graphs already compiled by NOAA's Ken Finkelstein and the Center's Joe Cunningham. The goal was to develop a user-friendly tool to evaluate the threat of oil constituents—polycyclic aromatic hydrocarbons (PAHs)—to freshwater and marine species within the water column. "We asked ourselves," says Crowe, "'how do we educate people on injury based on what we have?'" In an iterative process, Baker and Crowe drafted and revised various models of how best to present the data in a user-friendly, yet functional, form. Their efforts resulted in an early draft of the toxicity field guide as well as an interactive CD version of the manual.

"The internship," notes Crowe "was a good 'crash course' in the world of environmental pollutants." In addition to working on the field guide and collaborating with an experience practitioner, Crowe was also given the opportunity to observe response efforts for the July 2008 fuel oil spill at New Orleans.



"Troy was a great mentor," notes Crowe, "he was so positive and open to my contributions." That interaction and the internship experience, Crowe believes, helped him to become a more critical thinker and prepared him well for his graduate work.

In 2009, Crowe is participating in an international research effort on oils spills and dispersants at the Center of Documentation, Research and Experimentation on Accidental Water Pollution (CEDRE) in Brest, France.

Environmental Response Management Application

Immediately following an oil spill, a vast array of data—concerning the size of the release and potential trajectory; the hydrology of the system and biota likely to be impacted; weather forecasts; and the location of key infrastructure and response equipment—needs to be received, processed, shared, and integrated into response management. While responders typically want as much data as possible upon which to base their decisions, the information must be presented in a format that is easy to understand and present to other stakeholders and the public. To this end, the Center spearheaded the development of the Environmental Response Management Application (ERMA), an integrated data management platform, capable of interfacing diverse spatial data sets and real-time information in a web-based mapping format accessible to the incident command post and assets in the field.



ERMA began as an R&D prototype, geographical information system (GIS) platform developed for the NH/ME coastal region in 2007. Designed to improve decision-making for preparedness, response, assessment, and restoration activities as well as other environmental incidents and natural disasters, ERMA assembles real-time and static information from various sources in an easy-to-use, fast, and flexible framework for data assimilation, visualization and delivery. A single ERMA output map is “worth a thousand words” in communicating the state of response activities and potential impacts to sensitive resources and communities.



ERMA was formally introduced to the spill response community during an industry-led National Preparedness for Response Exercise Program (PREP) drill held in Portsmouth, NH in June 2008. The PREP drill dealt with a liquid asphalt spill on the Piscataqua River and focused on effective implementation, management, and accountability of field resources needed during an emergency response. ERMA was used to access existing Geographic Response Plans; supply tide, current, and weather forecasts; compile data on resources at risk; and provide an operational picture (e.g., location of response vessels) as the drill progressed.

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“ERMA proved quite successful in this first drill effort,” notes Piscataqua River Cooperative (PRC) Chairman Don Gray. “It’s a tool that can provide mapping capabilities without needing a GIS specialist on hand.” Gray was one of the many technical advisors involved in the prototype’s early development. “ERMA wasn’t developed in a vacuum,” notes Gray. “The Center involved a lot of potential end-users in the planning and development process, which makes for a better end product.”

As a first step in moving ERMA toward broader use, the Center’s NOAA Co-Director Amy Merten and NOAA Environmental Scientist Michele Jacobi were invited to present ERMA at the June 2008 National Response Team (NRT)/Regional Response Team (RRT) Co-Chairs meeting in Tacoma, Washington for a demonstration of the platform’s capabilities. It was at that meeting that several U.S. Coast Guard (USCG) and U.S. Environmental Protection Agency (US EPA) representatives had their first glimpse of ERMA. “I had been looking for a web-based GIS tool for managing environmental preparedness and spill response for a number of years,” says Eric Mosher, Response and Prevention Branch Chief for US EPA’s Region 2. “We need a viable system that provides access to data and information held by many different agencies and organizations. This one-stop source for data/information is a significant advantage during response activities.” And that’s the idea behind ERMA. It’s not intended to take the place of other government or commercial products that develop or maintain information and data sets; it simply leverages and links existing data sets into a common management, visualization and analysis tool.



“This one-stop source for data/information is a significant advantage during response activities.”

Now in its second year of development, ERMA is transitioning from a prototype to a fully operational application. ERMA has become the primary spatial data delivery tool for NOAA’s Office of Response and Restoration. “It’s really exciting to see ERMA go from a prototype platform to an operational product,” says Merten. US EPA and NOAA have established an interagency agreement to develop and implement a national standard for information and management for preparedness and environmental response based on ERMA. The first full-scale application of ERMA—which will set the stage for the national standard—is under development for the Caribbean Regional Response Team. “In EPA Region 2,” says Mosher, “we’re collaborating with USCG and other federal, Commonwealth, and Territory agencies to use existing data and information products as well as the Regional and Area Contingency Planning efforts to contribute to the Caribbean ERMA platform.” A draft version of the Caribbean ERMA was used during the Caribbean PREP drill in May 2009.

