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MODIS Rapid Response Team

Gulf Oil Spill

SETAC Focused Topic Meeting

26–28 April 2011 | Pensacola Beach, FL

SETAC®

SOCIETY OF ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY | WWW.SETAC.ORG | SETAC@SETAC.ORG

Welcome to the Gulf Oil Spill SETAC Focused Topic Meeting.

Your professionalism and real-world experience, combined with a comprehensive program of platform and poster presentations and moderated panel discussions will offer substantial value to attendees. We believe the meeting will help us to better understand the environmental and community impacts of the April 2010 explosion of the Deepwater Horizon oil drilling rig, to better engineer solutions that prevent such situations, and to better present complex data to the public. We have assembled experts like you in order to facilitate the collection of available information in a format that allows open discussion and debate and to develop science-based recommendations for improving oil spill response and tracking, control techniques, management, effects assessment, and communication.

SETAC is known for its commitment to tripartite balance among academia, business, and government. Because roughly half the program was built from an open call for papers, some topics are disproportionally represented, but in total, we have achieved a balance. Such a balance, no doubt, will stimulate the scientific debate that we encourage. We expect attendees to understand that the complex issues raised by the oil spill, as well as current litigation, may limit participation by some individuals and organizations. If someone in your session indicates they cannot respond to a question or comment, please respect their position.

Our sincere thanks go to the Steering Committee, who were challenged to fit the volume of submissions into a limited number of program slots. Criteria included whether the subject matter was specific to and representative of Gulf oil spill research, whether it fit the overall goals of the meeting, whether research findings were current and well in hand, and whether it contributed to a diversity of topics and to sector balance. We also want to thank the session moderators, the panel participants, and the platform and poster presenters. In addition, we thank the SETAC North America staff for their uncanny way of identifying an issue and resolving it, even before we perceived it as a potential concern.

Last, we thank each of you for participating in this meeting. We believe that supplementing platform and poster presentations with panel discussions and Q&A will provide a forum for research that is still new and ongoing. While this approach differs from that of SETAC's traditional meetings and workshops, we will do our best to meet your expectations. If you have any questions, please let us know, or contact the SETAC staff or the Steering Committee. We look forward to an exciting and fast-paced meeting over the next three days.

Marc S. Greenberg
USEPA Environmental Response Team (ERT)

William L. Goodfellow, Jr.
EA Engineering, Science, and Technology, Inc.

Meeting Co-Chairs

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Code of Conduct

Members of the Society of Environmental Toxicology and Chemistry (SETAC) are expected to exhibit the highest standards of integrity and professionalism. To ensure a strong and successful organization, our activities require honesty and equity and should reflect well on the Society. In the spirit of promoting "Environmental Quality through Science®," members should strive to be good stewards of environmental resources and effective and objective contributors to the environmental discussion globally as well as locally.

Professional behavior and integrity are also expected from every attendee (members and nonmembers alike) of SETAC meetings, workshops, and activities.

Each member and all persons participating in SETAC meetings and activities are bound by this code of ethics and should:

- Conduct themselves responsibly, objectively, lawfully, and in a nondiscriminatory manner
- Ensure that presentations during Society-sponsored events and other communications are restricted to and based on scientific principles and made in a respectful manner
- Respect the rights, interests, and contributions of professional colleagues
- Respect intellectual property and provide appropriate attribution for all intellectual property arising elsewhere
- Declare and avoid conflicts of interest
- Not knowingly make false or misleading statements, or engage in activities that could be viewed as defamatory about a professional colleague or an organization
- Recognize and respect confidentiality while being honest and forthcoming in all issues of public record
- Objectively and clearly communicate scientific methods, understanding, and knowledge in a professional manner
- Conduct research and related activities so as to avoid or minimize adverse environmental effects of that research, and ensure compliance with legal requirements for protection of researchers, human subjects, and research organisms and systems

Cell Phones

Out of courtesy to our speakers and attendees, we require that all cell phones be turned off during sessions and meetings.

Wi-Fi

Wi-Fi availability at the Hilton Pensacola Beach offers you the opportunity to get online with your own laptop. SETAC is not responsible for any damages or loss of data caused by accessing this connection. (Printing capabilities will not be provided.) Accessing web sites that are controversial or in questionable taste is strictly prohibited. Such use could warrant loss of Wi-Fi privileges.

Media Policy

SETAC welcomes media representatives to report objectively on scientific presentations and environmental issues. All attendees at SETAC meetings must formally register, and advance registration is required for a complimentary press pass.

While the scientific sessions are limited to participating scientists, we are happy to work with you to arrange interviews and to help you locate additional information. The press pass also gives you access to the Communication Challenges and Solutions session, the Closing Plenary and Panel session, and the Press Conference.

If you would like to arrange an onsite or telephone interview prior to the meeting, please contact Greg Schiefer, SETAC North America Executive Director, at schiefer@setac.org or (850) 469 1500 ext. 105.

In order to prevent disruptions and to ensure science-based discourse among speakers and attendees, the following policy applies:

- Members of the press will not be allowed into the scientific sessions unless approval has been obtained in advance from the SETAC North America executive director
- Cameras, recording, and broadcast equipment may be used with consenting speakers during press briefings only, unless express, advance approval has been received from the SETAC North America executive director
- A SETAC member or staff member may be assigned to news crews in order to familiarize them with the meeting purpose, answer questions about the Society, and generally facilitate their work
- All requests for filming, photographs, interviews, etc. outside this policy must be submitted to the SETAC North America executive director for a decision in advance
- This policy is intended to engender a rational and professional forum in which science-based issues can be discussed. Any media representative who sells, markets, or represents a company for purposes of obtaining advertising or subscriptions from any exhibitor or registrant will immediately forfeit press credentials for this and subsequent meetings.

Photo Policy

Recording, photographing, interviewing are not allowed.

No attendee at a SETAC meeting may record, film, tape, photograph, interview, or use any such media during any presentation, poster display, or exhibit without the express, advance approval of the executive director of SETAC North America. This policy applies to all SETAC members, nonmembers, guests, and exhibitors as well as members of the print, online, or broadcast media.

Photo Release

Photographs will be taken at the Gulf Oil Spill SETAC Focused Topic Meeting. By registering for this meeting, you agree to allow SETAC to use your photo in any SETAC-related publication or website.

Presentation upload and preview

Arrive at least 30 minutes prior to the beginning of your session and introduce yourself to the chairperson or moderator. Provide appropriate information to him/her for your introduction. All presentations must be copied to the presentation computer at least 30 minutes before the session starts. Please contact the registration desk onsite if you need assistance.

Please take a moment to thank the following people who work so diligently behind the scenes to ensure everything runs smoothly:

Steering Committee Co-Chairs

Marc S. Greenberg, USEPA Environmental Response Team
William L. Goodfellow, EA Engineering, Science, and Technology, Inc.

Steering Committee Members

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Michael W. Murray, National Wildlife Federation
John Pardue, Louisiana State University
Amy H. Ringwood, University of North Carolina–Charlotte

SETAC North America Staff

Greg Schiefer, Executive Director, greg.schiefer@setac.org
Jason Andersen, IT Manager, jason.andersen@setac.org
Sabine Barrett, Communications Specialist, sabine.barrett@setac.org
Terresa Daugherty, Finance/Membership, terresa.daugherty@setac.org
Linda Fenner, Finance/Exhibits Manager, linda.fenner@setac.org
Barbara Knight, Membership Services, barbara.knight@setac.org
Laura McCaffrey, Office Operations, laura.mccaffrey@setac.org
Mimi Meredith, Publications Manager, mimi.meredith@setac.org
Nikki Turman, Events Coordinator, nikki.turman@setac.org
Bruce Vigon, Scientific Affairs Manager, bruce.vigon@setac.org

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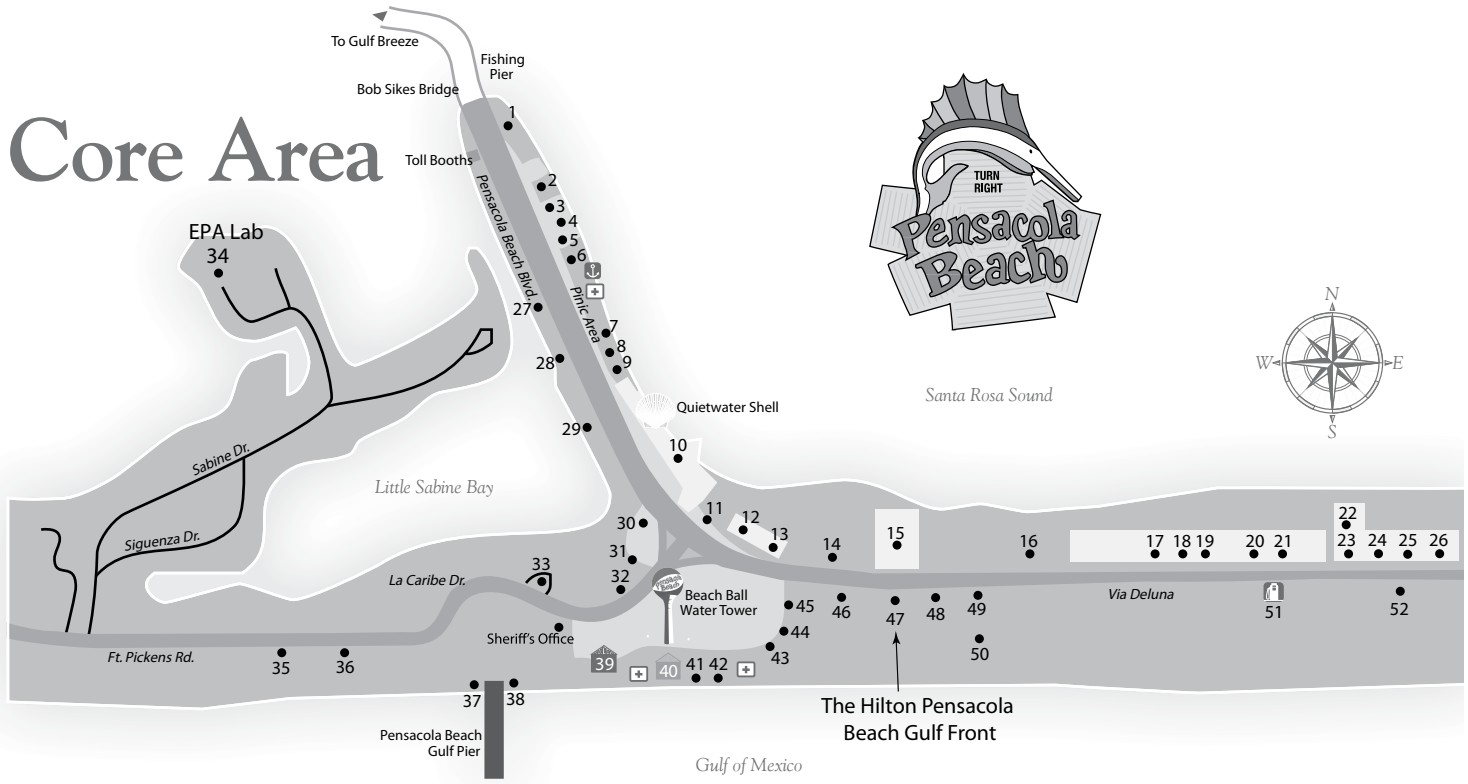
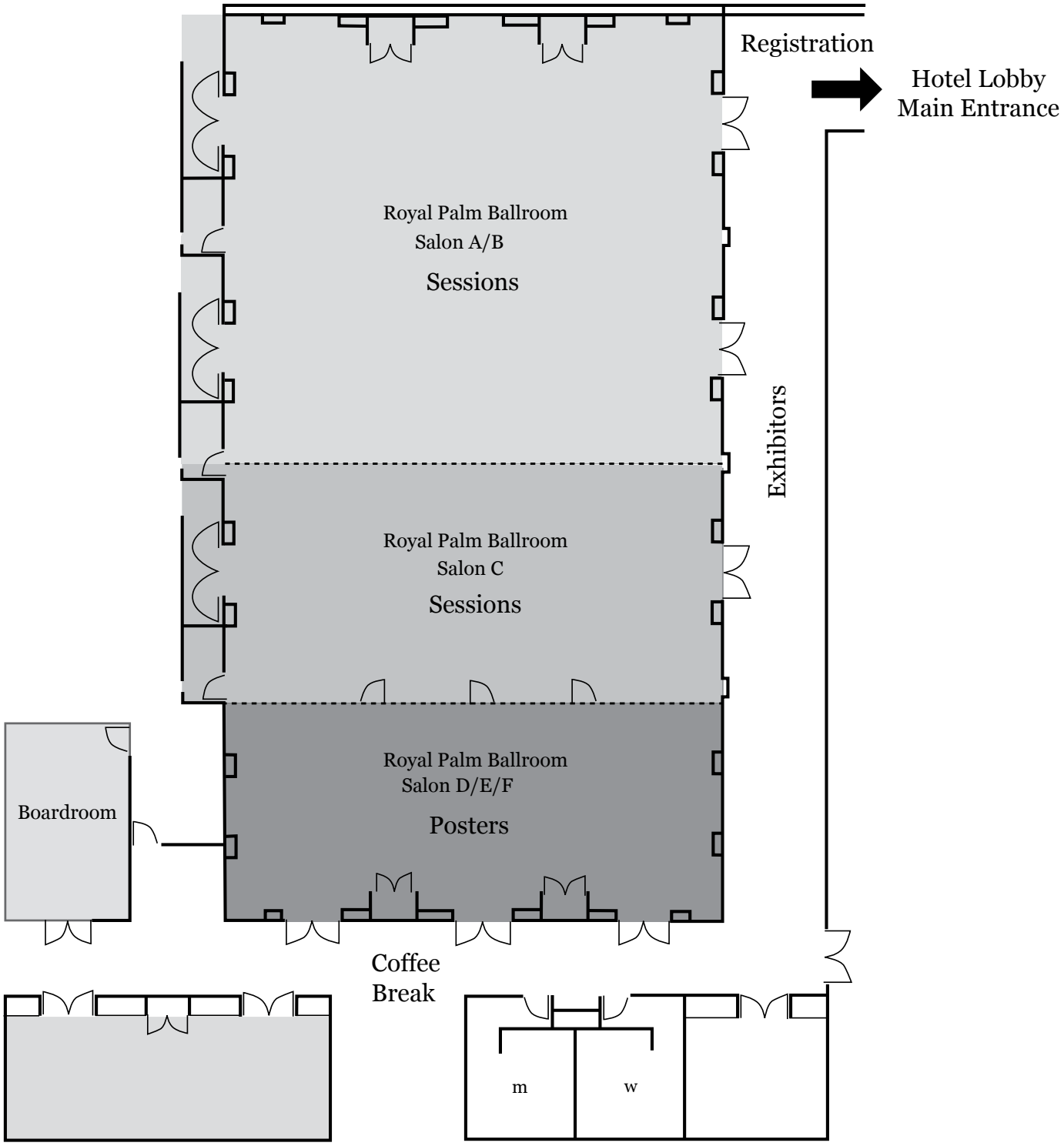
1. The Grand Marlin
2. Radical Rides
3. Bonifay Water Sports
4. Island Palms Miniature Golf
5. Speedy John's Go-Carts
6. James P. Morgan Memorial Park
7. Quietwater Beach
8. Key Sailing, Surf Burger
9. Hemingway's/ Bimini Beach Bar
10. Portofino Boardwalk
    a. Alvin's Island
    b. Bamboo Willie's
    c. Bamboo Willie Wear
    d. Boardwalk Café
    e. Laguna's Restaurant
    f. Capt'n Fun Beach Club
    g. Castaways Beachside Restaurant and Raw Bar
    h. Go Fish Clothing & Jewelry
    i. Hooters
    j. International Boutique
    l. Islander's Surf & Sport
    m.Lee Tracy
    n. Papa's Pizza
11. Down Home Kitchen/ Circle K
12. Flounder's Chowder House
13. Island Style-Island Trader
14. Tropical Waves
15. Soundside Centre
    a. Florida Pizza Kitchen
    b. Beach Wine & Liquor
    c. The Fun Store
    d. Funny Cars
    e. Fusion Spa and Salon
    f. Lillo's Tuscan Grille
16. Paradise Inn/ Paradise Bar & Grill
17. Dog House Deli
18. Beach Laundry
19. Subway
20. Islander Package Lounge
21. Native Café
22. Paddy O'Leary's Irish Pub
23. Beach Pops
24. DJ's Beach Café
25. The Break Beach Bar
26. Geronimo's Outpost
27. Aloha Wine & Liquor
28. Elks Lodge
29. Pensacola Beach Yacht Club, Sabine Sandbar
30. Pensacola Beach Chamber/ Visitor Information Center
31. Sandshaker
32. Comfort Inn
33. Bank of the South
34. USEPA Lab
35. Holiday Inn Express
36. Margaritaville Beach Hotel/ Land Shark Landing
37. The Fish Sandwich Snack Bar
38. Go Fish
39. Public Safety Building/ Restrooms
40. Gulfside Pavilion
41. Tiffany's
42. The Dock
43. Crabs We Got 'Em
44. Tiki Island Golf & Games
45. Sidelines
46. Hampton Inn
47. The Hilton Pensacola Beach Gulf Front/H2O Restaurant
48. Holiday Inn Resort
49. Island Wine & Liquor
50. Days Inn Pensacola Beachfront
51. Surfside Food Store/Gas
52. SpringHill Suites



For more information go to www.visitpensacolabeach.com

Hilton Pensacola Beach Gulf Front

Floor Plan



Cambridge Isotope Laboratories, Inc.

Terry Grim
50 Frontage Road
Andover, MA 01810 USA
+1 978 749 8000
TerryG@isotope.com | www.isotope.com

CIL is the world leader in the manufacture and separation of stable isotopes and stable isotope labeled compounds and produces the world's gold standards for trace analysis by Isotope Dilution MS. CIL offers analytical standards for pesticides, persistent organic pollutants (POPs), pharmaceutical and personal care products (PPCP), flame retardants, dioxins/furans, PCBs and many other organic pollutants. In 2010, CIL synthesized isotopically labeled Sodium bis (2-ethylhexyl) sulfosuccinate (DOSS) in response to the growing need for accurate analysis of the chemical dispersant in various matrices.

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Nai-chia Luke
50 Hampshire Street
Cambridge, MA 02139 USA
+1 617 452 6000
LukeN@cdm.com | www.cdm.com

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1317 S 13th Avenue
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Mary Christie
1700 Elm Street
Minneapolis, MN 55414 USA
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Tracy Weidman
111 Pencader Drive
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	Monday	Tuesday		Wednesday		Thursday	
7:00–8:00	Arrival in Pensacola. If you have time, take a breath and enjoy the area's beatiful beaches.	Poster Viewing and Continental Breakfast					
8:00-8:20		Opening Plenary and Panel Session		1A007 Ringwood	2B005 Shea	Risk and Damage Assessment (1C) Panel	Response Technology Effectiveness (2D) Panel
8:20-8:40				1A008 Palagyi	2B006 Jackson		
8:40-9:00				1A009 Benfield	Oil Fate and Transport Measurements and Modeling (2B) Panel		
9:00-9:20				1A cont'd			
9:20-9:40							
9:40-10:00							
10:00–10:20		Coffee Break				Coffee Break	
10:20–10:40		Oil Spill Response Operations and Incident Command System		Coffee Break		1C001 Henning	2D001 Boda
10:40-11:00				Seafood Contamination, Safety and Human Health Issues (1B) Panel	Oil Tracking Technology (2C)	1C002 Engle	2D002 Horel
11:00-11:20					2C001 Kurtz	1C003 Wakefield	2D003 Michel
11:20-11:40					2C002 Brown	1C004 Coelho	2D004 Cortez
11:40–12:00					2C003 Aulov	1C005 Bartell	
12:00–1:30		Lunch Break					
1:30-1:50		1A001 Stubblefield	Control and Abatement (2A) Panel	1B001 Brown	Oil Tracking Technology (2C) Panel	Closing Plenary and Panel Session	
1:50-2:10		1A002 Wetzel		1B002 Goff			
2:10-2:30		1A003 Mitchelmore		1B cont'd			
2:30-2:50		1A004 Anderson					
2:50–3:10		1A005 Martin		Coffee Break			
3:10–3:30		Coffee Break				Press Conference	USEPA Lab Tour
3:30–3:50		1A006 Smith	2A001 Mabile	Communication Challenges and Solutions (CC)			
3:50-4:10	Registration opens	Ecosystem Effects of Oil Spills (1A) Panel	2A002 Daling				
4:10-4:30			2B001 Overton				
4:30-4:50			2B002 Beegle-Krause				
4:50-5:10			2B003 Redman	CC001 Kane			
5:10-5:30			2B004 Boehm	C002 Grattan			
5:30–6:00		Daily Summary of Sessions and Discussion		Daily Summary of Sessions and Discussion			
6:00–8:00	Opening Reception						

Monday 25 April

Opening Reception

Join us on the pool deck of the Hilton Pensacola Beach Gulf Front from 6–8 p.m. for the Opening Reception. Appetizers and drinks will be served while you meet new friends or reconnect with old ones, all with the emerald-green waters of the Gulf of Mexico in the background. Admission is included with your registration. Please wear the blue wristband provided in your registration package to redeem your two free drinks.

Tuesday 26 April

Time	Schedule	Location
7:00 a.m.–6:00 p.m.	Registration Desk Hours	
7:00 a.m.–6:00 p.m.	Poster Viewing Hours	Salon D/E/F
7:00 a.m.–6:00 p.m.	Exhibitor Hours	
	...	
7:00 a.m.–8:00 a.m.	Poster Viewing and Continental Breakfast	Salon D/E/F
8:00 a.m.–10:00 a.m.	Opening Plenary and Panel Session	Salon A/B
10:00 a.m.–10:20 a.m.	Coffee Break	
10:20 a.m.–12:00 p.m.	Oil Spill Response Operations and Incident Command System	Salon A/B
12:00 p.m.–1:30 p.m.	Lunch Break	
1:30 p.m.–3:10 p.m.	Ecosystem Effects of Oil Spills (1A)	Salon A/B
1:30 p.m.–3:10 p.m.	Control and Abatement (2A)	Salon C
3:10 p.m.–3:30 p.m.	Coffee Break	
3:30 p.m.–5:30 p.m.	Ecosystem Effects of Oil Spills (1A cont'd)	Salon A/B
3:30 p.m.–4:10 p.m.	Control and Abatement (2A cont'd)	Salon C
4:10 p.m.–5:30 p.m	Oil Fate and Transport Measurements and Modeling (2B)	Salon C
5:30 p.m.–6:00 p.m.	Daily Summary of Sessions and Discussion	Salon A/B

OPENING PLENARY AND PANEL SESSION

Moderator: Jaqui Michel
Panelists: Rob Ricker, Roger Prince, Gina Saizan, Alan Maki, Kurt A. Hansen, Rich Camilli

Jaqui Michel is an internationally recognized expert in oil and hazardous materials spill planning and response, with a primary focus in the areas of oil fates and effects, non-floating oils, shoreline cleanup, alternative response technologies, and natural resource damage assessment. Much of her expertise is derived from her role, since 1978, as part of the Scientific Support Team to the US Coast Guard provided by the National Oceanic and Atmospheric Administration (NOAA). Under this role, she is on 24-hour call and provides technical support for an average of 50 spill events per year. She leads shoreline assessment teams and assists in selecting cleanup methods to minimize the environmental impacts of the spill. Michel has evaluated and used a wide range of alternative response technologies including surface washing agents, solidifiers, bioremediation agents, in situ burning (mostly on wetlands and inland habitats), and methods to track and recover non-floating oils. She has been the NOAA Shoreline Cleanup Assessment Technique (SCAT) Coordinator in Louisiana for the Deepwater Horizon spill since April 2010.

Michel also has extensive expertise in natural resource damage assessment (NRDA). She is part of the NOAA Damage Assessment Center's Rapid Assessment Program, and since 1985, she has conducted NRDAs for numerous spills in the US. She assisted NOAA in preparing two guidance documents on how to conduct the preassessment and injury assessment phases of NRDAs under the Oil Pollution Act of 1990.

OIL SPILL RESPONSE OPERATIONS AND INCIDENT COMMAND SYSTEM

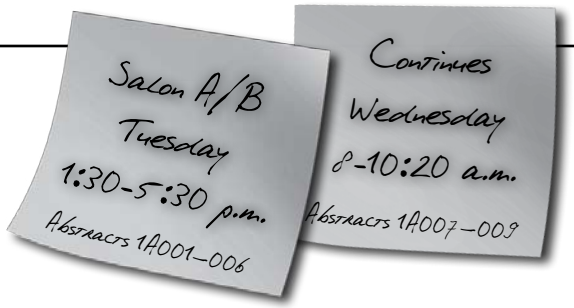
Moderator: Marc Greenberg
Panelists: David P. Wright, Cdr Arex Avanni, Bea Stong

Marc S. Greenberg is an Environmental Scientist and Toxicologist on the USEPA's Environmental Response Team where he supports various clean-up, emergency, and other response actions within the Superfund program. During the Deepwater Horizon oil spill, he served as an Environmental Unit Leader in USEPA's Regional Emergency Operations Center and in the Unified Area Command in New Orleans, LA. His technical experience includes research in both human-health and aquatic ecological toxicology with a focus on pharmacokinetics, contaminated sediments, bioavailability, and the role of dynamic environmental conditions on in situ effects. Greenberg serves as an advisor to the Hudson River PCBs, Grasse River PCBs, Anniston PCB, Molycorp Mine, Upper Columbia River, and Newtown Creek Management Teams. At the national level, Greenberg is a member of the USEPA Contaminated Sediments Technical Advisory Group (CSTAG) and the OSRTI Sediments Team, he is the USEPA Headquarters Chair of the agency's Ecological Risk Assessment Forum (ERAF), and he presented an overview of USEPA's post-remedial monitoring strategies to the National Research Council Review Panel on Dredging at Superfund Megasites.

Internationally, he has advised the Government of Thailand regarding potential environmental quality issues associated with offshore oil operations, he has consulted with the French Ministry of the Environment on issues regarding PCBs in the Rhône River, and he has consulted with researchers and government officials in Finland regarding contaminated sediment management. He serves as an Adjunct Assistant Professor at Clemson University, SC, and has served as a Visiting Scientist at the NOAA Great Lakes Environmental Research Laboratory, and as an Inhalation Research Toxicologist at the Air Force Toxicology Laboratory, Wright-Patterson Air Force Base, OH.

As an internationally recognized expert in sediments, Greenberg has been invited to give many presentations and lectures; serves on scientific steering and advisory committees, workshops, and panels; and reviews articles for scientific journals. Greenberg is an active member of SETAC and has served on its North America Board of Directors (2007–2010) and is presently on the Editorial Board for the SETAC journal *Environmental Toxicology and Chemistry*.

ECOSYSTEM EFFECTS OF OIL SPILLS (1A)

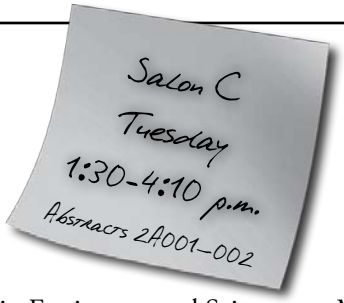


Moderators: Tracy Collier and Amy Ringwood
Panelists: Peter Hodson, Brett Thomas, Carys L Mitchelmore, Mary Ann Ottinger, Marie BenKinney, Irv Mendelssohn, Kristen Hart

Tracy Collier currently serves as the Science Advisor to NOAA's Oceans and Human Health Program, where he provides science direction in the areas of chemical contaminants, pathogens, and algal toxins and their effects on human and ecosystem health for US coastal waters and the Great Lakes. The OHH Program also investigates benefits from the sea, including the development of novel drugs. Until recently, Collier was Director of the Environmental Conservation Division of NOAA's Northwest Fisheries Science Center, where he supervised a research enterprise comprised of approximately 90 scientists. His expertise is in the area of environmental toxicology, where he conducted some of the first work on metabolism of PAHs by aquatic animals, and throughout his career has emphasized field assessments and biologically based monitoring aimed at understanding the stresses posed by toxic chemicals on aquatic ecosystems. More recently he has overseen studies on the effectiveness of restoration efforts, especially in urbanizing areas. Collier received his PhD from the University of Washington, he holds faculty appointments at Oregon State University and Washington State University, and he consults for NOAA through a cooperative agreement with the University Corporation for Atmospheric Research. Collier serves on a number of regional, national, and international panels and committees, including the recently created Delta Independent Science Board in California and the pool of experts for GESAMP (Group of Experts on Scientific Aspects of Marine Protection), advising the United Nations. Until recently, he was an editor for *Environmental Toxicology and Chemistry*, and he has more than 130 scientific publications.

Amy H. Ringwood is currently an Associate Professor in the Department of Biology at the University of North Carolina – Charlotte. Her professional career has included positions in both government (Marine Resources Research Institute, SC Department of Natural Resources) and academia (UNC Charlotte and graduate faculty positions at the College of Charleston, Medical University of SC, and University of South Carolina). The primary emphases of her research have been characterizing the impacts of anthropogenic and natural stressors on marine invertebrates, developmental stages (embryos and larvae) as well as adults. This work has involved extensive field as well as laboratory studies and has spanned a range of biological organization — from cellular and molecular biomarkers to organismal and community-level responses. These investigations have included work related to oil spills, metal and organic pollutants, hypoxia and pH, and more recently nanoparticles. As an internationally recognized expert in biomarkers and contaminant bioavailability and effects, she has given presentations as an invited speaker throughout the world. She has participated in Pellston Workshops, a Biomarker Workshop as an organizer and has contributed to associated publications in books and dedicated journal volumes. She was recently a visiting scientist in Sydney, Australia, hosted by the University of New South Wales, and the Centre for Ecotoxicology, Ecotoxicology and Environmental Contaminants Section. She is a longstanding member of the international organizing committee for the PRIMO (Pollutant Responses in Marine Organisms) Conferences. She has served on various scientific advisory committees and workshops over the years, as well as journal editorial boards and as a reviewer for many journals. Ringwood is an active member of SETAC, also serving as a regional board member, and other scientific organizations (Society of Toxicology, National Shellfisheries Association, Sigma XI). She obtained her BA in Biology from Wake Forest University and her PhD in Zoology from the University of Hawaii, followed by Postdoctoral Fellowships at the Pacific Biomedical Research Center, Honolulu, HI and the Duke University Integrated Toxicology Program, Durham and Beaufort, NC.

CONTROL AND ABATEMENT (2A)



Moderator: Al Venosa
Panelists: David Fritz, Francois Merlin, Victoria Broje, Gary Shigenaka

Albert D. Venosa is the Director of the Land Remediation and Pollution Control Division, National Risk Management Research Laboratory in USEPA's Office of Research and Development. He manages and directs the division's science and research programs and conducts research in his area of expertise, which is oil spill remediation and mitigation. From 1990 to 2009, Venosa served as Senior Research Scientist and Program Manager, Oil Spill Research Program. Venosa's 20 years of work in this area include membership on the science team for the Alaska Oil Spill Bioremediation Project involved with assessing effectiveness of nutrient formulations in the field for stimulating enhanced biodegradation of contaminated shorelines in Prince William Sound. In 1990 he led an independent field study to determine if commercial bioremediation agents could accelerate biodegradation in multiple field plots. From 1986 to 1988, he served as USEPA's Chairman of the Pathogen Equivalency Committee in the Sludge Research Program, and for the previous 18 years he was the National Program Manager for ORD's Municipal Wastewater Disinfection Program. Venosa holds a PhD in Environmental Science, an MS degree in Environmental Engineering, and a BS degree in Microbiology, all from the University of Cincinnati. His research interests and expertise include developing protocols for testing the effectiveness of commercial bioremediation products for biodegrading crude oil in seawater; developing protocols for chemical countermeasure products such as dispersants, surface washing agents, and solidifiers in freshwater, beach sediments, wetlands, and soils; conceiving methods for microbiological and chemical analysis of oil spill remediation activities; and advancing our knowledge in the area of improved scientific and practical understanding of the mechanisms of biodegradation of petroleum hydrocarbons, especially polycyclic aromatic hydrocarbons. Venosa has received numerous awards for his work and has been lead author on 37 out of a total of 120 peer-reviewed scientific publications throughout his career.

OIL FATE AND TRANSPORT MEASUREMENTS AND MODELING (2B)

Moderators: Scott A. Stout and Debbie Payton
Panelists: Michel Boufadel, Wolfgang Konkel

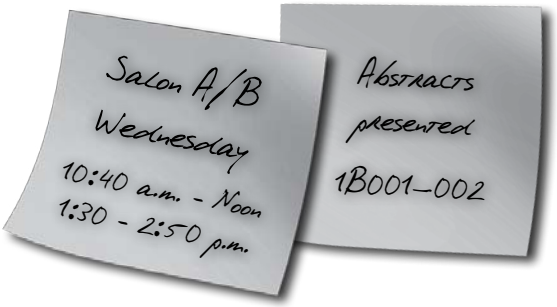
Scott A. Stout is an Organic Geochemist at NewFields Environmental Forensics Practice LLC in Rockland, MA (7 years), with expertise in chemical fingerprinting of petroleum and other organic pollutants. He was formerly with Battelle Memorial Institute (7 years) and Unocal Corporation (9 years). He has authored more than 120 professional publications, including several book chapters on chemical fingerprinting and has co-edited a 2007 textbook entitled *Oil Spill Environmental Forensics*. Stout received his PhD in 1988 from Penn State and is a member of the American Chemical Society, European Association of Organic Geochemists, and the American Academy of Forensic Sciences.

Debbie Payton is from the NOAA/Office of Response and Restoration/Emergency Response Division. She has been a part of virtually every major US spill since 1978 (and a number of international ones). During Deepwater Horizon, she served in a management role supporting chemists, biologists, oceanographers, and modelers who were providing information and products to Incident and Area Commands through the SSCs as well as supporting the National Incident Command. In addition, she performed several overflights to support modeling activities, coordinated modeling activities from Seattle and served as a chief scientist for the subsurface monitoring unit. Payton has just recently moved to a new position as the Emergency Response Division Chief for NOAA.

Wednesday 27 April

Time	Schedule	Location
7:00 a.m.–6:00 p.m.	Registration Desk Hours	
7:00 a.m.–6:00 p.m.	Poster Viewing Hours	Salon D/E/F
7:00 a.m.–6:00 p.m.	Exhibitor Hours	
	...	
7:00 a.m.–8:00 a.m.	Poster Viewing and Continental Breakfast	Salon D/E/F
8:00 a.m.–10:20 a.m.	Ecosystem Effects of Oil Spills (1A cont'd)	Salon A/B
8:00 a.m.–10:20 a.m.	Oil Fate and Transport Measurements and Modeling (2B cont'd)	Salon C
10:20 a.m.–10:40 a.m.	Coffee Break	
10:40 a.m.–12:00 p.m.	Seafood Contamination, Safety, and Human Health Issues (1B)	Salon A/B
10:40 a.m.–12:00 p.m.	Oil Tracking Technology (2C)	Salon C
12:00 p.m.–1:30 p.m.	Lunch Break	
1:30 p.m.–2:50 p.m.	Seafood Contamination, Safety, and Human Health Issues (1B cont'd)	Salon A/B
1:30 p.m.–2:50 p.m.	Oil Tracking Technology (2C cont'd)	Salon C
3:10 p.m.–3:30 p.m.	Coffee Break	
3:30 p.m.–5:30 p.m.	Communication Challenges and Solutions (CC)	Salon A/B
5:30 p.m.–6:00 p.m.	Daily Summary of Sessions and Discussion	Salon A/B

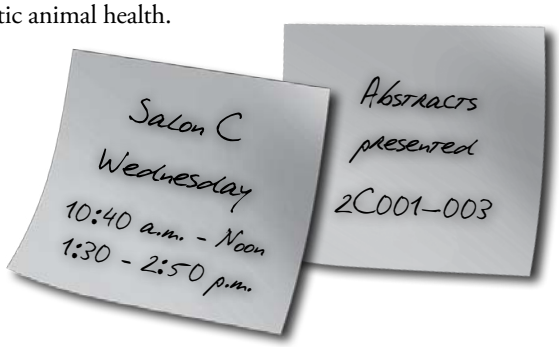
SEAFOOD CONTAMINATION, SAFETY, AND HUMAN HEALTH ISSUES (1B)



Moderators: Steven Lewis and Calvin Walker
Panelists: Walt Dickhoff, Robert Dickey, Kevin Armbrust

Steven Lewis holds a BA in Chemistry and a PhD in Toxicology from Indiana University. For more than 28 years, he held various technical, consulting, and management positions with ExxonMobil Biomedical Sciences, Inc. His research focused on potential risks from environmental carcinogens, nervous system toxicants, and hazards to reproductive health. Following the oil spill incident in 1989, he served as senior on-site health scientist in Alaska. Following retirement,Lewis founded Integrative Policy & Science, Inc. (IPSi), an independent consulting firm providing advice in toxicology, qualitative and quantitative risk assessment for environmental hazards, science policy, and regulatory affairs. Lewis is Adjunct Professor of Environmental and Occupational Medicine, Robert Wood Johnson Medical School, and Adjunct Professor of Toxicology and Public Health at the University of Massachusetts (Amherst). He is certified by the American Board of Toxicology, has served on the editorial boards of four scientific journals, is currently Associate Editor of Dose-Response, and is active in a variety of professional societies. He has served as a consultant to the USEPA, has been repeatedly selected as a peer reviewer for toxicological profiles, summaries and risk assessments, and is a frequent commenter on scientific and regulatory issues before US, state, and international agencies. Having retired as Chair of the Board of Trustees of Toxicology Excellence for Risk Assessment (TERA), he is continuing his association with TERA as a collaborative Fellow. He recently completed a term on the US National Research Council's panel on "Public Participation in Environmental Assessment and Decision-Making." He retains the title of Senior Fellow University of Texas at Dallas, where he was a Visiting Scholar in 1995. He has published and presented the results of his work widely (27 peer-reviewed papers, 10 book chapters, more than 50 presentation and abstracts), and has delivered more than 70 invited seminars, lectures, and other presentations.

Calvin C. Walker is the Lead Analyst for NOAA Fisheries' National Seafood Inspection Laboratory in Pascagoula, MS. His career includes research and regulatory positions in the USFDA, USEPA, and NOAA Fisheries in veterinary drug residues, environmental contaminants, marine biotoxins, endocrine disruptors, proteomic biomarkers, seafood safety, and petroleum hydrocarbon contaminants. Walker currently manages monitoring, regulatory, and research programs on seafood safety, seafood forensics, aquaculture drugs, seafood decomposition products, petrochemical contaminants, pathogenic bacteria, and aquatic animal health.



OIL TRACKING TECHNOLOGY (2C)

Moderators: Chris Reddy and Paul Boehm
Panelists: Charlie Henry, Roger Prince, Greg Wilson, Edward Overton, Rich Camilli

Christopher M. Reddy is a Senior Scientist in the Department of Marine Chemistry and Geochemistry at the Woods Hole Oceanographic Institution (WHOI). He is also the Director of the Coastal Ocean Institute at WHOI. Chris received his BS in Chemistry from Rhode Island College in 1992 and his PhD in Chemical Oceanography in 1997 from the University of Rhode Island's Graduate School of Oceanography. After completing his PhD, Reddy took a post-doctoral position at WHOI and has worked there ever since.

Reddy has won many honors and awards, including Kavli Fellow Awards in 2009 and 2010 from the US National Academy of Sciences. He examines the source, transport, and fate of organic contaminants in coastal and oceanic waters and has published more than 100 peer-reviewed manuscripts.

His current work examines the short- and long-term fate of petroleum hydrocarbons in marine systems. Reddy is currently studying natural oil seeps and several oil spills, including one that occurred four decades ago as well as the Deepwater Horizon spill. He has testified in Congress several times about oil spills and pollution. In September 2010, he worked as the academic liaison at the Unified Area Command for the Deepwater Horizon spill.

Paul D. Boehm is a Principal Scientist at Exponent, Inc. and has overall responsibility for Exponent's environmental business. He has devoted his 34 years of consulting experience to advising industrial, legal, and government clients on scientific aspects of contaminated sediments, terrestrial sites, and oil spills. He has studied and published on the fate and effects of oil spills in North America, Europe, and the Middle East. His body of work includes natural resource damage assessments and research related to the *Exxon Valdez*, the Ixtoc 1 blowout, the *Prestige* spill in Spain, the *Amoco Cadiz* tanker spill in France, the 1991 Gulf War spill, the Baffin Island Oil Spill (BIOS) experimental studies in Canada, and many others. His scientific work involves investigations on oil spill chemistry and methods development, chemical fingerprinting, water and shoreline fate and transport studies, bioavailability, and injury assessment.

He has been appointed to serve on several national panels on environmental/marine pollution matters, has served on several National Research Council panels, and has published more than 120 papers in peer-reviewed journals.

Boehm holds a PhD and MS in Oceanography from the University of Rhode Island, and a BS in Chemical Engineering from the University of Rochester.

COMMUNICATION CHALLENGES AND SOLUTIONS (CC)

Moderator: Mary McDaniel
Panelists: Ann Hayward Walker, Jon Rauscher, Ben Raines, Herb Ward, Sonya Daniel

Mary McDaniel is a board-certified occupational and environmental medicine physician, licensed attorney, and risk and crisis communication expert. McDaniel brings more than 20 years of experience in environmental health assessment, risk communication, risk management, and occupational and environmental medicine to McDaniel Lambert, which she co-founded in 1997. She is also involved in developing risk communication and crisis communication strategies for communities, public agencies, and companies in the US and overseas. She is a member of the faculty of the UCLA Occupational and Environmental Medicine Program and serves as a member of the Residency Advisory Board. She is the current president-elect of the Southern California Society of Risk Analysis.

During her career, McDaniel has developed and supported community involvement programs in a variety of settings worldwide. She has planned, facilitated, and served as a health expert at public meetings throughout the US, where she seeks to integrate the expertise of health agencies, elected officials, industry, and community members to enhance the communication and decision-making process. McDaniel is currently helping NOAA with community outreach activities related to the assessment of natural resource damages in the aftermath of the BP oil spill. She most recently facilitated a NOAA community meeting to collect input from Gulf communities about potential restoration projects.

McDaniel received her medical degree from Oklahoma State College of Osteopathic Medicine in 1986 and completed a residency in Occupational Medicine at the University of Oklahoma in 1989. During her residency, McDaniel also completed a Masters in Public Health at the University of Oklahoma. She obtained a law degree from the University of Tulsa in 1976 after receiving a BS in Journalism in 1971. She is licensed to practice medicine and law in the State of California.

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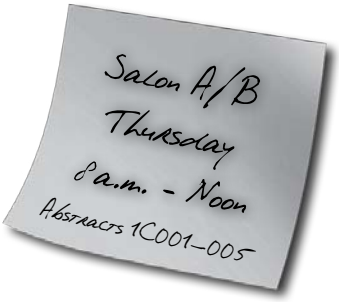
Thursday 28 April

Time	Schedule	Location
7:00 a.m.–3:00 p.m.	Registration Desk Hours	
7:00 a.m.–3:00 p.m.	Poster Viewing Hours	Salon D/E/F
7:00 a.m.–1:30 p.m.	Exhibitors Hours	
	...	
7:00 a.m.–8:00 a.m.	Poster Viewing and Continental Breakfast	Salon D/E/F
8:00 a.m.–10:00 a.m.	Risk and Damage Assessment (1C)	Salon A/B
8:00 a.m.–10:00 a.m.	Response Technology Effectiveness (2D)	Salon C
10:00 a.m.–10:20 a.m.	Coffee Break	
10:20 a.m.–12:00 p.m.	Risk and Damage Assessment (1C cont'd)	Salon A/B
10:20 a.m.–12:00 p.m.	Response Technology Effectiveness (2D cont'd)	Salon C
12:00 p.m.–1:30 p.m.	Lunch Break	
1:30 p.m.–3:10 p.m.	Closing Plenary and Panel Session	Salon A/B
3:15 p.m.–3:30 p.m.	Press Conference	Salon A/B
3:15 p.m.–4:30 p.m.	USEPA Lab Tour (no onsite registrations permitted)	

RISK AND DAMAGE ASSESSMENT (1C)



Moderators: Gene Mancini and William H. Benson
Panelists: Robin Bullock, Rich DiGuilio, Deborah French-McCay
Ken Boda, Lisa DiPinto

Eugene R. Mancini, Principal and Sr. Scientist at E. R. Mancini & Associates, has more than 35 years' experience in environmental impact assessment for industrial activities ranging from upstream and downstream petroleum and utility operations to hard rock mineral mining. Mancini is an aquatic ecologist with extensive background in freshwater and marine ecosystems, surface water and groundwater quality, and issues related to the fate, behavior, and effects of contaminants in environmental media. He worked as a Senior Consultant to ARCO for more than 17 years where he was an emergency response team member, technical NRDA consultant, and an environmental advisor to operating companies/subsidiaries, the legal department, and executive management. His spill response experience includes marine and freshwater spills of crude oils, product spills from pipelines/USTs, oxygenated fuels, methanol, MTBE, acids, and produced fluids. He has worked in interdisciplinary NRDA groups including environmental engineers, modelers, toxicologists, chemists, attorneys, natural resource economists, and trustees. Mancini has conducted environmental site assessments on both operating and abandoned or decommissioned facilities under CERCLA, RCRA, TSCA, and equivalent state guidelines. He has worked on projects in more than 32 of the United States as well as internationally in South America, Canada, the Pacific Rim, and the Middle East. Mancini has conducted both cooperative and defensive NRDAs for PRPs including more than a dozen petroleum hydrocarbon NRDAs undertaken in response to emergency releases and more than fifteen CERCLA site assessments for contaminants ranging from metals/metalloids to chlorinated organics. He has used technical information in support of cooperative assessments, negotiated settlements, and comprehensive litigation efforts.