NOAA is now planning ERMAs for the New York/New Jersey area, in concert with U.S. EPA and other stakeholders, and is developing national layers for ERMA, so that all regions will have base maps available within the ERMA framework. “The next step,” Mosher says, “is to bring ERMA to our New York and New Jersey preparedness and response efforts. ERMA will enhance our ability to communicate and share data and information to support the decision-making and work activities of the environmental preparedness and response communities.”

2009 Center Events

Research and Development Priorities Workshop

The Center will host the *Research and Development Priorities: Oil Spill Workshop* on March 17-19, 2009 at the University of New Hampshire's Durham campus. The goal of the workshop is to identify current applied science needs that will improve decision-making across the continuum of oil spill preparedness, response and restoration. In November 2003, the Center hosted a similar workshop to encourage thinking about oil spill research and development, develop some agreement on research needs, and foster partnerships among the oil spill and research communities. The 2003 workshop report served as a blueprint for oil spill research priorities from 2004 through 2008. The 2009 workshop will consist of plenary and small group break-out discussions on: spill response during disasters; response technologies; acquisition, synthesis and management of information; human dimensions; ecological monitoring and recovery following spills; bio-fuels; ecological effects of oil spills; and environmental forensics. Workshop participants will include approximately 40 experts in the noted topic areas representing academia; state, federal, and international agencies; and the private sector. The findings from this workshop will update the research and development needs priorities blueprint.

Climate Change Workshop

In July, the Center's UNH Co-Director will participate in a workshop entitled *Climate Change Impacts on Defense Missions and Assets in Alaska* to be held in Anchorage, AK. The workshop will examine climate change impacts on defense missions, infrastructure, facilities, and managed ecosystems in Alaska. The workshop is co-sponsored by the U.S. Army Corps of Engineers and the Department of Defense.

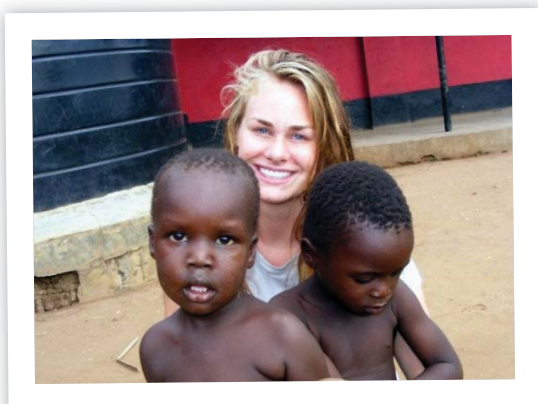
Liquid Asphalt Releases in Aquatic Environments

On October 21, 2009, the Center will host a one-day workshop entitled *Response to Liquid Asphalt Releases in Aquatic Environments* at the University of New Hampshire's Durham campus. The workshop will address such topics as the characteristics of asphalt; effects of spilled asphalt; fate, behavior, and modeling of spilled asphalt; mitigation techniques; and detection and recovery of submerged asphalt. Visit the Center's website for further updates on this event.

Student Activities

Tyler Crowe

In 2009, Tyler Crowe, a UNH Civil Engineering Master's student funded by the Center, is participating in international research efforts at the Center of Documentation, Research and Experimentation on Accidental Water Pollution (CEDRE) in Brest, France. Crowe is assisting a Joint Study Project on the use of chemical dispersants in coastal areas. The goals of this research are to assess the biological impact of dispersed oil on various fish, mussels and oysters inhabiting coastal and estuarine environments and provide responders with data needed to make decisions about the use of chemical dispersants in these areas. This data will ultimately be included in the Center's *Oil Toxicity Field Guide for Aquatic and Marine Habitats*.



Heather Ballestero

In the summer of 2009, Heather Ballestero, a UNH Natural Resources Master's student, will work toward establishing clean water and proper sanitation within the community of Lukodi, Uganda as part of ChildVoice International. Ballestero will educate the community on the importance of sanitation, gather feedback on culturally acceptable wastewater treatment options, construct freshwater and rainwater slow sand filters, and monitor water quality.

Whitney Blanchard

Whitney Blanchard, UNH Civil Engineering doctoral candidate, has accepted a one-year position in NOAA's Office of Ocean and Coastal Resource Management (OCRM) in the Coastal Programs Division in Silver Spring, MD. Blanchard will support NOAA in meeting statutory mandates and interests related to offshore renewable energy and assist with the restoration of NOAA's regulatory infrastructure for administering the agency's licensing responsibilities under the *Ocean Thermal Energy Conversion Act*. In the fall of 2010, Blanchard will return to UNH to continue her PhD research with the Center.



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Feature articles and profiles in the 2008 Annual Report were written by Kimberly Newman unless noted otherwise. The executive editor of the report was Kimberly Newman and it was designed by Colleen Mitchell.

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