William H. Benson serves as Director of the National Health and Environmental Effects Research Laboratory's Gulf Ecology Division within the USEPA Office of Research and Development. In that capacity, Benson is responsible for directing ecological effects research to assess estuarine and coastal condition and services, determine causes of affected and declining systems, predict future risks to populations and ecosystems, and support development of criteria to protect coastal environments.

Benson's research activities have been directed towards assessing the influence of environmental stressors on health and ecological integrity. He has conducted research in the areas of metal and pesticide bioavailability, reproductive and developmental effects in aquatic organisms, endocrine-disrupting chemicals, and use of indicators in assessing health and ecological integrity. In addition, he has published more than 100 scientific publications focusing on environmental toxicology and chemistry.

Benson serves as Chair of Dow Chemical Company's Technical Advisory Board and is responsible for reviewing specific research programs of its Toxicology and Environmental Research and Consulting Laboratory. He also serves as a member of NOAA's National Advisory Panel for the Oceans and Human Health Initiative as well as the Climate Advisory Council under the bilateral Science and Technology Agreement between the US and Vietnam.

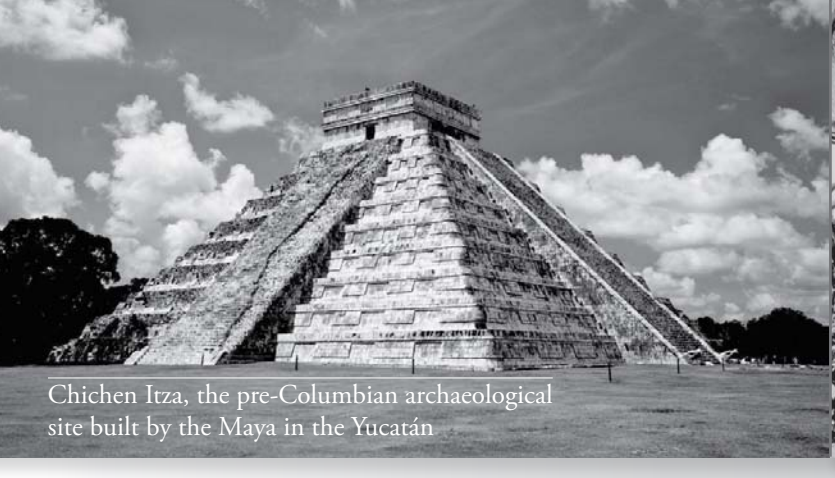
Benson obtained a BS in Biology from Florida Institute of Technology and his MS and PhD degrees in Toxicology from the University of Kentucky. While in graduate school he was the first recipient of SETAC's Pre-Doctoral Fellowship sponsored by The Procter & Gamble Company. Benson is a Past President of SETAC and has served on the Society's International Council. Benson was elected as a Fellow of the American Association for the Advancement of Science and is active in several other professional societies, including the Society of Toxicology.

RESPONSE TECHNOLOGY EFFECTIVENESS (2D)

Moderators: Francois Merlin and Steve Lehmann
Panelists: Kenneth Lee, Al Venosa, Michael Cortez

Francois Xavier Merlin is Head of Research and Development at Cedre, a French non-profit association that was created following the *Amoco Cadiz* incident. He specializes in developing research projects and studies on treatment products, especially oil spill dispersants. His experience relates to all areas of dispersants, including efficiency assessment, environmental impact and application equipment, and methodology. Specifically, he conducts experiments in hydrocarbons using analytical capabilities such CG-MS, HPLC, and specific test methods for oil spill treating agents; performs pilot-scale testing with equipment such as a hydraulic canal, coastal mesocosms, vertical tank, large open pools, artificial beach, and greenhouse devoted to ecotoxicological experimental studies; and conducts sea trials with the French Navy to assess real-scale pollution combating techniques and products.

He has contributed to various publications and handbooks such as the IMO guidelines on dispersants, the Ipieca report on dispersants as well as national standards of testing methods for dispersants. He is also in charge of the approval procedure for dispersants in France. Merlin has assisted many other countries in the evaluation of pollutions and has been an advisor on the selection of treatment methods and products.



Chichen Itza, the pre-Columbian archaeological site built by the Maya in the Yucatán

SETAC North America Focused Topic Meeting

Pollutants in the Environment: Fate and Toxicity

24–27 August 2011
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- Promote collaboration among scientists and decision makers in Mexico, Canada and the US
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- Participate in short courses, platform and poster presentations, panel discussions and social events

The meeting will kick off with a joint syposium together with the Society for Ecological Restoration (SER) on 24 August:

Coastal Oil Spills Before and After the Deepwater Horizon: Integrating impact assessment with restoration

You qualify for a discounted rate if you attend both meetings in their entirety. Please contact the SETAC office for more information.

Deadlines*

Abstract Submission: 1 May
Discount Registration: 10 June
Registration: 22 July
(**Dates subject to change)*

Contact

Doris Vidal-Dorsch at
dorisv@sccwrp.org

Ruth Hull at
rhull@intrinsikscience.com

mexico2011.setac.org

Stephen Lehmann is Scientific Support Coordinator for the NOAA Office of Response and Restoration. He has served as the NOAA Scientific Support Coordinator (SSC) for the New England region since 1990, providing training, contingency planning support, and coordinating scientific advice to the US Coast Guard, state agencies, and others. He has acted as the SSC for every notable marine pollution emergency in the region during that time. In addition, Lehmann has developed contingency plans, provided training or coordinated on-scene scientific support on major spills around the country and internationally, including such marine emergencies as the *Exxon Valdez* in Alaska, Persian Gulf War oil spill in Saudi Arabia and Kuwait, M/V *Wellborn* in Madagascar, TWA 800 airline crash in Long Island Sound, Barge *Morris J Berman* in Puerto Rico, John F.Kennedy Jr. airplane crash and search in Massachusetts, M/V *Selendang Ayu* in Alaska, Barge *North Cape* in Rhode Island, Barge DPL-152 in Texas, and Deepwater Horizon in the Gulf of Mexico. His planning and training inlcude: NOAA Representative to the UNESCO, Paris, for the Persian Gulf Oil Spill Conference; Bahrain contingency planning and technical assistance, US Navy Fifth Fleet; Honduras, training for Central American pollution agencies; Panama, Panama Canal contingency planning and drill; and South Korea, guest instructor, Korea Ocean Research and Development Institute.

Lehmann is the NOAA representative to Regional Response Teams for Regions 1, 5, and 7, the Joint US/Canada Response Team, and is the chairman of the National Response Team's Science and Technology Committee. He is also the Department of Commerce representative for the Interagency Coordinating Committee on Oil Pollution Research.

CLOSING PLENARY AND PANEL SESSION

Moderator: William L. Goodfellow, Jr.

Representatives from each session will provide a synopsis of the presentations and discussion from each of the meeting topics. Meeting Co-Chair Bill Goodfellow will then facilitate discussion and Q&A among the representatives, further elucidating the significant information presented during these three days and identifying recommendations from each session, including lessons learned, data gaps, research needs, and how to better present complex technical information to the public.

William L. Goodfellow, Jr. is Vice President at EA Engineering, Science, and Technology, Inc. in Sparks, Md., where he leads the Water, Natural Resources, and Ecotoxicology business unit. He is the Immediate Past President of SETAC North America, has played an active role in the scientific programming for SETAC as the meeting chair for two annual meetings, and has provided leadership to several other SETAC committees. Goodfellow has a MS in Fishery Management and undergraduate degrees in Biology and Chemistry. He has more than 30 years of experience in sediment management, watershed management, environmental toxicology, and bioassessments. His primary technical responsibilities include the design and assessment of freshwater, estuarine, and marine contaminated and navigation dredged sediments as well as watershed management programs. He has been a leader in the development of Toxicity Reduction Evaluations (TRE) and Toxicity Identification Evaluations for aqueous and sediment matrices; evaluating the toxicity, fate, and effects of chemicals in aquatic ecosystems; and assessing environmental damage resulting from point and non-point source. He has served on peer review panels, task forces, and editorial committees for toxicology and TRE issues, and has been widely published.

USEPA LAB TOUR

If you have pre-registered for the US Environmental Protection Agency Gulf Ecology Division Lab Tour , the trolley will depart at 3:15pm from the Hilton, right after the Closing Plenary and Panel Session. The trolley will return at approximately 4:30pm. Please bring a government-issued photo ID. No onsite registration is permitted.

Abstracts

Gulf Oil Spill SETAC Focused Topic Meeting

The following pages comprise the abstracts for poster and platform presentations of the Gulf Oil Spill SETAC Focused Topic Meeting. The abstracts are reproduced as accepted by the Steering Committee.

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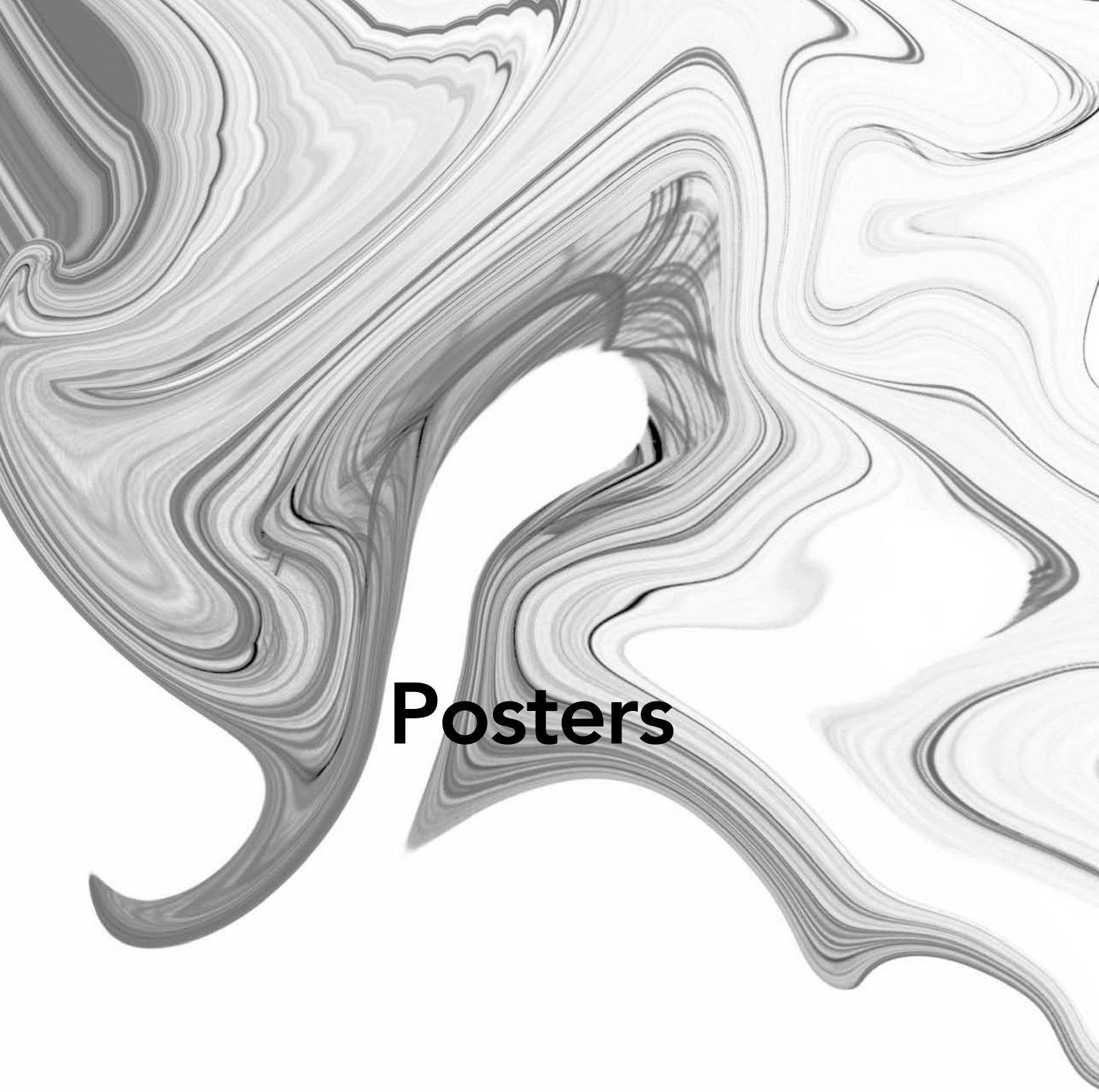


Posters

Posters Key

TP.....Tuesday Posters
WP.....Wednesday Posters
RP.....Thursday Posters

ECOSYSTEM EFFECTS

TP001 Effect of the Dispersant Corexit upon Bioavailability and Toxicity of Deep Horizon Light Crude Oil Emulsion Components to Developing Fish. KM Kleinow, Dept of Comparative Biomedical Sciences, Louisiana State Univ, Baton Rouge LA; A Bui, Dept of Comparative Biomedical Sciences, Louisiana State Univ, Baton Rouge LA; LJ Thibodeaux, Dept of Chemical Engineering, Louisiana State Univ, Baton Rouge LA; SM Fritz-Kleinow, Dept of Comparative Biomedical Sciences, Louisiana State Univ, Baton Rouge LA. Louisiana light crude oil released into the Gulf of Mexico by the Deep Horizon (DH) incident underwent significant alterations by remediation attempts, emulsification with water, and weathering processes before reaching coastal marshes. These studies examined the effect of varying Corexit dispersant concentrations upon the developmental toxicity of components from DH emulsions to fish embryos. Shaking flask dispersion tests indicated that in contrast to the crude oil even high concentrations of the dispersant, Corexit, were not effective in liberating significant proportions of the oil emulsions into the water. Corexit alone at 0.0, 0.3, 3.0, and 100.0 mg/L did not alter the incidence of abnormalities or death in zebrafish (ZF) embryos exposed through 8 days of development (near completion of organogenesis). Direct contact exposure of ZF embryos to DH emulsions "buttered" on a contact surface of 16cm^2 (250mg) resulted in a high incidence of edema/axial deformities and subsequent mortality (40%–90%) over a range of Corexit concentrations of 0, 0.3, 3.0, and 100mg/L. Deformities present were generally evident by 96hrs of the 8-day exposure. The elevated incidence of abnormalities and mortality related to emulsion exposure were independent of Corexit concentrations at 0.0, 0.3, and 3.0 mg/L. Both the number of abnormalities and mortalities increased for the contact "buttered" emulsion and Corexit 100 mg/L co-exposure. Non-contact water exposures at the same "buttered" dose (250 mg) resulted in axial changes alone and mortalities <10% throughout the 0.0 to 100 mg/L Corexit concentration range. Significant delays to hatch were evident for these exposures although the number of abnormalities was dramatically increased above controls for only the 3.0 and 100 mg/L Corexit concentrations. Exposure and developmental data suggest that an emulsified light crude effectively presents hazardous compounds to fish embryos under direct exposure conditions present in coastal marshes. Corexit had little effect on the developmental toxicity of oil emulsions except at the highest concentrations.

TP002 Identification of Compounds in Heavy Oil that are Toxic to the Early Life Stages of Rainbow Trout (*Oncorhynchus mykiss*). J Adams, School of Environmental Studies, Queen's Univ, Kingston ON, Canada; PVH Hodson, School of Environmental Studies, Queen's Univ, Kingston ON, Canada. Heavy fuel oil (HFO), the refined product of crude oil distillation, has a density equal to or greater than that of freshwater, resulting in a different environmental fate than lighter crude oils that float on the water surface and contaminate shoreline environments. HFO may sink in the water column, contaminate vegetation and be incorporated into sediments, affecting aquatic organisms not typically exposed to floating oils. There has been little chemical characterization and identification of the compounds within HFO responsible for fish toxicity. The 3-4 ringed alkyl PAH (naphthalene, phenanthrene, dibenzothiophene, fluorene and chrysene) have been identified as the toxic components of crude oil. HFO is comprised of a higher concentration of 3-ringed alkyl PAH and an abundance of 5-6 ringed PAH, and is predicted to be more toxic to fish. The combination of HFO's physical properties that control its environmental fate and its toxicity to fish embryos, present a unique risk to fish reproduction and recruitment of fish populations. Before strategic plans appropriate for HFO are produced, adequate characterization of the hazards to embryos exposed to sunken oil is critical. Bioassay-driven oil fractionation will be used to identify the major classes of compounds in Bunker C (HFO) that are chronically toxic to the early life stages of fish, determine whether these components are sufficiently bioavailable to cause toxicity, and establish the toxicity of HFO relative to medium and light oil.

TP003 Deepwater Horizon Ephemeral Data Collection: Carcass Stranding and Oiling Rate Data to Help Evaluate Acute Avian Mortality. JR Wakefield, Cardno ENTRIX; P Reilly, Cardno ENTRIX; L Elmore, Cardno ENTRIX; L Holly, Cardno ENTRIX; R Klosowski, Cardno ENTRIX. In response to the Deepwater Horizon oil spill, BP and state and federal Trustees worked cooperatively to systematically search shorelines for stranded bird carcasses and to gather data on the proportion of live birds in the Gulf of Mexico that were visually oiled. Prior to oil making landfall, a series of transects was established along Mississippi, Alabama, and Florida Panhandle shorelines. These transects, representing approximately 20% of the coastline, were searched for beach cast carcasses once every 3 to 7 days from mid-May through September, 2010. The effort was adaptively managed in response to on-sea events and real-time data analysis such that, at various points in time, transects were being systematically searched from Cape Canaveral, Florida around the Gulf of Mexico to the Texas/Mexico border. This poster will describe the sampling design and protocols developed to support the data collection effort. Carcass collection rates and live bird oiling rates will be summarized in a series of temporally and spatially explicit figures and compared to data describing carcass collection rates and live bird oiling rates that may have been expected absent the Deepwater Horizon oil spill.

TP004 Monitoring of Total Petroleum Hydrocarbons in Water Column, Sediment and Biological Samples from Barataria Bay, LA. JL Bouldin, Ecotoxicology Research Facility, Arkansas State Univ; RAF Warby, Dept of Chemistry & Physics, Arkansas State Univ. The BP Deep Water Horizon spill that began on April 20, 2010 is one of the largest accidental marine spills in US history. To assess Total Petroleum Hydrocarbons (TPH) concentrations as a result of this discharge, we collected a total of 11 sediment and 19 water samples from 19 sites across Barataria Bay and in the Gulf of Mexico between 22 July and 6 August 2010. A Ponar sampler was used to collect sediment samples in areas <3 meters below the surface while deeper sediment samples were collected manually by snorkeling. All sediment samples were stored in amber bottles and placed on ice at <40 °C. Water samples were collected from just below the ocean surface with a Wildco vertical PVC sampler and stored in Nalgene bottles on ice at <40 °C. All samples were over-night shipped to an EPA-certified laboratory in New Jersey and analyzed for TPH (C8-40). On 9 September 2010 sponge, Tubstrea, and Bryozoan specimens were collected from Rig MP-311 at depths of 2, 12, 15, and 18 m and also analyzed for TPH (C8-40). Of the 11 sites at which sediment samples were collected, 7 sites were below the reporting limit, while 4 sites with TPH concentrations above the reporting limits, ranged from 520–18,000 mg/Kg. All sponge, Tubstrea, and Bryozoan specimen samples had TPH concentrations above detection limits and ranged from 120 to 2,300 mg/Kg. Of the 19 sites at which water samples were collected, 15 sites were below the reporting limit (<300 µg/L) while the 4 sites with TPH concentrations above the reporting limit ranged from 430–530,000 µg/L. These results clearly demonstrate that TPH concentrations in the sediments and in the organisms were significantly greater than in the water column. These high TPH concentrations in the sediments in Barataria Bay could have far-reaching environmental and economic consequences as this area is farmed extensively for oysters and shrimp, both of which are sediment-associated organisms and the industry generates a significant amount of income for the local economy. While the long-term impacts of these high TPH concentrations on the sponges, Tubstrea, and Bryozoan communities are still unclear, our results show that these communities were impacted to a depth of at least 18 m, and these petroleum compounds were still present in these organisms 2 months after the well was finally capped.

TP005 A Proteomic and Analytical Chemistry Approach: Seagrasses and Oil Contaminants from the Deepwater Horizon Oil Spill. J Corrales, Dept of Pharmacology, Univ of Mississippi, University MS; S Lee, Environmental Toxicology Graduate Program and Dept of Pharmacognosy, Univ of Mississippi, University MS; L Steele, Dept of Biology, Univ of South Alabama, Mobile AL; DJ Gochfeld, National Center for Natural Products Research, Univ of Mississippi, University MS; M Slattery, Environmental Toxicology Graduate Program and Dept of Pharmacognosy, Univ of Mississippi, University MS; A Boettcher, Dept of Biology, Univ of South Alabama, Mobile AL; KL Willett, Dept of Pharmacology, Univ of Mississippi, University MS. The Deepwater Horizon oil spill was the largest marine oil spill in the history of the petroleum industry with over 200 million gallons of crude oil spilled into the northern Gulf of Mexico. Seagrass beds in the Northern Gulf of Mexico are important both from an environmental and economical standpoint. They not only serve as critical nursery grounds for many species including commercially important reef fishes, shrimp and crabs, but also provide feeding grounds for these species and others such as the endangered green sea turtle and manatee. Other environmental benefits include wave protection, oxygen production, and minimization of erosion in coastal ecosystems. Anthropogenic impacts such as the Deepwater Horizon oil spill put at risk the resilience of seagrasses to adapt

to changes in the environment. In the present study, we are measuring the presence of oil spill contaminants such as PAHs by gas chromatography mass spectrometry (GC/MS) in seagrasses and associated sediments collected along the Mississippi-Alabama coast from May to October 2010. We are also determining variation in the proteome profile of these seagrasses (*Halodule wrightii*, *Ruppia maritima*, and *Thalassia testudinum*). To study protein expression, we used a bottom-up proteomics approach where proteins were digested into peptides and analyzed by liquid chromatography coupled with MS. Differentially expressed proteins were identified by the Protein Lynx Global Server software. To anchor the protein effects, Western blots were done on seagrass samples to measure HSP70 expression, a general marker of stress response. Supported by Northern Gulf Institute 191001-306811-02 / TO 002 and NIUST NA07OAR4300494.

TP006 Stage of Toxicological Vulnerability and Gene Expression Changes in a Developing Fish Model following Exposure to a Deep Horizon Light Crude Oil Emulsion. A Bui, Dept of Comparative Biomedical Sciences, Louisiana State Univ, Baton Rouge LA; Z Perveen, Dept of Comparative Biomedical Sciences, Louisiana State Univ, Baton Rouge LA; LJ Thibodeaux, Dept of Chemical Engineering, Louisiana State Univ, Baton Rouge LA; AL Penn, Dept of Comparative Biomedical Sciences, Louisiana State Univ, Baton Rouge LA; SM Fritz-Kleinow, Dept of Comparative Biomedical Sciences, Louisiana State Univ, Baton Rouge LA; KM Kleinow, Dept of Comparative Biomedical Sciences, Louisiana State Univ, Baton Rouge LA. Massive amounts of Louisiana light crude oil were released into the Gulf of Mexico during the Deep Horizon (DH) incident. The oil was transported and significantly altered before reaching coastal marshes that serve as fish nurseries. The stage of embryonic fishes in the marshes at the time of exposure and the sensitivity of the various embryonic stages to weathered oil emulsions are two of the major determinants of the long-term effects of the DH oil spill and recovery of fish populations. These studies examined the sensitivity of various stages of early zebrafish embryonic development to DH oil emulsions and the associated changes in gene expression. Zebrafish were directly exposed to DH oil emulsion (250mg spread on 16cm^2 surface emulating coverage of vegetation in marshes) during the 0–48, 48–96, or 96–192 hour post fertilization (hpf) intervals. Embryos were exposed to clean media in each of the intervals other than the single interval of emulsion exposure. Developmental abnormalities and mortalities resulted at significantly higher rates for embryos exposed to emulsion from 0–48hpf than those exposed to emulsion for either the 48–96 or 96–192hpf intervals. Abnormalities were predominantly edema combined with axial changes often resulting in death of the animal by 192 hpf. Of the few abnormalities resulting from the 48–96hpf exposures, deformities were less severe (slight axial changes and lethargy) than the 0–48 hour interval with 2 animals exhibiting recovery by the end of 192 hours. RT-PCR demonstrated selected significant fold increases in mRNA expression of CYP, AHR, oxidative stress, and other genes. These studies demonstrate specific intervals of developmental susceptibility to DH oil emulsions with the zebrafish model and provide information that may expedite assessments with Gulf species. (Gulf of Mexico Research Initiative)

TP007 Assessment of Water and Sediment for PAH Concentrations and Embryo Toxicity following the Deepwater Horizon Oil Spill. M Dailey, Dept of Pharmacology and Environmental Toxicology Research Program, Univ of Mississippi, University MS; C Thornton, Dept of Pharmacology and Environmental Toxicology Research Program, Univ of Mississippi, University MS; H Patterson, Dauphin Island Sea Lab, Dauphin Island AL and Univ of South Alabama, Mobile AL; Ruth Carmichael, Dauphin Island Sea Lab, Dauphin Island AL; KL Willett, Dept of Pharmacology and Environmental Toxicology Research Program, Univ of Mississippi, University MS. On April 20, 2010, BP's Deepwater Horizon oil rig exploded leaking oil into the Gulf of Mexico for 100 days. Exposure to oil-associated polycyclic aromatic hydrocarbons (PAHs) in the water and sediment could severely impact the aquatic organisms inhabiting the Gulf of Mexico (i.e. death, developmental defects, reproductive effects, etc.). Therefore, water and sediment samples were collected approximately bimonthly between May 26 and November 30 from three sites along the Alabama Gulf Coast, namely, two sites in Mobile Bay (Denton and Sand at various depths (1 or 0.1 m above the bay floor)) and near Perdido Bay. Water was extracted for quantification of 26 PAHs with methylene chloride and analyzed by GC/MS. Additionally, *Fundulus heteroclitus* embryos were exposed to water collected from these sites from 4.5 hours post-fertilization (hpf) to 10 days post-fertilization (dpf). Embryos were scored on 5 and 10 dpf for cardiac toxicities (blood clot, edema and tube heart using a deformity index of 0 (no deformities), 1 (mild deformities) or 2 (severe deformities)), lethality, and cytochrome P450 enzyme induction was measured by an index of 0 (no deformities), 1 (mild deformities) or 2 (severe deformities)), lethality, and cytochrome P450 enzyme induction was measured by an total PAHs were observed on 6/28/10 for Sand (1 m), 8/4/10 for Sand (0.1 m), 7/21/10 for Denton (1 and 0.1 m), and 9/9/10 for Perdido. Fundulus embryos were not significantly affected by the water collected from these sites. There was less than 4% and 2% incidence of edema and blood clot, respectively, and there were no significant differences in deformity index or lethality. Sediment was also collected from these sites and the percent carbon to nitrogen ratio ranged from 12.1–124 for sites in Mobile Bay and 9.25–34.2 for Perdido. Quantification of sediment total and the percent carbon to nitrogen ratio ranged from 12.1–124 for sites in Mobile Bay and 9.25–34.2 for Perdido. Quantification of sediment total PAHs is ongoing. Supported by the Northern Gulf Institute and NIUST NA07OAR4300494.

TP008 Effects of Corexit 9500 on Mallard (*Anas platyrynnchos*) Embryo Survival and Development. K Wooten, Dept of Environmental Toxicology, The Institute of Environmental & Human Health, Texas Tech Univ; B Finch, Dept of Environmental Toxicology, The Institute of Environmental & Human Health, Texas Tech Univ; PN Smith, Dept of Environmental Toxicology, The Institute of Environmental & Human Health, Texas Tech Univ. The objective of this study was to examine avian embryotoxicity of Corexit 9500 using mallard duck (*Anas platyrhynchos*) eggs. Treatments ranging from 0–100µL of Corexit 9500 were applied topically to mallard eggs on day 3 of incubation. The largest incidence of embryo mortality occurred at stage 4, corresponding to the day following treatment. When compared to controls, hatching success was significantly decreased in eggs treated with ≥30µL of Corexit 9500. All embryos from eggs treated with ≥40µL experienced mortality prior to hatching. Developmental stage at embryo death was also significantly decreased as compared to controls in exposures of 40µL and above.

TP009 Biomarker Responses of Bivalves for Assessing Oil Spill Impacts. AH Ringwood, Univ of North Carolina at Charlotte, Charlotte NC. Bivalve mollusks (oysters and mussels) have been used worldwide to assess the impacts of oil spills. Cellular biomarker responses can be used as valuable indicators of cellular toxicity associated with oil exposures. Therefore, ecosystem surveys of biomarkers such as lysosomal destabilization can be used to assess the extent of the impacts, and can also be used to identify recovery. The Gulf BP disaster is unprecedented. Oil that deposits into marshlands and coastal habitats tends to persist for long periods, increasing the potential to cause long term impacts on shellfish and fishery resources. The valuable roles of sensitive biomarker responses in bivalves for addressing these important issues will be presented. The lysosomal destabilization responses of hepatopancreas or hemocyte cells of bivalves (and also fish tissues) have been used as a very valuable indicator for oil spills all over the world. Some results associated with a recent spill event that occurred in Charleston Harbor, SC as well as data from other worldwide spills will be presented. In the SC study, oysters (*Crassostrea virginica*) were collected from oiled and not-oiled sites, and the effects on lysosomal destabilization and other biomarkers were studied. Lysosomal destabilization rates were significantly higher in oysters from oiled sites, and also indicated signs of recovery in some areas in the following year. From our extensive experience with this assay, we have also demonstrated important linkages between lysosomal destabilization responses and gamete viability, a response that can seriously impact recruitment and recovery. Likewise, studies with mussels (*Mytilus* sp.) collected in areas oiled by the Prestige Oil Spill were used to track damage and recovery along the coast of Spain. Biomarker responses can provide important diagnostic information for assessing the extent and duration of the impacts of oil spills.

MOVED TO 1A007

TP010 Evaluation of Potential Impacts of the Deep Water Horizon Oil Spill on the Benthic Environment at the Mississippi River Southwest Pass and Adjacent Areas. GR Lotufo, US Army Engineer Research and Development Center, Vicksburg MS; JM Corbino, US Army Corps of Engineers, New Orleans District. Depending on the magnitude and location of chemical spills, there is a potential for USACE dredging operations may be delayed by response activities and evaluation of potential environmental impacts. Multiple USACE dredging projects spanning the Gulf were impacted

by the Deepwater Horizon (DWH) incident due to suspicion of dredged material contamination. Maintenance dredging sediment from Mississippi River Southwest Pass (MRSWP), located 40 miles northwest from the source of the oil leak, an area suspected of impact, was collected in October 2010. Chemical and biological effects evaluation followed USEPA/USACE guidance. The concentration of PAHs in surface water, sediment elutriates, and whole sediment was below detection limit or minimal, and lower than any available effects criteria or guidelines values. Except for modest fish mortality in one elutriate sample, no toxicity to fish or invertebrates was observed and no organic chemicals were found above detection limits in test organism tissues. The evaluation concluded that MRSWP dredged material was suitable for open water disposal. Comparison with historic data from that site and post-spill subtidal sediment chemistry data for the Gulf Coast indicates that the frequently dredged areas at the MRSWP and adjacent areas were not contaminated, at least at measurable levels, by the DWH spill. While the magnitude of that spill was unprecedented in US waters, it was not an isolated incident. A proposed approach for streamlined and expedited sediment sampling and evaluation for use in dredging operations in areas suspected of impact from oil spill incidents will be presented.

TP011 Are Subchronic Effects Reliable Predictors of Long Term Ecologically Significant Effects? K Jenkins, ERM; B Sanders, ERM; P Goodrum, ERM. Evaluations of risk/injuries to ecological receptors have most often focused on measures of mortality, impaired growth, and reproduction. These measures of injury are easily understood and provide information on both acute and chronic toxicity. Data on mortality and reproductive rates can also be incorporated into quantitative population models that can be used to evaluate the effects of increased mortality or reduced reproduction, on the sustainability of local populations. In recent years, a variety of subchronic parameters have also been employed to evaluate exposure to specific chemical groups and potential chemical-specific mechanisms of toxicity. Subchronic parameters that have been studied include: 1) genetic alterations, 2) biochemical responses, 3) immune system responses, and 4) tissue histopathology. Most studies of subchronic responses have been conducted in the laboratory under controlled conditions where exposure to a chemical of interest is varied and all other variables are held constant. Many of these subchronic effects are not contaminant-specific making it difficult to establish causation in field-collected organisms. Moreover, relationships between measures of subchronic responses in field collected organisms, and the implications of those responses to the fitness of individual organisms, let alone the sustainability of the local population, have not been established. For oil spills, the subchronic parameter that is most often measured is the induction of CYP1A in response to the exposure to petroleum-related compounds. CYP1A is often used as an indicator of exposure in oil spills and in some cases has been proposed as a measure of deleterious effects. Based on a rigorous evaluation of the available data we conclude that subchronic measures of effects including CYP1 may have some utility in evaluating exposure to specific classes of chemicals, they do not provide reliable predictors of long-term, ecologically significant effects. The basis for these conclusions will be discussed.

TP012 Phytotoxicities of Oils, Dispersants and Dispersed Oil: Review and Evaluation. M Lewis, USEPA, Gulf Breeze FL. This presentation summarizes the published data (1975–present) on toxic effects of petrochemicals on plants found in the Gulf of Mexico such as algae, phytoplankton, wetland plants, mangroves, and seagrasses. Oils and dispersants are difficult to study toxicologically; this difficulty is compounded when the test species are plants. Aquatic plants have varied morphologies and life history characteristics that impact the experimental design and relevancy of results. Most information on the toxic effects of oils and remediation products are based on post oil-spill observations. Toxic effect concentrations are relatively uncommon, particularly those from dose-response studies. Standard toxicity test methods are not available for most aquatic plants and experimental conditions vary widely. Tests have been conducted in the laboratory, in-situ and in outdoor mesocosms with cultured and field-collected species for periods between 4 hours to 1 year. Sublethal effects on growth, pigment content, and photosynthetic activity have been more commonly measured than lethality. Toxic effect concentrations are available for 18 algal, 13 wetland plant, 6 mangrove and 7 seagrass species and 20 crude oils and 18 dispersants. Most dispersant information is for algae (9 dispersants) and the least for wetland plants (2 dispersants). Algae and wetland plants have been exposed to more oils (9) in toxicity tests than other aquatic plants. Tests conducted with different species and the same petrochemical and those conducted with the same species and different petrochemicals using similar test designs have not been commonly reported. As a result, the literature database does not support a ranking of toxicities and of sensitive species, life stages and response parameters. Furthermore, the database is not useful to reliably predict phytotoxicities of current dispersants, oils, and their combinations prior to and during spill events. Compounded with the usual lack of information on dispersant exposure concentrations, toxicity-based hazard assessments will remain difficult for aquatic plants. A proactive and experimentally consistent approach is recommended to fill data gaps.

TP013 The Uptake of Dispersed Oil Droplets by Zooplankton. R Lee, Skidaway Institute of Oceanography; GA Paffenhöfer, Skidaway Institute of Oceanography; M Köster, Skidaway Institute of Oceanography. Perry and coworkers reported the presence of oil droplets in crab larvae collected off the coast of Louisiana (www.climatecentral.org/blog/nicole__blog/posts/) after the recent Gulf of Mexico spill. As a follow up to these observations we carried out studies on the uptake of dispersed oil by the copepod, *Eucalanus pileatus*, an important zooplankton species in the Gulf of Mexico. A stock solution of dispersed oil droplets was produced by mixing oil (200µl) from the Deepwater Horizon spill with the dispersant Corexit 9500 in 20ml of seawater at the ratio of 40:1 (oil:dispersant) and aliquots of this stock solution were added to cultures of *E. pileatus*. Droplet size, based on photomicrographs, varied from 5 to 50 µm in diameter with final concentration of oil droplets in the copepod culture varying from 25 to 200 droplets/ml. The copepods were fed on the diatom, *Thalassiosira weissflogii*, at a concentration of 80µg of carbon/liter. After 5 hours of exposure to oil droplets, there was evidence of oil droplets attached to the carapace of the copepods, as well as intake of 5µm sized oil droplets. Videos taken of the copepods exposed to oil droplets and diatoms showed active feeding taking place along with extensive food in the gut. There was no evidence of oil droplets within copepods when food was not present in the water, suggesting the need for feeding currents to bring the oil droplets into the animals. There was evidence of oil droplets in the fecal pellets of the copepods, suggesting that at least some of the oil droplets are passed quickly through the gut. This would be an avenue by which oil could enter the benthos. Studies are planned to determine if reproduction and growth are effected in the copepods as a result of taking up dispersed oil droplets. Preliminary work suggest that larvae of the grass shrimp, Palaemonectes pugio, can also take up dispersed oil droplets, suggesting a mechanism by which zooplankton in the Gulf of Mexico can take up dispersed oil.

CONTROL AND ABATEMENT

TP014 Molecular Beam Study on Nonthermal Plasma Treatment of Volatile Organic Compounds using VUV and Femtosecond Laser Photoionization Time-of-flight Mass Spectrometry. LH He, Chemistry Dept, Tulane Univ, New Orleans LA; MS Sulkes, Chemistry Dept, Tulane Univ, New Orleans LA. Historical data on oil spills indicate that VOCs are likely to evaporate, disperse, and/or react quickly after the oil reaches the surface of the water. Most of those VOCs are toxic and harmful to the environment. Nonthermal plasma (NTP) methods present potential advantages in the treatment of VOCs with relatively low energy consumption. Efforts have been under way since at least the early 1990s to improve practical techniques via a better fundamental understanding of NTP phenomena. Mechanistic understanding of the early post discharge chemistry is fundamental to characterizing and then improving NTP remediation for various VOCs. However, direct study of post discharge chemistry has been limited, leading to a growing demand for general capabilities to identify numerous post discharge species, stable and reactive, neutral and ionic. Molecular beam methods afford this possibility. Indeed, VUV and resonant photoionization methods already are established in environmental compound trace detection. In order to study NTP remediation chemistry of alkylbenzenes, we first looked at post discharge products of toluene and other alkylbenzenes seeded in He, then co-added additional species, O_2 in particular. Now employing ~800 nm fs pulses for photoionization, we have extended our studies to additional alkylbenzenes as well as to pyridine. The newly obtained data reveal important information about the intermediate species in benzene, toluene, and other alkylbenzene species following corona discharges. As established from discharge, flame, and pyrolysis product studies on benzene in rare gases, the product chemistry shows general similarities in each case, in particular the formation of

higher mass polycyclic aromatic hydrocarbons (PAHs). The VUV and fs laser photoionization time-of-flight mass spectrometry combined with molecular beam technique have proven to be ideal and sensitive tools for a comprehensive diagnosis of nonthermal plasma treatment of volatile organic compounds. Moreover, general and sensitive mass detection of trace pollutants is an important capability. Sensitive molecular beam time-of-flight mass spectrometry has been used for this purpose for some time. Practical arrangements for general species detection have employed 118 nm (10.5 eV) photons. We have found multiple advantages in instead employing ~800 nm fs laser pulses for photoionization. In this approach, species with IPs above 10.5 eV can also be observed. Further, our detection sensitivities for aromatics exceed the levels we observed with 118 nm photoionization. The results reported indicate that near IR ultrashort laser pulse photoionization shows utility for environmental monitoring applications.

SEAFOOD CONTAMINATION, SAFETY, AND HUMAN HEALTH

WP001 Determination of PAHs in Mississippi Seafood from Areas Affected by the Deepwater Horizon Oil Spill Disaster. G Hagood, Mississippi State Chemical Laboratory, Mississippi State Univ; C Childers, Mississippi State Chemical Laboratory, Mississippi State Univ; L Ware, Mississippi State Chemical Laboratory, Mississippi State Univ; K Xia, Mississippi State Chemical Laboratory, Mississippi State Univ; A Brown, Mississippi State Chemical Laboratory, Mississippi State Univ; K Armbrust, Mississippi State Chemical Laboratory, Mississippi State Univ; D Diaz, Mississippi Dept of Marine Resources, Office of Marine Fisheries; J Jewell, Mississippi Dept of Marine Resources, Office of Marine Fisheries. The Mississippi State Chemical Laboratory has been providing expedited analysis on seafood samples from areas of the Gulf affected by the Deepwater Horizon oil spill. This is an ongoing concerted effort with the Mississippi Department of Marine Resources, Mississippi Department of Environmental Quality. The first set of samples consisting of shrimp, crab, oysters, and finfish were received by MSCL on May 27, 2010. Samples were collected and analyzed weekly until November 2010, and monthly thereafter. The MSCL method for the PAHs analysis in seafood samples consists of ASE extraction, silica/alumina column cleanup, and GC/MS/MS analysis. The sample turnaround time for a batch of 24 samples was 2.5 to 3 working days, requiring one chemist for extraction and cleanup and one chemist for GC/MS/MS analysis and data reporting. An Agilent 7000B triple quadrupole GC/MS/MS PAH analyzer operated in MRM mode was used for qualification and quantitation. Our method had 69% to 140% recovery rates for PAHs in the seafood samples analyzed. The instrument detection limit was 0.05 ppb. The limit of quantitation (LOQ) ranging from 29 to 61 ppb for the 25 PAHs analyzed was achieved. Up to date, the levels of PAHs detected in close to 250 seafood samples were below the levels of concern (LOC) established by the USFDA. In addition, the detected PAHs levels in the seafood samples were similar to those detected in the processed food such as smoked chicken, smoked pork, smoked catfish, smoked brisket, smoked shrimp, sandwich turkey, and sandwich ham collected from local grocery stores and restaurants.

WP002 Mitigation of Matrix Specific Interferences in Oil Release Impacted Tissue Evaluations using Sample Extract Clean-ups. B Stearns, TestAmerica; A Vicinie, TestAmerica; P McIsaac, TestAmerica; W Cicero, TestAmerica. A bench scale study was performed to evaluate the applicability and performance of different clean-up procedures on organic extracts from tissue samples spiked with a known amount of a crude oil. The investigation sought to identify sample matrix-related interferences, how they might impact the determinations for oil release-related constituents, and how they might be mitigated by organic extract clean-up procedures. The study evaluated 5 standard SW-846 clean-up techniques: Gel Permeation Chromatography (3640), Silica Gel (3630), Alumina (3611), Acid (3665), and Sulfur (3660). The study design utilized a single source of marine fish tissue and with each test aliquot being generated using the same extraction procedure. All study extracts, both pre and post clean-up, were evaluated for a suite of oil spill related constituents including PAHs, aPAHs, and biomarkers using a GC/MS instrumentation operating in SIM mode.

OIL FATE AND TRANSPORT MEASUREMENTS AND MODELING

WP003 Weathering of MC252 Oil in the Water Column of the Gulf of Mexico from May through September 2010: Fluorometry, Dissolved Oxygen, and Quantitative Chemistry Evaluation. MW Johns, Exponent Inc, Seattle WA; R Atlas, Univ of Louisville, Louisville KY. The Deepwater Horizon oil spill was unique in that it originated from a water depth of approximately 1,500 m. Between April 20, 2010, when the rig accident occurred, and July 15, 2010, when the well was capped, approximately 725,000 gallons of chemical dispersants were injected in the Deepwater Horizon well head. Physical and chemical dispersion of the MC252 oil resulted in a cloud of fine droplets at approximately 1,100–1,200 m that generally moved in a southwesterly direction while larger droplets moved to the surface and formed a slick that moved toward the shoreline. Two vessels managed by the Submerged Monitoring Unit Response Group, along with numerous other vessels, were equipped with conductivity temperature and depth (CTD), dissolved oxygen (DO), fluorometry, and deep water collection capabilities to evaluate and track the subsea dispersed oil cloud. Field fluorometry measurements were used to track the location of the subsea dispersed oil in real time and water chemistry samples were collected and analyzed to quantify the field measurements. This paper presents an evaluation of the correlations between the fluorometry, DO, and analytical chemistry results. Chemistry samples sometimes, but not always, showed correlations with fluorometry and DO measurements. The purpose of the study is to understand the relationships between chemistry, fluorometry, DO, and biodegradation weathering processes.

WP004 Analysis of Oil Spill Dispersants and Degradation Products in Seawater by Two-dimensional Liquid Chromatography-High Resolution Mass Spectrometry. GJ Getzinger, Duke Univ, Nicholas School of the Environment, Durham NC; PL Ferguson, Duke Univ, Civil and Environmental Engineering, Durham NC. The largely unknown toxicity and environmental fate of oil spill dispersants in open-ocean environments has raised concerns about their application in response to the recent Deep Water Horizon oil spill in the Gulf of Mexico. The most heavily used dispersant formulation has been the Corexit® series, which contains a complex mixture of monomeric and polymeric surfactants including dioctylsulfosuccinate (DOSS), polyoxyethylene sorbitan mono- and trioleates, and sorbitan monooleates. There are currently very few published reports of comprehensive analytical characterization of these mixtures and even fewer detailing the biodegradation of Corexit® dispersant components in marine environments. Due to the complexity of dispersant formulations, most reports have focused exclusively on the fate and toxicity of only one component the oil spill dispersant (DOSS). Toxicity studies of dispersant chemicals will undoubtedly rely on sensitive and accurate methods for the analysis of all dispersant components and their transformation products. We have developed a comprehensive analytical method based on high-resolution mass spectrometry for separation and structural analysis of Corexit® 9500 components in seawater. The method utilizes large volume injection and 2-dimensional liquid chromatography (2D-LC) for the exhaustive separation of both monomeric and polymeric dispersant surfactants from seawater. Exact mass and MSn measurements were performed with a hybrid linear ion-trap Orbitrap mass spectrometer (LTQ Orbitrap Velos), allowing structural elucidation with unsurpassed sensitivity and mass accuracy. The chromatographic resolution achieved by 2D-LC, coupled with the high performance capabilities of the LTQ Orbitrap Velos (R>100,000, mass error<5 ppm) has allowed, for the first time, the extensive characterization of dispersant components and their aerobic biodegradation products. Results of these experiments will provide invaluable data on the potential for persistence and transport of these compounds in marine waters, facilitating a thorough assessment of the toxicological risk of oil spill dispersants.

WP005 Confirmation of Non-MC-252 Oil in Water Column Samples Southwest of the Wellhead using Hydrocarbon Biomarkers and PAH Ratios. M Cejas, Cardno ENTRIX; R Barrick, Infinity Solutions Group. In response to the Deepwater Horizon Oil Spill, BP and state and federal natural resource trustees worked cooperatively to assess injury to the water column during the response and in the initial phase of the Natural Resource Damage Assessment (NRDA). Hydrocarbons were undetected in most water samples collected during the NRDA cruises, and detected PAH often consisted of a small number of the most soluble compounds such as naphthalene and methylnaphthalenes. Some samples contained evidence of entrained oil, including relatively insoluble saturate biomarkers and higher molecular weight PAH such as chrysene and alkylated chrysenes. Comparison of these persistent compounds with MC-252 source oil enables the matching or not of oils found along the south west trajectory from the wellhead with MC-252 oil. Following this initial assessment of the PAH composition, gas chromatograms, and extracted ion profiles (EICPs) as basic confirmation of the potential presence/absence of MC-252 oil, source matching was carried out with a statistical protocol on a subset of samples. These water samples included several in which PAH concentrations exceeded a conservative aquatic life benchmark but were not associated with MC-252 oil. The chemometric assessment was structured in a tiered process that included a weighted least squares PCA analysis that maximized use of all acquired PAH and biomarker scans, including multiple biomarker profiles known to be resistant to dissolution and biodegradation weathering mechanisms. This presentation will demonstrate that the integrated

statistical method is effective at processing both quantitative and semi-quantitative chemical results in environmental samples that might contain MC 252 source oil. The first tier of this assessment is an overall hypothesis testing by using weighted least squares fitting of the principal components, while the second tier is a linear regression comparison to analytically comparable MC-252 reference oil. Weathered and unweathered samples are classified as matches to MC-252 if confirmed by other lines of data, potential matches to MC-252 pending findings from other lines of data, or unlikely to be associated with MC-252 using this procedure.

WP006 Protocol for Petroleum and PAH Source Determination in Sediments: MC 252 Source Chemical Fingerprinting. PD Boehm, Exponent Inc; JS Brown, Exponent Inc. A protocol is presented for the primary use of petroleum geochemical biomarkers combined with supporting and confirmatory lines of chemical evidence to determine the presence of MC252 oil in sediments of the offshore and nearshore Gulf of Mexico. These approaches can also be applied to other matrices with appropriate matrix-specific caution. Two parallel fingerprinting considerations are included in the protocol. The first involves identification of the petroleum source in a sample through the comparisons of the sample-specific concentrations of a group of petroleum biomarkers to those in the MC252 (Q4000) reference oil through an R^2 regression. The quantitative results of this statistical analysis are used to scale the degree of confidence in a "match" of the petroleum hydrocarbons in a sample to that in the MC252 oil. Examination of the gas chromatograms (GCs) and extracted ion current profiles (EICPs) of the sample then confirms or negates the R^2 finding. The second parallel approach focuses on the PAHs themselves. Two types of PAHs may be present in a sample, petrogenic or pyrogenic, the latter likely unrelated to any petroleum source. A petrogenic/pyrogenic analysis of the PAH data is made and combined with the petroleum biomarker fingerprinting results to answers the questions: Is the petroleum in the sample from MC252? Are some or all of the PAHs in a sample related to other sources? Quantitative, high quality biomarker analyses and analyses of parent and alkylated PAHs must be generated to support this protocol along with expert interpretation of the biomarker data and fingerprinting results.

WP007 Operational Modeling of the Surface Oil for the Deepwater Horizon Oil Spill. CH Barker, Emergency Response Division, National Oceanic and Atmospheric Administration; A MacFadyen, Emergency Response Division, National Oceanic and Atmospheric Administration; G Watabayashi, Emergency Response Division, National Oceanic and Atmospheric Administration. During the unprecedented Deepwater Horizon MC252 oil spill response in the Gulf of Mexico, NOAA's Emergency Response Division provided a suite of modeling products to support the response community. The products included daily 72-hr tactical forecasts for movement of the floating oil and statistical modeling of where oil could go on longer time scales. A review of the modeling products, the results, and the methods used to develop them will be provided. Daily tactical trajectories for the surface oil were produced that provided maps of where the surface oil was likely to be in the following 24, 48, and 72 hours, as well as uncertainty bounds associated with the predictions. In addition, a 5-day outlook was provided of potential shoreline oiling. These analyses were based on an ensemble modeling approach, utilizing currents from a number of external hydrodynamic models from government and academic sources. Trajectories were initialized daily from analysis of satellite imagery, information from aircraft equipped with multiple sensors for detecting oil, and incorporation of visual overflight observations. In the first few days after the Deepwater Horizon (DWH) rig sank in the Gulf of Mexico, it was apparent that the potential for a very large spill of long duration was in store. While the daily trajectory forecasts guided immediate response efforts, an analysis of the long-term outlook for oil transport was also required. If the well were to remain uncontrolled for many months, the response community needed to know where efforts should be focused to prepare for future response activities, and to determine whether foreign governments should be notified. For a longer term outlook, NOAA adapted a Monte-Carlo simulation approach—running an oil spill trajectory model 500 times. Individual oil trajectory scenarios were developed by sampling the historical data using random start times from April and May for the years 1992 to 2008. A 90-day release was used, with the model run for a total of 120 days. The results of this modeling effort will be discussed, as well as comparisons with other hydrodynamic models, and the efforts made later in the spill to refine and extend the approach as the real scenario began to unfold.

WP008 Bioavailable PAHs utilizing Passive Sampling Devices in Water and Air in the Gulf of Mexico Pre- and Post-shoreline Oiling during the Deepwater Horizon Oil Spill. SE Allan, Oregon State Univ, Dept of Environmental and Molecular Toxicology, Corvallis OR; S O'Connell, Oregon State Univ, Dept of Environmental and Molecular Toxicology, Corvallis OR; L Tidwell, Oregon State Univ, Dept of Environmental and Molecular Toxicology, Corvallis OR; K Hobbie, Oregon State Univ, Dept of Environmental and Molecular Toxicology, Corvallis OR; BW Smith, Oregon State Univ, Dept of Environmental and Molecular Toxicology, Corvallis OR; G Wilson, Oregon State Univ, Dept of Environmental and Molecular Toxicology, Corvallis OR; KA Anderson, Oregon State Univ, Dept of Environmental and Molecular Toxicology, Corvallis OR. In response to the Deepwater Horizon oil spill, lipid-free tubing passive sampling devices (PSDs) were deployed in water and air at near shore locations in the Gulf of Mexico prior to and during shoreline oiling. Samples were obtained at 4 sites in Florida, Alabama, Mississippi, and Louisiana. PSD extracts were analyzed for 20 unsubstituted polycyclic aromatic hydrocarbons (PAHs), 13 methylated PAHs (methyl-PAHs), and 16 oxygenated PAHs (OPAHs). Furthermore, the samples were screened for over 1,200 chemicals using retention time locking and de-convolution reporting software. PSDs sequester and concentrate the freely dissolved portion of a variety of hydrophobic organic contaminants, providing a time integrated measure of the bioavailable fraction of these chemicals. The first samples were obtained 20 days after the sinking of the Deepwater Horizon oil rig when none of the sites had been impacted by the oil from the spill. Further sampling was carried out at the 4 Gulf Coast sites during the summer of 2010, following extensive oiling of areas of the coastline. Significant differences in the bioavailable concentrations of PAHs, OPAHs, and methyl-PAHs sequestered by the PSDs were observed pre- and post-oiling of the coastline. Furthermore, the chemical profiles, diagnostic rations, and multivariate analyses showed significant changes from the pre-spill impact baseline following coastal oiling. This data demonstrates significant changes in the bioavailable fraction of PAHs, a component of crude oil, which are known to be toxic and carcinogenic to people and wildlife. Ingration PSD extracts with zebrafish and Ames bioassays will be discussed.

WP009 Distribution and Fate of MC252 Oil across an Elevational Gradient on Fourchon Beach, Louisiana. JH Pardue, Dept of Civil & Environmental Engineering, Louisiana State Univ; V Elango, Hazardous Substance Research Center, Louisiana State Univ; K Lemelle, Dept of Civil & Environmental Engineering, Louisiana State Univ; M Urbano, Dept of Civil & Environmental Engineering, Louisiana State Univ; SJ Williams, SOEST, Dept of Geology & Geophysics, Univ of Hawaii. The distribution and fate of remnant MC252 oil are being assessed across an elevational gradient along a 15 km-long stretch of Fourchon Beach, Louisiana, one of the heaviest impacted shorelines following the Deepwater Horizon leak on 20 April 2010. Fouchon Beach is an eroding low-relief wash-over dominated headland consisting of thin fine-grained sands overlying marsh/back barrier muddy organic-rich sediments. Subenvironments include subtidal and supratidal beach environments, high salinity salt pans and anaerobic salt marsh and mangrove sediments. Distributions of weathered oil on the beach are being assessed using high dynamic range imaging and time-series chemical analysis of alkane and PAH concentrations referenced to hopane. These field measurements are being supplemented by biodegradation studies in the laboratory in both highly saline salt pan sands and sands with lower salinity. Time-series hydrocarbon analyses referenced to hopane, supplemented with measurements of stable carbon isotopic signatures of respired CO_2, are being used to assess biodegradation. In the wetland habitats behind the beach, crude oil component analyses coupled with laboratory microcosm studies and field measurements of alternate electron acceptors and nutrient status are being used to assess MC252 oil fate. Results to date indicate that complex distributions of oil forms are observed across the elevational gradient of Fourchon Beach, driven by tropical weather (Hurricane Alex and Tropical Storm Bonnie) and the passage of strong winter cold fronts. This has resulted in buried oil mats and buried remnant oil balls both in the subtidal and supratidal environments and oiling of anaerobic sediments in the marsh. Difference in environmental conditions across the gradient including oxygen, nutrient status and the form of the oil are creating slower natural biodegradation reactions when compared with previous studies at these locations. The presence of MC252 in the form of an oil:water emulsion when it reached shore is an underlying factor affecting both the fate and distribution

of oil from this event. The fate of emulsions in these marine–estuarine–marsh environments is largely unknown and represents a huge gap in our scientific understanding that can be reduced by results from this spill assessment study.

OIL TRACKING TECHNOLOGY

WP010 The Submerged Oil Dragging Procedure as a Means to Screen for Presence and Extent of Oilspill Residuals. SM Bodensteiner, Weston Solutions Inc; S Rutkowski, Weston Solutions Inc. As recently reported at the Association for the Advancement of Science, significant quantities of oil from the BP oil spill remain on the Gulf of Mexico seafloor. Over the next several years, significant monitoring efforts will continue to determine the full extent of the sub-surface impact zone, the rate at which the residual oil is degrading, and whether the oil residuals are any more persistent in different locations of the Gulf. The Submerged Oil Dragging Procedure (SODP) has been used as a low-cost screening measure to determine the extent of the subsurface impact at locations near substantial oil spills that have occurred in the United States. The SODP involves dragging viscous snare material over the top of sediments in the spill impact zone. This material is gathered in small bundles called "pompoms" and attached to a weighted beam which is then submerged and lowered to the seafloor. The beam is held perpendicular to the direction of travel, such that a continuous area of coverage the length of the beam is created. After each pass of the mopping beam, it is raised and inspected for any trace of residual oil deposits. If residual oil is detected, the contaminated materials are removed for forensic analysis and petroleum finger printing. The SODP was originally developed for the New Jersey Department of Environmental Protection following an oil spill on the Delaware River in 2004. More recently, it was implemented in San Francisco Bay following the spill involving the container ship, *Cosco Busan*, which resulted in a discharge of 58,000 gallons of bunker fuel oil. It was used to determine whether residual oil from the spill was present in sediments proposed for dredging within federal navigation channels of the Bay. This presentation discusses the objectives of this and other projects where the SODP was used, how they relate to the near and long-term objectives of the monitoring effort in the Gulf, and how the SODP could be implemented as a cost-effective tool for this effort.

WP011 The Methods used to Characterize Oiling on Shorelines as a Result of the MC252 Incident. GD Harmon, Cardno ENTRIX; AM Morrow, Cardno ENTRIX; SA Briggs, Cardno ENTRIX. In response to the Deepwater Horizon Oil Spill, three programs were implemented to delineate the spatial extent of shoreline oiling in the Gulf of Mexico (GOM): Shoreline Cleanup Assessment Teams (SCAT) overseen by the Response unit, pre-assessment point evaluation by Shoreline Natural Resource Damage Assessment (NRDA) teams, and rapid pre-assessment mapping by Shoreline NRDA teams. The SCAT teams examined shoreline from May through the present. The purpose of SCAT was to locate and map oil in order to direct clean-up operations. The NRDA teams conducted a pre-assessment survey of the shoreline from mid-May to mid-September and collected detailed data at over 2,200 representative points across the GOM. The purpose of this effort was to collect more detailed information that was expected to relate more closely to shoreline injury. The Shoreline TWG also conducted rapid assessments in Louisiana marshes from early August through mid-October. Approximately 2,520 miles of shoreline were surveyed. The purpose of the rapid assessment was to collect data useful to the NRDA but over longer shoreline reaches. Rapid assessment focused on areas near known oiling that had not been previously surveyed but there is overlap between the rapid assessment surveys and the other two surveys. These methods will be described regarding their role in the overall characterization of oil exposure to marshes in the GOM. This paper will present the data collected from these three different assessments to show the oiled footprint on habitats in the GOM. This evaluation will provide a better understanding of the spatial extent of exposure to oil from the MC252 Incident.

WITHDRAWN

WP012 Time Integrative Large Volume In Situ Water Extraction for Total and Dissolved Trace Organics. B Hepner, Aqualytical Services Inc Center for Environmental Research, Maple Valley WA; Don Mabe, Aqualytical Services Inc Center for Environmental Research, Maple Valley WA. PAH concentrations in the marine water column are extremely low, even after a spill event. In the past, estimation of PAH concentrations in the water column were obtained from mussel and fish tissue residue studies, using equilibrium partitioning calculations. These studies were time consuming and supplied data only for dissolved PAHs, and not for oil droplet phases. The intent of this study was to develop a large volume time integrative extraction event, to determine the total and dissolved oil and PAH in the marine water column itself, and test it in a spill event. The difficult task in concentrating large volume samples is capturing the pollutants in both the particulate droplet and dissolved phases without allowing significant break-through of the contaminants. In order to accomplish this, two different pollutant removal mechanisms must be employed. Pollutants bound to the particulate phase can be removed via a filtering system that physically removes all particulate matter. Those pollutants in the dissolved phase, however, must be extracted from the water utilizing a substance that sequesters them. In order to extract in situ large volumes of water while separating the pelagic sediments and oil droplets from the dissolved fraction, a 2-stage Luer locked disk system coupled to a small submersible pump was developed. The first stage disk used lofted glass depth filtration to quantitatively retain pelagic sediments and oil droplets, for extraction and analysis. The second stage disk sequestered dissolved trace organics of interest, with solid phase extraction media. The small submersible pumping system would draw water slowly through the disks at 10–50 ml/min. providing a time integrative extraction event, representing days to weeks, and up to 100 liters of water. The water column off Dauphine Island, Alabama was field extracted and analyzed using Ion Trap GC/MS during the Horizon spill event using this extraction system. PAH concentrations in the PPT level during 3 months of continuous monitoring before and during the event will be presented.

WP013 Fluorescence and Dissolved Oxygen Anomalies as Indicators of Hydrocarbon Presence Following the Deepwater Horizon Oil Spill. J Harney, Cardno ENTRIX; A Isley, Cardno ENTRIX; T Thompson, Cardno ENTRIX. In response to the Deepwater Horizon Oil Spill, BP worked cooperatively with state and federal trustees to assess the state of the water column during the response and in the initial phase of the Natural Resource Damage Assessment (NRDA). In situ measurements of fluorescence and dissolved oxygen were used to infer the presence of subsurface hydrocarbons and to guide water sampling during a series of cruises completed between July and December 2010. The most fluorescent and turbid waters were sampled on July 10 and 11 at two stations located within 5 km of the Mississippi Canyon 252 wellhead. ADCP records suggest waters sampled at these sites were closest to the wellhead within 8–12 hours prior to being sampled. Subsurface hydrocarbons were visually observed using a live-feed video camera aboard an ROV. Over the ensuing weeks, the deepwater layer of interest generally displayed less marked fluorescence, although negative excursions in dissolved oxygen continued to be observed, often coincident with peaks in turbidity. This presentation will explore the relationships between fluorescence and dissolved oxygen data, water chemistry, ROV observations, and particle size (LISST) measurements over space and time following the spill. It will discuss the conditions or factors required for fluorescence and/or dissolved oxygen measurements to be reliable indicators of oil presence.

WP014 Carbon Nanotube Based Sensor for Monitoring of Underwater Oil Contents. C-X Liu, Dept of Electrical and Computer Engineering, Louisiana State Univ, Baton Rouge LA; J-W Choi, Dept of Electrical and Computer Engineering, Louisiana State Univ, Baton Rouge LA. After oil spill, various components of crude oil may stay underwater at different depth over a significant period of time. While these oil contents post potential threat to the marine ecosystem, the detection and containment of these contents are proven to be challenging. Current detection techniques are complex and expensive, thus difficult to field deploy over multiple sites long term. This work develops a simple and reliable scheme to detect the presence of underwater oil contents (e.g., benzene, toluene, etc.), by using unique electrical properties of polymer nanocomposite materials that are based on carbon nanotubes. Upon exposure to oil contents, the micro-patterned nanocomposite changes its conductivity (or resistivity), which is measured and then transmitted via communication protocols to control centers. These sensor systems are miniaturized in size and cost-effective to make. Although at early stage of development, this technique yields promising potential to be used in practice. In that case, by deploying large amounts of these systems, underwater oil could be effectively monitored over large areas of sea surface—a valuable tool for post-spill recovery effort.

WP015 Tracking Oil Sampled for Chemical Fingerprinting Offshore and Along the Louisiana and Texas Shorelines. L Benton, Exponent; LL Cook, Exponent; JS Brown, Exponent; SM Mudge, Exponent. As part of the MC252 oil spill response efforts, samples of oil were collected offshore and along the Louisiana and Texas shorelines. Once the decision was made in May 2010 to determine the source of oil in these samples, a tracking system was developed to manage the data. Samples of offshore oil were collected by Rapid Assessment Teams (RATs) and samples of onshore stranded oil were collected by the Forensic Rapid Assessment Teams (FRATs). Materials sampled ranged from floating oil, sheen, mousse, tar balls, and oiled vegetation and debris. Samples were submitted to laboratories for detailed chemical analyses used for source determination (i.e., MC252 oil or not). Interpretations were made using gas chromatograms, parent and alkylated polycyclic aromatic hydrocarbon (PAHs), and geochemical biomarkers. Tracking began once the field personnel delivered samples to the Houma Incident Command. Information from the Chain-of-Custody forms (COCs) and field notes were used to maintain a database of the samples. Daily maps were produced showing samples collected and source determinations. These included static printable maps and a Google Earth kmz file (zipped Keyhole Markup Language files) that could be loaded onto an individual's personal computer. Map symbols represented sample status and interpretation results (e.g., results pending, MC252 oil, not MC252 oil, indeterminate, no crude present, hold, or archive). Sample locations were labeled with the date of collection and included additional information in call-out boxes accessible by clicking on the sample marker (e.g., sample name, date collected, matrix, general location, coordinates). This combination of sampling history and source information allowed multiple users with different objectives to rapidly assess the extent of the MC252 impact in relation to other sources. In addition to tracking the oil sample status and source, the real-time posting of sample information provided quality control benefits. Errors recorded in the sample records (COCs and field notes) were noted and corrected. Incorrect positional coordinates were obvious once posted on a map and could be resolved quickly. The production of these electronic sample tracking maps provided the most efficient method for the rapid dissemination of chemical fingerprint results to users throughout the Houma Incident Command and provided an opportunity to check sample collection records and quickly resolve documentation errors.

WP016 Evaluation of the Utility of Hyperspectral Data for Oil Spill Monitoring and Assessment. D Liang, Wind Science & Engineering Research Center, Texas Tech Univ; B Nutter, Wind Science & Engineering Research Center, Texas Tech Univ; SP Cox, Dept of Environmental Toxicology, The Institute of Environmental & Human Health, Texas Tech Univ; PN Smith, Dept of Environmental Toxicology, The Institute of Environmental & Human Health, Texas Tech Univ. While monitoring and assessment of oil spills has traditionally relied on visual observations made either in the field or via remotely sensed imagery, recent advances in sensing technologies and computational capabilities offer new opportunities for developing reliable, quick, and automated detection and mapping methods to better support response, recovery planning, and impact analysis. Unlike single-band or multispectral sensors, hyperspectral sensors such as NASA's Hyperion (on-board EO-1 satellite) and AVIRIS (on-board ER-2 aircraft) acquire more than 200 contiguous narrow bands of solar reflectance from the Earth's surface that produce a complete spectrum between ultraviolet and shortwave infrared. Because every material has a unique spectral signature, hyperspectral imaging is a very powerful tool in material and object identification with successful applications in mineralogy, agriculture, surveillance, and urban management. Following unintended releases of oil, degradation processes quickly and dramatically change the chemical composition of crude oil. Thus, its physical form, toxicity, and spectral image signature will also evolve. We hypothesized that spectral signatures of oils were unique, and would change over time (in response to weathering) in a manner that would allow hyperspectral imaging to be used as an oil spill monitoring and assessment tool. Using a Field Spectroscopy Environmental Analysis system, we measured solar reflectance from fresh West Texas crude and weathered crude oil collected from the Gulf of Mexico. Crude oils were exposed to environmental conditions, and hyperspectral solar reflectance was measured weekly. Hyperspectral image data were analyzed and evaluated to determine its utility for: 1) rapidly and accurately locating and identifying crude oil in the environment, 2) distinguishing among various sources of crude oil, 3) determining the thickness of crude oil mats present in the environment, 4) assessing temporal changes in spectral signatures during the weathering process, and 5) determining if hyperspectral signatures could be used to estimate the age of weathered oils. Correlation of in-situ data with hyperspectral aerial or satellite imagery has the potential to yield a powerful tool for long-term monitoring, assessment, and management of future spills.

WP017 Spectrally Resolved, Ultrafast Measurement of Methane and Carbon Dioxide in Sea Waters. HA Schuessler, Texas A&M Univ Dept of Physics; F Zhu,Texas A&M Univ Dept of Physics; A Kolomenski, Texas A&M Univ Dept of Physics J Strohaber, Texas A&M Univ Dept of Physics. The monitoring of the sea water content of methane and green house gas (CO_2) is of great importance for correct assessment of global processes on the Earth, since due to its abundance the sea water is a major factor affecting climate. In particular, the methane content in sea water reflects general trends of methanogenesis, but it also is indicative of the local disruptive events, such as oil spills, volcanic eruptions, and animals. Therefore accurate measurements of the concentration of such gases can provide valuable information for monitoring these dynamical processes, and even make predictions of their occurrences, and quantify the amount of oil spilled. We give an overview and comparison of state of the art technologies of methane detection and report on a novel sensor which is under construction in our laboratory. This instrument will be submersible and has the potential to work in situ. It is based on broad band frequency comb spectroscopy using a super-continuum laser. In addition we are using a time of flight mass spectrometer to characterize sea water taken at different depths from the gulf oil spill area and present initial results.

WITHDRAWN

WP018 Simultaneous Determination of Key Components of Corexit EC9500A and EC9527A in Seawater and Crude Oil by Direct Injection Liquid Chromatography-Tandem Mass Spectrometry. CE Ramirez, Florida International Univ, Dept of Chemistry and Biochemistry; SR Batchu, Florida International Univ, Dept of Chemistry and Biochemistry; PR Gardinali, Florida International Univ, Dept of Chemistry and Biochemistry and Southeast Environmental Research Center. During the response effort following the Deep Water Horizon incident, approximately 1.8 million gallons of dispersants were used. Assessing the fate of dispersants in open ocean waters requires selective and sensitive methods in the low part per billion levels in complex matrices such as seawater and seawater–oil mixtures. A direct injection LC-MS/MS method was developed for the quantitative determination of two key components of Corexit dispersant formulations (dioctyl sulfosuccinate sodium salt (DOSS) and 2-butoxyethanol) that may have been employed following the DWH incident. The method was tested for the detection of these tracers in seawater, crude oil and in seawater/oil mixtures. Surface seawater from Biscayne Bay was diluted with acetonitrile and spiked with labeled analytes before injection. A light crude oil from Texas, not related to the DWH incident, was spiked with the labeled analytes and surrogates and extracted with acetonitrile. An aliquot of the extract was diluted, supplemented with deuterated dodecylsulfate (DS-2H25), and injected directly. The organic phase of seawater/oil mixtures was skimmed from the surface and analyzed according to the crude oil procedure, while the remaining aqueous phase was analyzed as seawater. The analysis-ready samples were injected into a 50 mm Hypersil Gold-aQ column, with a 10min gradient separation using an Accela pump. Detection was performed on a TSQ-Quantum Access QqQ MS in ESI SRM mode, operated sequentially in positive mode for 2-butoxyethanol and in negative mode for DOSS. Calibration curves for seawaters were obtained by plotting the peak area ratio (analyte/labeled analyte) against the concentration in µg/L. The calibration ranges in artificial seawater were from 0.5–20 µg/L and 2.5–30 µg/L for DOSS and 2-butoxyethanol respectively. Direct injection of full strength seawater diluted with acetonitrile produced limits of detection (LOD) of 2.17 and 2.36 µg/L with average recoveries of 90% and 96% for DOSS and 2-butoxyethanol, respectively. These LOD are below the suggested USEPA reporting limits for environmental analysis of 125 µg/L and 20 µg/L, respectively. Quantification in oil was obtained by using DS-2H25 as internal standard, using the recovery precentage of labeled analytes to correct for analyte losses during the extraction proceedure. Recoveries in spiked crude oil samples were 99% for DOSS and 134% for 2-Butoxyethanol.

COMMUNICATION CHALLENGES AND SOLUTIONS

WP019 Getting Resource Protection Measures Implemented During An Oil Spill - Seven Key Communication Strategies. G McGowan, ARCADIS-US Inc; PR Krause, ARCADIS-US Inc. The success of biological and cultural resource protection during emergency spill response is primarily dictated by the individuals implementing response activities and by the effectiveness of communications that describe how and when resource protection measures can be integrated into response operations. A robust regulatory framework exists to facilitate resource protection during emergency response; however in focusing on the procedural components, many training programs fail to address the critical need and appropriate techniques for effective and efficient communications in the Incident Command Center and in the field to actually manifest implementation of resource protection. When spills occur in sensitive ecosystems or cultural resource areas, there are numerous state and federal statutes, laws, and regulatory programs that potentially apply (e.g., Endangered Species Act, Clean Water Act, National Historic Preservation Act, etc.) but for which the standard compliance procedures are modified or infeasible given the emergency response timeframe. Through Area and Regional Contingency Plans and through established emergency consultation procedures and MOUs, there are a number of formal mechanisms that help to ensure that the objectives of the state and federal resource protection programs are addressed. However, even where detailed planning documents exist, the dynamic and variable nature of emergency response, compounded by the seasonal and dynamic nature of biological resources, creates situations and subtleties that cannot be fully planned for in advance. For this reason, it is critical that responders understand key strategies for effective communications in an Incident Command setting and at the site of a release. The roles and responsibilities of responders are established by the National Contingency Plan (NCP). The Incident Command System (ICS) facilitates the integration of facilities, equipment, personnel, procedures, and communications. Collectively, this organizational structure has proven to be efficient, but as always, the major opportunities and constraints for excellence lie in the hands of the individual people in each position and the effectiveness of the team is intimately tied to the effectiveness of their communications. Employing specific strategies to maximize the efficiency and effectiveness of communications during an emergency oil spill will greatly enhance the implementation and optimization of resource protection.

RISK AND DAMAGE ASSESSMENT

RP001 Is CEWAF Prepared in the Lab Suitable for Predicting Toxicity to Herring Embryos? C Greer, Dept of Biology, Queen's Univ, Kingston ON; PV Hodson, Dept of Biology, Queen's Univ, Kingston ON; Z Li, Centre for Offshore Oil, Gas and Energy Research, Bedford Institute of Oceanography, Dartmouth NS; T King, Centre for Offshore Oil, Gas and Energy Research, Bedford Institute of Oceanography, Dartmouth NS; K Lee, Centre for Offshore Oil, Gas and Energy Research, Bedford Institute of Oceanography, Dartmouth NS. The use of chemicals to disperse oil spills raises concerns for organisms living below the surface of the water. Chemical dispersants are used to break oil slicks into smaller droplets suspended in the water column to enhance the ability of microbes to degrade the oil and to increase the rate of dilution. However, smaller droplets also increase the rate of partitioning of hydrocarbons from oil to water. Chemical dispersion can increase the amount of oil in the water column and the exposure of pelagic and benthic organisms to polycyclic aromatic hydrocarbons (PAHs) by 100- to 1000-fold. As a model for a full-scale spill at sea, a wave tank was used to simulate dispersion of spilled oil by Corexit 9500A and to determine if the concentrations of chemically dispersed oil were sufficient to cause toxicity to embryos of Atlantic herring (*Clupea harengus*). Brief exposures of 24 h to dispersed oil caused blue-sac disease in herring embryos and reduced the percentage of normal embryos at hatch. While the responses of embryos to dispersed oil from the wave tank were not large, the exposure–response relationship was consistent with that of laboratory-prepared dispersed oil. Hence, the use of chemical dispersants to clean up oil spills occurring near herring spawning beds during spawning season would increase the risk of impacts on herring survival and recruitment.

RP002 Methods for Characterizing Hydrocarbon Content of Oil Toxicity Test Solutions. PV Hodson, Queen's Univ at Kingston; J Adams, Queen's Univ at Kingston; S Brown, Queen's Univ at Kingston; C Greer, Queen's Univ at Kingston; T King, Fisheries and Oceans Canada, Bedford Institute of Oceanography; J Martin, Queen's Univ at Kingston; B Robinson, Fisheries and Oceans Canada, Bedford Institute of Oceanography. Aquatic toxicity tests of oil added to water provide data for ecological risk assessments, comparisons of toxicity among oils and species, and assessment of modifying factors such as water quality, the use of chemical dispersants, and the extent of oil weathering. Nominal concentrations can, in some cases, provide a useful estimate of the relative amount of oil needed to cause toxicity, e.g., in the presence or absence of a dispersant. However, the solubility of individual hydrocarbons within an oil mixture varies considerably with molecular size and shape, so that nominal concentrations (amount added) are not a reliable basis for describing the actual exposure of organisms. Thus, endpoints (EC50s, LC50s) based on nominal concentrations grossly under-estimate toxicity. In all cases, it is important to characterize the exposure to oil by some chemical measure of the total hydrocarbons present, or the concentration of specific constituents such as BTEX, a major contributor to acute lethality, or alkyl PAH, the likely cause of chronic toxicity. Common analytical techniques used to measure hydrocarbons in water include fluorescence, which reflects the concentrations of aromatic rings in PAH, resins and asphaltenes, GC-FID, which measures total petroleum hydrocarbons, and GC-MS, which can quantify individual alkanes and PAH. We will review the strengths and weaknesses of each method, including their cost and effort, and the observed relationships among results. We will also recommend a mix of analyses for a practical trade-off among cost, timeliness, and amount and quality of data needed to describe toxicity test performance and the toxicity of the test oil.

RP003 Nearshore Sediment Exposure to Louisiana Crude Oil: Spatial and Temporal Patterns. LE Riege, Cardno ENTRIX; RJ Dickey, Cardno ENTRIX; W Kicklighter, Cardno ENTRIX; J Brewer, Cardno ENTRIX. In response to the Deepwater Horizon Oil Spill, BP and state and federal natural resource trustees are working cooperatively to assess injury to the nearshore resources during the initial phase of the Natural Resource Damage Assessment (NRDA). Over 20 independent, response-directed and NRDA-led studies have collected sediments in the nearshore and subtidal habitats to assess exposure of nearshore habitats and wildlife to oil from the MC-252 incident. The geographic range includes the Northern Gulf of Mexico from the state of Louisiana to Apalachee Bay, Florida. The temporal range includes samples from May 2010 (before MC-252 incident oil made landfall) through December 2010. This presentation examines the results to date of two independent BP sediment studies, with an emphasis on the spatial distribution of total PAH concentrations across the Northern Gulf of Mexico and changes in those concentrations over time. Comparisons are made with surface water PAH concentrations collected at the same locations. Sediment concentrations are compared to measures of aquatic life criteria, including the US Environmental Protection Agency aquatic life benchmarks, and ERL and ERM quotients. Forensic analyses are used to determine if sediment hydrocarbons are of MC-252 origin.

RP004 Mexican Approach for the Evaluation of Coastal Aquatic Ecosystems Effects of Oil Spills. P Ramirez-Romero, UAMI; M Gallegos-Martínez, UAMI, MC Gonzalez-Macias, IMP; L Salazar-Coria, IMP; X Guzmán-García, UAMI; MC Guzmán-Martínez, UAMI. When the explosion and subsequent oil spill of the Horizon BP platform were made public, the Mexican environmental authority (SEMARNAT by its Spanish acronym) gathered a group of specialists and authorities to explore the possible outcomes of this event for the Mexican environment. From this it was clear that, as a country, Mexico did not have a current baseline that could be used in case the oil were to arrive, thus a series of studies were planned, and even though by now it's very unlikely that this oil will reach Mexico, the authorities considered it important to obtain the necessary data to have a current environmental baseline; therefore the objective of the present work is to present the coastal ecosystems effects evaluation strategy adopted. Four government and academic institutions (CONAGUA, IMP, INE, UAMI) are obtaining information which includes: physical and chemical water quality parameters, physical and chemical characteristics of particles and sediments, biota (plankton and benthos), wetland ecosystems' biodiversity, composition and distribution and toxicity data (Microtox, bivalve biomarkers and histology). These studies are being carried out in 32 locations along the Mexican Gulf of Mexico, from Laguna Madre in Tamaulipas to Holbox island in the Yucatan Peninsula; they include a variety of ecosystems from coastal lagoons to coral reefs. At the present moment data are still being gathered but a description of each ecosystem's present situation regarding the presence and influence of petroleum hydrocarbons is expected to serve as a baseline in case of future oil spills. It is also recognized that the Mexican government needs to channel more resources into the implementation of broader monitoring programs than what actually is in place if oil spills responsible parties are to be held accountable for damages in the future.

WITHDRAWN

RP005 Evaluation of Environmental Exposures, Toxicity Methodology and Modeling Needs: The NRDA Aquatic Toxicology Research Program to Better Understand Potential Toxicity, Hazards and Injury of Petroleum Hydrocarbons to Marine Organisms. GM Rand, Florida International Univ, North Miami FL; P Gardinali, Florida International Univ, North Miami FL; R Markarian, Cardno ENTRIX, New Castle DE; M Huddleston, Cardno ENTRIX, New Castle DE; J Kubitz, Cardno ENTRIX, New Castle DE; W Stubblefield, Oregon State Univ, Corvallis OR. Prior oil accidents in the marine environment have been primarily on the water surface and have been classified as "oil spills." The recent Deepwater Horizon Incident that originated from a depth over 5,000 feet in the Mississippi Canyon 252 lease block, and subsequent use of the dispersant Corexit 9500, have raised some important questions and issues relative to complex mixtures like petroleum, the exposure scenarios that are produced in water and sediment after release, and how they are assessed to determine their potential toxicity. The existing literature is limited and not consistent with respect to toxicity methodology, making it difficult to compare results from different investigators on the aquatic toxicity of petroleum hydrocarbons. This presentation provides an overview of a comprehensive program designed to provide a robust empirical toxicity database for the following: 1) comparison to toxicity endpoints predicted by oil fate and effects models, 2) application directly to assessment of potential acute and chronic ecological risks and injury to Gulf of Mexico biota, and 3) validation of existing toxicity exposure media and systems to provide replicable data. Because the program is understanding/issue-driven rather than experiment-driven it will consider lessons learned from the past. Relevant environmental exposure scenarios are considered in petroleum toxicity studies and include but are not limited to studies on: the effects of dispersant application over time, different weathering techniques and their effects on toxicity, toxicity resulting from decreasing concentrations of oils, the effects of changes in salinity and temperature overtime, etc. A multispecies trophic-level testing approach is used with ecologically and economically important native test organisms as

well as standard test organisms. Furthermore, an existing effects model will be validated to more accurately predict potential adverse effects. The results of this program will decrease the uncertainty in extrapolation of laboratory results to field conditions.

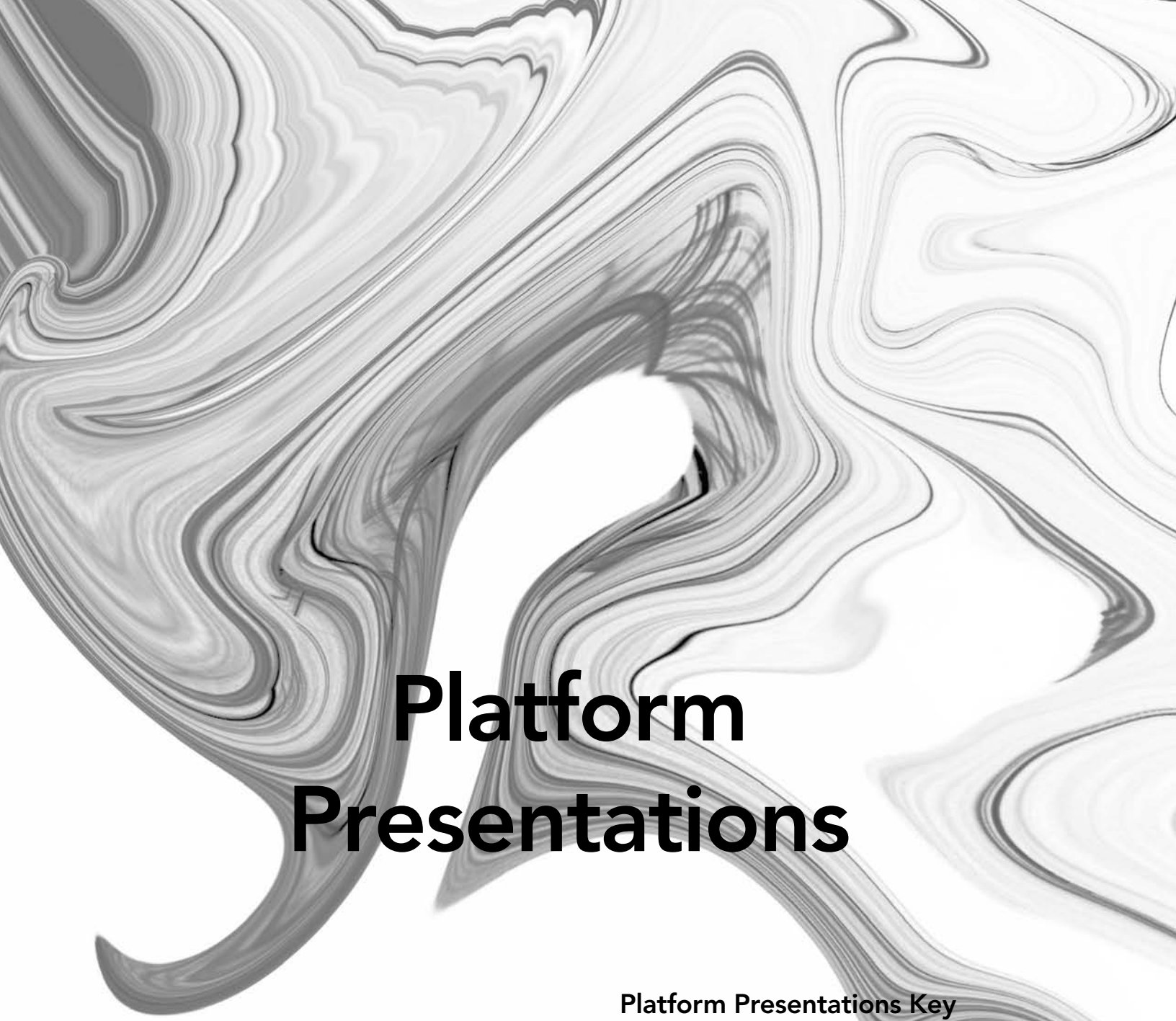
RP006 Is the Cure Worse than the Oil Spill? A New In Depth Look at the Hazards of Chemical Dispersants Applied in the Gulf of Mexico. SD Shaw, Marine Environmental Research Institute (MERI). After the Deepwater Horizon drilling platform exploded in the Gulf of Mexico on April 20, 2010, almost two million gallons of chemical dispersants were applied, both on the surface and 5,000 feet beneath Gulf waters. By enhancing the amount of oil that physically mixes into the water column, dispersants reduce the amount of oil that reaches shoreline habitats. Although considered a tool for minimizing the impact of oil spills, chemical dispersants are controversial and their potential future use should be carefully examined. Since the 1970s, it has been known that application of dispersants to oil spills increases toxicity by increasing oil and hydrocarbon exposure to water column species and as a result of the enhanced toxicity of dispersed mixtures. This paper reviews the toxicology of two dispersants used in the Gulf, Corexit 9500 and 9527A, and discusses health effects of oil-dispersant mixtures in marine life and humans. Corexit dispersants contain surfactants, organic sulfonic acid salts, and petroleum solvents that mix with the crude oil mass and move through it, thus breaking down the oil to tiny droplets or "micelles" in the water column. Corexit 9527A contains 2-BTE (2-butoxyethanol), a solvent that ruptures red blood cells, causing hemolysis and liver and kidney damage. The properties that facilitate the movement of dispersants through oil also make it easier for them to move through cell walls, skin barriers, and membranes that protect vital organs, underlying layers of skin, the surfaces of eyes, mouths, and other structures. The combination of Corexit and crude oil can be more toxic than either alone, since they contain many ingredients that target the same organs in the body. In addition, Corexit dispersants facilitate the entry of oil into the body, into cells, which can result in damage to every organ system. Exposure to chemicals in crude oil and dispersants can occur simultaneously through skin contact, inhalation of contaminated air or soil/sand, and ingestion of contaminated water or food. Damage to these systems can cause a wide range of diseases and conditions. Some may be immediately evident, and others can appear months or years later. The chemicals can impair normal growth and development through a variety of mechanisms, including endocrine disruption and direct fetal damage. Some chemicals, such as the polycyclic aromatic hydrocarbons (PAHs), can cause mutations that may lead to cancer and multigenerational birth defects.

RP007 Fractionation and Analysis of a Heavy Fuel Oil for PAH Content and Toxicity. JM Bornstein, Queen's Univ Chemistry Dept; RS Brown, Queen's Univ Chemistry Dept and School of Environmental Studies; J Adams, Queen's Univ Biology Dept; PV Hodson, Queen's Univ Biology Dept and School of Environmental Studies. Recent oil spills have raised many issues about potential harm to aquatic and marine life. For risk assessment, an important question to ask is, "Which compounds in the oil have the potential to cause the most damage?" Heavy fuel oils used by large cargo ships and cruise liners are quite thick and viscous, and contain a variety of high molecular weight hydrocarbons, many of which cause acute and chronic toxicity to fish. Due to the high frequency of small volume transports, the risk of a spill of heavy fuel oils is quite high and it is critical assess their toxic properties. Bunker C (a Heavy Fuel Oil) was fractionated to identify which of its chemical constituents are most closely associated with toxicity to fish. First, a vacuum distillation apparatus was used to divide the oil into 4 fractions by boiling point. Next, fractions containing polycyclic aromatic hydrocarbons (PAHs) were further separated by solubility in cold solvents to remove asphaltenes and waxes in succession. Finally, HPLC was used to separate subfractions by approximate number of aromatic rings per molecule. For each fraction, GC-MS, GC-FID, and fluorescence were used to measure PAH and alkyl-PAH concentrations, and toxicity tests with rainbow trout identified which fractions and groups of compounds were associated with acute and chronic toxicity, recognizing physical and chemical properties such as size, shape, and Log KOW.

RESPONSE TECHNOLOGY EFFECTIVENESS

RP008 Influence Diagrams as Oil Spill Decision Science Tools. JF Carriger, US Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Gulf Ecology Division, Gulf Breeze FL; MG Barron, US Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Gulf Ecology Division, Gulf Breeze FL. Making inferences on risks to ecosystem services (ES) from ecological crises can be more reliably handled using decision science tools. Influence diagrams (IDs) are probabilistic networks that explicitly represent the decisions related to a problem and evidence of their influence on outcomes. The construction of IDs allows one to consider the important variables influencing prospects and the interdependencies between decisions, random variables, and objectives. After constructing a directed graph of the relevant or irrelevant relationships between variables, marginal or conditional probability distributions are assigned to express uncertainty and assess knowledge gaps and information needs. Reducing the uncertainty among these relationships can be done through targeted data collection and experimentation that evaluates the strength and nature of the conditional relationships. Conceptual frameworks relating deepwater, offshore, and onshore responses to the magnitude of spilled oil and ES impacts were developed for the Deepwater Horizon spill event. From these frameworks, an ID was constructed to display the potential interactions between exposure events and the trade-offs between costs and ES impacts from spilled oil and response decisions. Hypothetical probabilities were assigned for conditional relationships in the ID, and scenarios examining the impact of different response actions on components of spilled oil were investigated. Identified knowledge gaps included better understanding of the fate and transport of oil, the ecological risk of different spill-related stressors to important receptors (e.g., endangered species, fish for fisheries), and the need for stakeholder valuation of the ES benefits that could be impacted by a spill. Framing the Deepwater Horizon problem domain in an ID provided a retrodictive model of the trade-offs faced in the spill event. Moreover, the ID conceptualized important variables and relationships that could be optimally accounted for in preparing and managing responses to spilled oil. The potential impacts from decisions that mitigate exposure to ecological receptors and how exposure events could inhibit the provisioning of ES were described in the ID construction process. These features of the developed IDs will assist in better investigating the uncertainty in deepwater spills, the costs from losing ES, and the necessary trade-offs for minimizing these losses if future deep water disasters were to occur again.

RP009 Incorporating Green Alternatives into Emergency Response Waste Management Programs: Examples from the MC 252 Deepwater Horizon Event. DW Sweeten, BP - GCRO. This presentation delivers an overview of the Green Alternatives program that was developed as part of the waste management strategy during the MC252 Deepwater Horizon event in the Gulf of Mexico during 2010. The Green Alternative program was designed to minimize waste generation, as well as develop a comprehensive recycling, reuse, and recovery approach. A variety of materials were generated during the MC 252 response, and many of these materials could be recycled or reused. Hard and soft containment boom, absorbents, as well as segregated plastics could be sent to waste-to-energy facilities or recycled into new plastic products. Tar balls and oiled sand have potential for beneficial reuse as a matrix admixture to asphalt products. Recovered oily liquids are typically the most readily recoverable material via oil recovery and reclamation activities. Each potential media stream generated during an emergency response event needs to not only be evaluated by a proof-of-concept pilot test, but also undergo a comprehensive permitting and regulatory review. This was a unique opportunity to positively impact the environment and local communities by addressing concerns such as preserving critical landfill space, creating new products, and generating energy. Although each emergency response event is unique in size, scale, material released, and situational logistics, this presentation is designed to educate individuals involved with pre-planning activities with ideas for incorporating Green Alternatives into effective waste management strategies. These strategies can assist with managing potential long-term environmental liabilities as well as the public's perception of the incident.



Platform Presentations

Platform Presentations Key

Starting Tuesday, 26 April

1A..... Ecosystem Effects
2A.....Control and Abatement
2B.....Oil Fate and Transport Measurements and Modeling

Starting Wednesday, 27 April

1B.....Seafood Contamination, Safety, and Human Health
2C.....Oil Tracking Technology
CC.....Communication Challenges and Solutions

Thursday, 28 April

1C..... Risk and Damage Assessment
2D..... Response Technology Effectiveness

ECOSYSTEM EFFECTS (Tuesday)

1A001 Wildlife Toxicology: Oil Spills and their Effects on Avian Species. WA Stubblefield, Oregon State Univ, Corvallis, OR. A primary problem following any oil spill is the potential for seabirds to perish of as a result of the debilitating physical effects of oil on the structure and function of feathers (i.e., waterproofing and insulation). The oil may also cause physiological effects due to oil ingestion or skin adsorption. With time the acute risks resulting from oil absorption through the skin, direct oil ingestion from preening, and consumption of oiled food items decrease due to oil compositional changes that occur as a result of the natural weathering and other oil removal processes (mechanical removal, evaporation, dispersion, etc.). Chronic risks may become more of a concern with time however, due to the potential for dietary consumption of oil contaminated food items. Yet, relatively few laboratory studies exist to assess these risks. Toxicity to developing eggs has been shown to be a concern with some fresh crude oils and certain petroleum-derived products with acute toxic effects reported at low µl/egg doses; this toxicity has been shown in some cases to diminish as a result of weathering processes resulting in removal of toxic constituents of the oil. The long-term success of cleaning and rehabilitation efforts can be difficult to assess because of the challenges in following oiled animals after rehabilitation and subsequent release. The *Exxon Valdez* and BP Deepwater Horizon oil spills represent uniquely different situations (e.g., different oil source, continuous oil release, unprecedented dispersant use) and these will no doubt affect potential risks to exposed wildlife.

1A002 Effects of Exposure to Deepwater Horizon Source Oil and Dispersant Corexit 9500 on Coral Larvae from the Florida Keys. DL Wetzel, Mote Marine Laboratory, Sarasota FL; G Goodbody-Gringley, Mote Marine Laboratory, Sarasota FL; KB Ritchie, Mote Marine Laboratory, Sarasota FL. Coral reefs represent some of the world's richest and most biologically diverse communities where reef organisms act synergistically for the continuity of the system. Acute catastrophic events such as spills of crude oil can cause both significant disruption and damage in a short time period and devastating long-term impacts. It is a common misconception in ecotoxicology that a biological effect lasts only as long as the contaminant/stressor is present. Information as to the significance of an exposure on corals is generally lacking, yet is essential for accurate risk assessment modeling. The objectives of this study were to examine larval mortality and settlement success for two corals, Porites astreoides and Montastraea faveolata, exposed to multiple concentrations of the water-accommodated fraction (WAF) of BP Horizon oil, the chemically enhanced water-accommodated fraction (CEWAF) of the oil in combination with dispersant Corexit 9500, and the dispersant alone under two exposure regimes. These regimes included the static constant exposure (72 hrs) and the spiked, declining concentration (96 hrs). Results suggest that there may be significant impacts on survival and settlement from exposure to all test solutions, but especially so from the dispersant only and the dispersed oil solutions for the constant exposure experiments. Spiked exposure results for survival only, exhibit similar results: i.e., the fractions that include the Corexit 9500 were more toxic than the source oil WAF. Preliminary indications warrant more detailed work into the lethal and sublethal effects of crude oil and dispersants on coral larvae.

1A003 Impacts of Corexit 9500 and Chemically Dispersed Oil on Anemone and Coral Species. CL Mitchelmore, Univ of Maryland Center for Environmental Science, Chesapeake Biological Laboratory, MD; JE Baker, Univ of Washington Tacoma, Tacoma WA; W Hatch, St Mary's College of Maryland, St Mary's City MD. There are numerous uncertainties and data gaps regarding the fate and effects of chemically dispersed oil. The impacts of dispersed oil on sensitive species, such as corals, is one such understudied area. Anemones and corals were exposed for 8–96 hours (acute tests) and 8 hours (sublethal tests with recovery for 30 days in clean seawater) to either physically dispersed oil, chemically dispersed oil fractions or dispersant only using weathered Arabian light crude oil and the dispersant Corexit 9500. In the sublethal tests, oil exposures also consisted of filtered (via 0.7 micron glass fiber filters) versus nonfiltered preparations to investigate in more detail the route of exposure (dissolved, colloidal versus particulate fractions). A suite of biological stress endpoints, ranging from molecular metrics through behavioral changes were coupled with well-characterized (52 polycyclic aromatic hydrocarbons ((PAHs) and total petroleum hydrocarbons (TPH)) quantifications. Corals were much more sensitive to dispersant than were the anemones (96hr LC50 levels were <16.5ppm and >250ppm respectively). Behavioral endpoints were sensitive sublethal metrics. Corals exhibited dose and time-dependent decreases in pulsing rates and intensity and anemones retracted their tentacles and produced excessive mucus in the dispersant and oil-dispersant exposures. In the corals, delayed mortality was observed in the oil-dispersant unfiltered exposure and at the end of the 30-days experiment growth rate was significantly reduced in the dispersant (20ppm), filtered and nonfiltered oil-dispersant exposures (22.04 and 21.76 µg l^{-1} t-PAH respectively). There were no significant effects in the short and long term with the corresponding oil only exposures prepared using the same oil loading rates (3.17 and 2.38 µg l^{-1} t-PAH for unfiltered and filtered preparations respectively). Bioaccumulation of PAHs was from both the dissolved and colloidal fractions and was depurated quickly in both species. Overall this study highlights that long-term and delayed responses of corals to short-term exposures of environmentally relevant levels of dispersant and dispersed-oil occurs in corals and that careful consideration should be given when applying dispersant near coral reefs. As these organisms bioaccumulated PAHs from both the dissolved and oil droplet (particulate) phases current exposure risk models should also consider the particulate route of exposure for oil to organisms in addition to dissolved phase uptake.

1A004 Relative Toxicity of Chemically and Physically Dispersed Weathered Prudhoe Bay Crude Oil to Embryonic Topsmelt (Atherinops affinis). B Anderson, Dept of Environmental Toxicology, UC Davis; B Phillips, Dept of Environmental Toxicology, UC Davis; J Voorhees,Dept of Environmental Toxicology, UC Davis; K Siegler, Dept of Environmental Toxicology, UC Davis; R Tjeerdema, Dept of Environmental Toxicology, UC Davis; M Sowby, Office of Spill Prevention and Response, California Dept of Fish and Game; J McCall, Water Pollution Control Laboratory, California Dept of Fish and Game. As part of an effort to evaluate risks associated with treating coastal oil spills with dispersants, the California Department of Fish and Game's Office of Spill Prevention and Response has been conducting ongoing research investigating the relative toxicity of dispersed and undispersed oil on freshwater and marine species. Recent research has included studies on adult and embryonic topsmelt, an ecologically important atherinid fish that is ubiquitous in estuarine and near-coastal California waters. In the current project, chemically enhanced water-accommodated fractions (CEWAF) were created by treating weathered Prudhoe Bay crude oil (PBCO) with the dispersant Corexit 9500 following CROSERF procedures. Developing topsmelt embryos were exposed to a range of CEWAF solutions in a declining exposure system designed to approximate real-world spill conditions. Embryonic development in CEWAF was compared to development in physically dispersed oil (water-accommodated fraction WAF). Treatment with Corexit 9500 resulted in much greater total hydrocarbon concentrations (THC) and PAHs in CEWAF solutions, relative to WAF solutions, despite the fact that CEWAF solutions were created with lower oil loadings. Topsmelt embryo development and survival to hatching was significantly inhibited at the lowest CEWAF concentration, while minimal effects on embryo–larval development were observed in WAF. Based on THC, the LC50 for larval hatching success in CEWAF was 17 mg/L. The highest THC concentration in the WAF was 6.5 mg/L (at PBCO loading of 25 g/L) and no LC50 was calculated due to a lack of response. Increased hydrocarbon concentrations in the CEWAF tests caused cardiovascular abnormalities, including pericardial edemas, hemostatis, and tube heart formation. Larval yolk sac area and larval length at hatching were also reduced after CEWAF exposure. CEWAF-related effects coincided with elevated concentrations of PAHs including tricyclic PAHs. The results suggest that treating weathered oil with dispersant results in an increase in bioavailable hydrocarbons. At comparable oil loadings, total hydrocarbon concentrations were approximately 50 times greater in CEWAF than WAF. Concentrations of phenanthrene and dibenzothiophene were approximately 10 times greater in CEWAF. Implications of these results to the Gulf Spill will be discussed.

1A005 Interactions among Oil Exposure Regimes, Differential Partitioning of Alkyl PAH, and Toxicity to Fish. J Martin, Dept of Biology, Queen's Univ, Kingston ON, Canada; J Adams, Dept of Biology, Queen's Univ, Kingston ON, Canada; B Hollebone, Emergencies Science and Technology, Environment Canada, Ottawa ON, Canada; T King, COOGER, Fisheries and Oceans Canada, Dartmouth NS, Canada; J Mason, COOGER, Fisheries and Oceans Canada, Dartmouth NS, Canada; P Hodson, School of Environmental Studies and Dept of Biology, Queen's Univ, Kingston ON, Canada. The objective of this research was to assess how the behavior of oil in

water interacts with exposure and toxicity to early life stages of fish. Spilled oil can float on the surface, be partially dispersed chemically or physically, form emulsions, and/or sink and contaminate benthic substrates, by stranding or forming tarballs. We assessed several exposure scenarios by comparing the toxic responses of rainbow trout (*Oncorhynchus mykiss*) to the selective partitioning of several classes of alkyl PAH, the likely cause of observed toxicity. Scenarios included: static daily renewal of chemically dispersed water accommodated fraction (CEWAF), a continuous flow of WAF from oiled gravel columns by partitioning of hydrocarbons from stranded oil, and partitioning of hydrocarbons from "natural" tarballs derived from a freshwater spill of heavy oil in Alberta, Canada, and from emulsions of MC252-type oil, assumed to be from the Deepwater Horizon blowout. To assess whether water-soluble components of oil were bioavailable to fish, the extent of hepatic EROD induction was measured in juvenile trout. To assess whether these components were toxic to fish, we measured exposure-dependent mortality and signs of sublethal toxicity in embryonic trout exposed to WAF or to CEWAF. GC/MS analysis demonstrated the presence of distinct alkyl PAH classes in the various exposure solutions, oil stocks, and tarballs. Notably, chemical dispersion introduced more alkylated phenanthrenes, dibenzothiophenes, pyrenes, and napthobenzothiophenes into solution, coincident with increased toxicity. The results of this research indicate that the amount and nature of hydrocarbons partitioning from oil will vary with the type of oil tested and the exposure scenario. Risks to fish will be greatest for those scenarios that release the highest concentrations of alkyl PAH.

1A006 Avian Embryotoxicity of Weathered Crude Oil Collected from the Gulf of Mexico. B Finch, Dept of Environmental Toxicology, The Institute of Environmental & Human Health, Texas Tech Univ; K Wooten, Dept of Environmental Toxicology, The Institute of Environmental & Human Health, Texas Tech Univ; PN Smith, Dept of Environmental Toxicology, The Institute of Environmental & Human Health, Texas Tech Univ. The objective of this study was to evaluate the embryotoxicity of weathered crude oil collected from the Gulf of Mexico in June 2010 using mallard ducks (Anas platyrhynchos) as a model species. Weathered crude oil in masses ranging from 0.1–99.9 mg was applied by paintbrush to fertilized mallard duck eggs on day 3 of incubation. Mortality occurred as early as day 7, and the median lethal dose of weathered crude oil was calculated to be 30.8 mg/egg (0.5 mg/g egg). There were no significant differences in morphometric endpoints including body mass, liver and spleen mass, crown rump and bill lengths or in the frequency of abnormalities among hatchlings from oil-treated and control eggs. Weathered crude oil was less embryotoxic than fresh crude when our results were compared to literature-derived toxicity values. It appears that avian embryotoxicity following crude oil exposure varies in response to 1) the degree of crude oil weathering, 2) the stage of embryonic development wherein exposure occurs, and 3) egg surface area coverage. Our results suggest that bird eggs exposed to weathered crude oil from the Gulf of Mexico during summer 2010 may have had reduced hatching success.

ECOSYSTEM EFFECTS (cont'd Wednesday)

1A007 Biomarker Responses of Bivalves for Assessing Oil Spill Impacts. AH Ringwood, Univ of North Carolina at Charlotte, Charlotte NC. Bivalve mollusks (oysters and mussels) have been used worldwide to assess the impacts of oil spills. Cellular biomarker responses can be used as valuable indicators of cellular toxicity associated with oil exposures. Therefore, ecosystem surveys of biomarkers such as lysosomal destabilization can be used to assess the extent of the impacts, and can also be used to identify recovery. The Gulf BP disaster is unprecedented. Oil that deposits into marshlands and coastal habitats tends to persist for long periods, increasing the potential to cause long term impacts on shellfish and fishery resources. The valuable roles of sensitive biomarker responses in bivalves for addressing these important issues will be presented. The lysosomal destabilization responses of hepatopancreas or hemocyte cells of bivalves (and also fish tissues) have been used as a very valuable indicator for oil spills all over the world. Some results associated with a recent spill event that occurred in Charleston Harbor, SC as well as data from other worldwide spills will be presented. For the SC study, oysters (*Crassostrea virginica*) were collected from oiled and not-oiled sites, and the effects on lysosomal destabilization and other biomarkers were studied. Lysosomal destabilization rates were significantly higher in oysters from oiled sites, and also indicated signs of recovery in some areas in the following year. From our extensive experience with this assay, we have also demonstrated important linkages between lysosomal destabilization responses and gamete viability, a response that can seriously impact recruitment and recovery. Likewise, studies with mussels (*Mytilus* sp.) collected in areas oiled by the Prestige Oil Spill were used to track damage and recovery along the coast of Spain. Biomarker responses can provide important diagnostic information for assessing the extent and duration of the impacts of oil spills.

1A008 Deepwater Horizon Response and Ephemeral Data Collection: Assessment, Capture and Rehabilitation of Sea Turtles. T Palagyi, Cardno/ENTRIX. In response to the Deepwater Horizon Oil Spill, BP and state and federal natural resource trustees worked cooperatively to assess exposure and injury to sea turtles during the response and in the initial phase of the Natural Resource Damage Assessment (NRDA). Response activities included surveys of Sargassum and convergence lines, capture and relocation of turtles deemed to be at risk from in-situ burning or oil skimming activities, and capture and rehabilitation of injured and oil-impacted turtles. Beach survey transects were used to identify stranded turtles. These transects, representing approximately 20% of the coast line, were searched for beach cast carcasses or live strandings once every 3 to 7 days from mid-May through September. The effort was adaptively managed in response to on-sea events and real-time data analysis such that, at various points in time, transects were systematically searched from Cape Canaveral, Florida around the Gulf of Mexico to the Texas/Mexico border. Aerial surveys were also used as a tool to assess the distribution and abundance of the 5 species of sea turtle known to be present in the Gulf of Mexico. Additional studies, including nesting surveys and capture studies, were also implemented to assess injury, primarily on Kemp's ridley and loggerhead turtles. Study efforts focused on the coasts of Louisiana, Mississippi, Alabama, and the west coast of Florida. More than 550 sea turtles were captured and placed in rehabilitation centers. Many of these animals have been released back into the wild. Appropriately sized rehabilitated turtles were satellite tagged to assess fate and movements. This paper will describe techniques used to assess distribution and abundance of sea turtles, nesting success and relocation of eggs, and procedures that supported the data collection effort. Preliminary assessment data associated with response efforts and ephemeral data collection plans will be discussed and summarized. A discussion of the importance of evaluating habitat and ecology as it relates to life stages of these slow-growing, long-lived species will also be included.

1A009 Species Composition, Distribution, and Abundance of Planktonic, Benthic and Demersal Megafauna in the Vicinity of MC252 during August 2010. R Putt, TDI-Brooks International Inc. Once the MC252 well had been capped on July 15, 2010 there was a need to characterize the species composition and abundance of marine life in the vicinity of the spill. Two remotely operated vehicles were used to survey the distribution and abundance of marine organisms at four sites around the MC252 well. Three sites were located 2000 m due N, W, and S of the well and an additional site was located 500 m due N of the well. Video transect surveys of the water column documented the species composition and depth distribution of zooplankton and micronekton at strata from 500–4500 ft. On the seafloor, a series of radial 250 m transects on bearings separated by 15° were conducted. A subsea navigation system allowed the position of each organisms to be mapped. The sea floor sites were dominated by echinoderms (seastars), cnidarians (sea pens), crustaceans (*Plesiopenaeus*, *Glyphocrangon*, *Chaceon*) and squat lobsters, and a variety of fish species including eels (*Synaphobranchus*), tripodfish (*Bathypterois quadrifilis* and *B. grallator*), species of Moridae and Macrouridae. Comparisons with pre-spill ROV surveys at MC252 suggest similar species dominated before and after the spill. Evidence of mortality included carcasses of planktonic pyrosomes (*Pyrosoma atlanticum*), salps and sea pens. Species richness and abundance were reduced at the site located 500 m from the well relative to the more distant sites.

CONTROL AND ABATEMENT

2A001 Spilled Oil Removal Tactics by In-situ Controlled Burning Gulf of Mexico Deepwater Horizon (MC-252) Oil Spill Response. N Mabile, BP America Inc. (GCRO - Technology Theme Leader), Houston TX. Insitu burning was one of the response options used to remove spilled crude oil from the Gulf of Mexico. From a water depth of 5,000 feet, the Deepwater Horizon Mississippi Canyon 252 Incident in the Gulf of Mexico released crude oil for nearly 3 months. The author of this paper was engaged in the planning, aerial operations, and implementation of controlled burns involving fire-resistant booms throughout the response. The local area fishermen were called upon to provide vessels and boom-tending personnel. The fishing community became the core structure of the on-water burn teams. An estimated range of 220,000 to 310,000 barrels of oil were removed from the water surface by conducting a total of 376 burns. Controlled burns were used to remove significant amounts of oil before it could move toward and impact the shallow waters, shorelines, and other sensitive resources along the coastline of the Gulf of Mexico. Working with a variety of fire boom types and configurations, the In-Situ Burn Team involved BP personnel, fishermen, contractors, and the US Coast Guard to locate, contain, and ignite oil typically within 3 to 15 miles from the spill source. By coordinating the activities of numerous vessels and "spotter" aircraft, the burn teams demonstrated the feasibility of carrying out multiple burns each day, often simultaneously. While being safe and effective, in-situ burn teams, for the first time, demonstrated the burning of oil within a fire boom while encountering and "feeding" an ongoing burn with newly captured oil. By adapting to changing oil and weather conditions, the in-situ burn team was successful in developing new and improved techniques and equipment for the rapid and efficient removal of oil at sea with minimal overall impact to the environment. The use of in-situ controlled burning during this unprecedented oil spill response has made history, changed attitudes within the oil spill response community, and expanded our understanding of controlled burn strategies and tactics.

2A002 Weathering Properties at Sea of the Macondo MC252 Crude Oil. PS Daling, SINTEF, Marine Environmental Technology Dept, Trondheim, Norway; F Leirvik, SINTEF, Marine Environmental Technology Dept, Trondheim, Nprway; M Reed, SINTEF, Marine Environmental Technology Dept, Trondheim, Norway. During a spill incident, the effectiveness of countermeasures such as dispersant application and in-situ burning changes with the degree to which oil weathers and emulsifies on the sea surface. The purpose of the work reported here is to improve the understanding and documentation of this relationship. During the Deepwater Horizon (DWH) incident, a comprehensive weathering study was performed, including testing of dispersant effectiveness and ignitability of the Macondo MC252 crude oil. The data was put into the SINTEF Oil Weathering Model (OWM) to predict the weathering properties and the "time window" for effective use of dispersants and in-situ burning under various weather conditions. The weathering data generated in the laboratory is consistent with the properties of emulsion samples and observations from the field during the incident. MC252 oil is a light paraffinic crude oil, where, e.g., 50–55 wt% will evaporate within 5 days at sea. Due to the low content of emulsifying components (asphaltenes and waxes), the crude has a relatively slow water uptake and forms only a semi-stable emulsion after the first few (1–3) days at sea. With extended weathering under calm, warm, and sunny conditions, a more stable (light brown / red-orange colored) emulsion starts to form, and a viscosity up to 10,000cP can be achieved after 1–2 weeks at sea. During the first days at sea when the viscosity of the surface oil is still low (<1000–2000 cP), there is a high degree of natural dispersion if the oil is exposed to breaking wave sea conditions. This has been observed in the field and documented in weathering experiments in the SINTEF flume, where droplets in the range of 50–400 µm in diameter were generated. Such small oil droplets will contribute to an enhanced spreading, dilution, and subsequent microbial biodegradation of the dispersed oil in open sea conditions. The dispersant effectiveness tests, using Corexit 9500, showed that this crude is very dispersible. For dark, semi-stable emulsions, an effective dispersant dosage ratio under 1:250 was sufficient. For more weathered emulsions a more typical dosage of 1:25–1:50 was needed to achieve an enhanced dispersion process. The "time window" for use of dispersants was estimated to be more than 1 week at sea. The suite of weathering data generated from these field and laboratory studies can be used as input to numerical models computing weathering properties, response actions, oil budgets, and damage assessments.

OIL FATE AND TRANSPORT MEASUREMENTS AND MODELING (Tuesday)

2B001 The Chemistry of Oil Weathering, Implication for Impacts. EB Overton, Dept of Environmental Sciences, Louisiana State Univ; MS Miles, Dept of Environmental Sciences, Louisiana State Univ. Oil spilled from a tanker accident or pipeline rupture has a much lower vapor pressure than oil from a well blowout such the oil spilled from the Deepwater Horizon site. High-gas-content crude oils, such as that from Deepwater Horizon, behave quite differently in the marine environment than do low-vapor-pressure crudes. Oil released from blowouts can be significantly modified by its rapid decompression as well as its long and varied interactions with the water column. When oil enters the environment, whether from blowouts, tanker accidents, or ruptures, it undergoes a continuous series of compositional changes that result from a collection of processes known as "weathering." Weathering processes include evaporation, dissolution, emulsification, sedimentation, and microbial and photo oxidations, which change the composition of the original spilled oil as well as its physical and toxic properties. This talk will detail the chemical and physical changes that oil undergoes as it moves and spreads through the environment. Examples of the weathering process of oil from the Deepwater Horizon Oil Spill will be given, along with the implications for environmental impacts.

2B002 Dynamics and Modeling of the Deepwater Well Blowout and Resulting Subsurface Oil Layer (~1100–1300m) from the Deepwater Horizon MC 252. CJ Beegle-Krause, NOAA Office of Response and Restoration; C Barker, NOAA Office of Response and Restoration; D Payton, NOAA Office of Response and Restoration. Modeling studies and observations indicate a deep subsurface oil layer (and subsequent small oxygen depression) was formed at the dynamic point for the Deepwater Horizon MC 252 (DWH) deepwater well blowout. The hypothesis is that oil and gas from the well exited as a single phase, creating a momentum jet that transitioned into a buoyant plume. As the buoyant plume rose, the oil and gas separated 200–400 m above the well, with the gas bubbles and largest (>1 mm) oil droplets rising to the surface in a matter of hours. The smallest droplets (<60 µm), with rise velocities requiring weeks to months to reach the surface, spread out primarily along the 1027.70–1027.71 kg/m^3 density surfaces, roughly 1100–1300m depth. The Comprehensive Deepwater Oil and Gas (CDOG) model, and DeepBlow model supported these conclusions, based on incident-specific modeling done by Clarkson University (Yapa), Sintef (Johansen), and the authors. Within this layer, dissolved oil constituents, gas and subsurface applied dispersants were also found, as reported by Federal efforts and academic efforts. The DWH well is located within Antarctic Intermediate Water (AAIW). The source of this water mass is through the Yucatan Straits, with no connection to the Florida Straits or the continental shelf. Abyssal theory, previous studies, and the DWH observational programs support an overall counterclockwise transport in this depth range. Subsurface farfield modeling by the authors and He et al. support this general southwest transport. Modeling results and observations show some temporary flow reversals. Nearfield modeling by the authors using the CDOG model with Acoustic Doppler Current Profiler (ADCP) data near the well show how the blowout dynamic point and subsequent oil release into the deep water changed over time. Mean currents to the southwest were interrupted by current reversals at a variety of time-scales. Operational modeling efforts were primarily undertaken to provide guidance to vessels in searching for this dilute deep plume. The types of modeling undertaken and the results will be presented.

2B003 Estimating the Presence of Microdroplets and a Framework for Evaluating their Toxicity in Oil-Water Mixtures. A Redman, HDR | HydroQual; J McGrath, HDR | HydroQual; B Stubblefield, Oregon State Univ; A Maki, AW Maki Consulting; Dominic Di Toro, Univ of Delaware. Microdroplets are formed when oil is mixed with water and occurs in laboratory preparations, such as water accommodated fractions (WAFs), and in field settings such as oil spills. In some cases, the microdroplets can be observed visually while in others they are microscopic. The toxicity of oil is complicated

by the presence of these microdroplets, since it is due to exposure from both dissolved oil and oil that is in the microdroplet phase. A theoretical framework has been developed to estimate the concentration of the oil constituents that are in both the dissolved phase and microdroplet phase, referred to as the particulate phase. The oil constituents include MAHs, PAHs, and saturated hydrocarbons. The method is based on a Raoult's Law solubility model that includes corrections for temperature and "salting out" effects. Method validation was performed using available chemistry data from several laboratory exposure systems including oiled gravel generators and standard WAF preparations for several neat and weathered oil substances (e.g., crude, diesel, etc.). The model computes the amount of each oil component that is in the dissolved and particulate phases. This approach provides a framework for evaluating the aquatic toxicity of complex oil–water mixtures in terms of dissolved- and particulate-phase toxicity. The Target Lipid Model, a toxicity model that has been extensively validated for predicting the toxicity of dissolved phase oil constituents, can be used to estimate the toxicity of the dissolved-phase constituents. The estimated toxicity can then be compared to the observed toxicity. Any observed "excess" toxicity is attributed to the particulate-phase oil.

2B004 Polynuclear Aromatic Hydrocarbons from MC252 in the Water Column: Preliminary Exposure Assessment, Weathering, and Biodegradation. PD Boehm, Exponent Inc; LL Cook, Exponent Inc; RM Atlas, Univ of Louisville. Physical and chemical dispersion of the MC252 oil released into the Gulf of Mexico between April 20 and July 15, 2010 resulted in a cloud of fine droplets at approximately 1100–1200 meters that generally moved in a southwesterly direction while larger droplets moved to the surface and formed slicks. Surface oil was also reintroduced to the surface water by waves. The preliminary results from over 10,000 offshore water column samples (>3 miles from shore) that comprise a 4-dimensional (area x depth x time) data set from several key water column zones are discussed in this presentation. Total polycyclic aromatic hydrocarbon (TPAH) concentrations in whole, unfractionated water samples were found with a geometric mean of less than 0.01 ppb concentrations ranging from not detected (ND) to 146 mg/L (parts per million), the latter sample collected directly from the riser plume at 1524m water depth. Eighty-five (85) percent of all samples were at TPAH concentrations of <0.1 ppb, essentially at or near background levels. During the release (April–July), concentrations of TPAH attenuated rapidly with distance from the release point (the wellhead) and were seen to reach <1.0 ppb within 15–20 miles in all directions other than to the southwest, where a small number of samples exceeded 1ppb out to 40 miles. Several samples exceeded 1 ppb sporadically beyond that distance. Within the 1100–1200m depth range (i.e., the "plume" to the southwest), TPAH seldom exceeded 10ppb with the highest concentration of 23 ppb TPAH and a geometric mean value <0.1 ppb. Reductions in concentrations as the oil moved away from the wellhead are accompanied by a decreasing ratio of C17/pristane and C18/phytane and degradation of PAHs based on ratios to the conserved hopane. These changes clearly demonstrate extensive biodegradation in the deep sea cloud. The extent of measured biodegradation was higher in the deep sea than in surface oil slicks where higher oil concentrations and/or lower surface area may have limited rates of biodegradation. Despite the low temperatures of the deep sea, the indigenous microorganisms were well-adapted to biodegradation of both aliphatic and aromatic components of MC252 oil. Microbial biodegradation of the oil removed many of the toxic components and reduced the overall impact of the oil released from the well.

OIL FATE AND TRANSPORT MEASUREMENTS AND MODELING (cont'd Wednesday)

2B005 Bioavailability of PAH from the Deepwater Horizon Oil Spill. D Shea, North Carolina State Univ; K O'Neal, North Carolina State Univ; X Kong, North Carolina State Univ; X Xia, North Carolina State Univ; P Lazaro, North Carolina State Univ; C Hofelt, North Carolina State Univ. On 20 April 2010, the Deepwater Horizon offshore drilling rig in the Gulf of Mexico exploded after a blowout and sank 2 days later, killing 11 people and causing the largest offshore oil spill in U.S. history. One of the many ecological and human health issues associated with this spill is the potential for exposure to and accumulation of polycyclic aromatic hydrocarbons (PAH) and other oil components in the food chain and how the use of dispersants may have influenced the bioavailability of PAHs. We will update our preliminary assessment of PAH bioavailability presented at the SETAC North America Meeting in November 2010 with final data from field and laboratory experiments. We investigated the bioavailability of PAH in fresh and weathered crude to zooplankton, bivalves, crustaceans, and fish and also tested the ability of passive sampling devices (PSDs) and standard water sampling to predict PAH bioavailability. We found that bioavailability of PAH decreased significantly with the degree of weathering and this effect was most pronounced with lower molecular weight PAH. Use of dispersant increased the bioavailability of fresh crude oil in a manner that appears to be related to the surface area-to-volume ratio of the oil droplets. Various PSD designs were tested and some were subject to a very high bias that was dependent on the presence of oil droplets or films in the water and the ability of the oil to make sustained contact with the PSD sorptive phase. Standard whole and filtered water sampling also was subject to a very high bias and like most PSD designs this bias was highly variable and dependent on the presence oil droplets and films. Our results provide an excellent, though incomplete, basis for determining the bioavailability of PAH as a function of weathering and the appropriateness and potential pitfalls of various sampling technologies to estimate PAH exposure and bioavailability following this oil spill.

2B006 Crude Oil Biodegradation in *Spartina alterniflora* Dominated Salt Marshes: Intrinsic Capacity, Limiting Conditions, and Success of Amendments in Field Applications. WA Jackson, Dept of Civil and Enviromental Engineering, Texas Tech Univ; JH Pardue, Dept of Civil and Enviromental Engineering, Louisiana State Univ; PT Tate, Conestoga-Rovers & Associates. Crude oil biodegradation has been extensively studied in the past in a variety of environments. In general crude oil degradation can be limited by either or both nutrient and oxygen availability. Most previous research has focused on high energy beach-like systems and relatively few studies have focused on the low energy salt marsh systems characteristic of much of the Gulf Coast. This abstract summarizes USEPA funded research we performed over a 5-year period that investigated the controlling limitations of crude oil degradation in Spartina alterniflora–dominated Gulf Coast salt marshes. These studies included both laboratory microcosms, intact core studies, large intact mesocosms (1~ft^2), and culminated in a large controlled release field study. These studies systematically evaluated the intrinsic degradation rates of crude oil, determined the seasonal changes in mineralization rates, defined limiting nutrients, determined optimum form and concentration of nutrient amendments, qualified the impact of oxygen availability, and confirmed these findings in a field trial. These studies have been previously published and presented individually. However given the current impact of crude oil in these same type salt marsh systems and in some cases in overlapping study areas, summarizing the major findings may aid others contemplating future studies or remedial actions.

SEAFOOD CONTAMINATION, SAFETY, AND HUMAN HEALTH

1B001 Monitoring Polycyclic Aromatic Hydrocarbons (PAHs) in Seafood in Mississippi in Response to the Gulf Oil Spill. A Brown, Mississippi State Univ; K Xia, Office of the State Chemist - MS; K Armbrust, Office of the State Chemist - MS; G Hagood, Office of the State Chemist - MS; J Jewell, Mississippi Dept of Marine Resources; D Diaz, Mississippi Dept of Marine Resources; N Gatian, Mississippi Dept of Environmental Quality; H Folmer, Mississippi Dept of Environmental Quality. Following the sinking of the Deepwater Horizon, the state of Mississippi began sampling and monitoring crabs, shrimp, oysters, and several species of fish from numerous locations within Mississippi State Waters. From the end of May 2010 to date, over 250 samples have been analyzed by the State for polycyclic aromatic hydrocarbons (PAHs) as listed in the NOAA method for analysis of PAHs in seafood. Additional samples were also collected and submitted to the NOAA laboratory in Pascagoula, MS to support the reopening of state waters in accordance with the protocol jointly developed by the Gulf Coast states, USFDA, and NOAA. PAHs have not been detected in any sample collected to date at levels above the Level of Concern (LOC) as established in the reopening protocol. PAHs were routinely detected in most samples at low part-per-billion levels and are consistent with values commonly detected in samples measured in other studies unrelated to the oil spill. The levels measured in seafood were also consistent with or below levels of PAHs detected in food items (smoked turkey, ham, chicken, catfish, and barbecued pork) purchased at major retail supermarkets and restaurants.

1B002 Fishery Re-Opening Decisions during Deepwater Horizon Event: a Florida Perspective. KF Goff, Florida Dept of Health; JD Krause, Florida Dept of Health. When the Deepwater Horizon oil spill occurred, numerous human health issues were brought to the forefront, including the safety of consuming fish potentially affected by the event. The Florida Department of Health (FDOH) was tapped to chair the multi-agency, multi-state "Fish Consumption Advisory Workgroup." Because the spill would ultimately cover both state and federal jurisdiction, all agencies with roles in fish consumption from the federal to state level were asked to develop and adopt the criteria necessary to reopen a fishery. While fishery closures are easy to impose based upon certain predictions, a scientific foundation is needed to maintain and lift them. A multi-tiered approach to testing fish for re-opening was established and named "Protocol for Interpretation and Use of Sensory Testing and Analytical Chemistry Results for Re-Opening Oil-Impacted Areas Closed to Seafood Harvesting Due to The Deepwater Horizon Oil Spill" and is found on the USFDA website. The first tier consisted of sensory analysis which relied on a minimum of 70% of trained assessors finding no detectable petroleum or dispersant odor or flavor in samples. If a sample passed sensory analysis, the sample was sent to tier two, which included chemical analysis. Using standard USFDA and USEPA risk assessment methods, risk-based criteria were calculated for potential cancer and non-cancer risks associated with exposure to petroleum associated contaminants (i.e., polycyclic aromatic hydrocarbons (PAHs)) and dispersants in fish following the spill. For cancer risk, the carcinogenic potency of 7 PAHs were estimated, relative to benzo(a) pyrene (BaP), as a toxicity equivalency factor (TEF). Levels of concern (LOC) for BaP equivalent concentration for finfish, shrimp/crabs, and oysters were calculated as 0.035, 0.132, and 0.143 ppm, respectively. Non-cancer LOCs were calculated for 5 additional PAHs as well. LOCs for non-cancer risks were 3 to 4 orders of magnitude higher than carcinogens. Non-cancer risks were also calculated for a component of the dispersants called dioctyl sodium sulfosuccinate (DoSS). The LOCs for DoSS in finfish, shrimp/crabs, and oysters were calculated as 100, 500, and 500 ppm, respectively. While the LOCs were developed in response to the Deep Water Horizon Spill, the process used to create these criteria can serve as a template in future seafood contamination events.

OIL TRACKING TECHNOLOGY

2C001 Indicators used to Monitor Subsurface Oil during the Deepwater Horizon Event. J Kurtz, USEPA Gulf Ecology Division, Gulf Breeze FL; R Conmy, USEPA Gulf Ecology Division, Gulf Breeze FL. The Gulf of Mexico Deepwater Horizon oil spill was the largest accidental marine spill in the history of the petroleum industry. The spill was also unprecedented due to the extreme depth of the wellhead leak within the ocean, posing unique challenges to the monitoring efforts, where oil that remained in the subsurface plume (between 1000–1500m), could not be tracked via common methods such as aerial surveys. Alternatively, the response effort employed various indicators to detect and track the plume such as dissolved oxygen, fluorescence, and laser in situ scattering and transmissometery (LISST) of suspended particle size. Assessment of these indicators was conducted by a collaborative team of scientists from federal, academic, and industrial organizations (Joint Analysis Group - full membership at http://ecowatch.ncddc.noaa.gov/jag/membership.html), who were tasked with providing rapid response analysis of data. Discussed here will be a review of the indicators used during the response, with specific focus on the benefits and limitations of the measurements, indicator validation with chemical analyses (PAHs, TPH, BTEX), and lessons learned from the response effort.

2C002 Deep-water Sediments Collected after the MC252 Oil Spill Reveal a Small Footprint of Macondo Oil Associated with Drilling Mud near the Well-head. J Brown, Exponent, Maynard MA; L Bruce, BP, Naperville IL; P Boehm, Exponent, Maynard MA; L Cook, Exponent, Maynard MA. The Deepwater Horizon oil spill released Macondo (MC252) crude oil from the deepwater well-head from April 20 to July 15, 2010 when the well-head was capped. During May 27th to 29th a "top-kill" was attempted, where synthetic heavy drilling mud was injected into the well in an effort to control the flow of oil. The top-kill was unsuccessful and resulted in the release of some drilling mud used for this operation. Multiple surveys of the deepwater Gulf of Mexico sediments were conducted during the spill and after the well was capped. Preliminary anecdotal visual results from some early deepwater surveys suggested that there were large areas of the seafloor covered with MC252 oil. The most comprehensive chemistry survey of deepwater sediments to date was conducted in September and October 2010 (Annex surveys) to evaluate potential ecological risk of the spill to the near shore and offshore environment. In general, the chemistry results of the Annex surveys indicated that petroleum hydrocarbons (specifically polycyclic aromatic hydrocarbons [PAH]) from the spill did not pose a significant ecological risk to the deepwater sediments. The exception was noted at several stations near the well-head, that showed elevated petroleum hydrocarbons and PAH. A detailed evaluation of the deepwater sediment samples collected within 20 miles of the well-head was performed using metals, saturated hydrocarbons (SHC), PAH, biomarkers (steranes and triterpanes), organic carbon (TOC), and particle size data. The presence of drilling mud was confirmed by elevated barite levels and the presence of alpha olefin mud additives, and MC252 oil was identified based on the biomarkers, SHC and PAH chemical signatures. The results of the focused evaluation enabled precise identification of MC252 oil and revealed a correlation between the presence of drilling mud and MC252 oil in the deepwater sediments. The co-occurrence of MC252 oil with drilling mud revealed the primary mechanism for deposition of MC252 oil in deepwater sediments was the mixing of drilling mud and crude oil during the initial top-kill injection, with subsequent deposition on the seafloor after the drilling mud:crude oil mixture was ejected from the well-head when the top-kill failed. Using the combination of unique drilling mud and crude oil markers, a well-defined "footprint" of MC252 oil in sediments was calculated. The footprint indicated that MC252 oil was found in a limited area around the well and become undetectable within several kilometers from the well-head.

2C003 Human Sensor Networks: Improving Oil Spill Model Predictions Using Social Media Data with Geolocation. O Aulov, Univ of Maryland Baltimore County; M Halem, Univ of Maryland Baltimore County. Timely responses to natural and manmade disasters and in particular oil spills—such as the recent BP oil spill of April 2010—can save lives, prevent property damage, and help minimize environmental impact. We show how we can model more accurately the spread of an oil spill by using social media data from flickr as a human sensor network. Human sensor networks can serve as low-cost alternatives to traditional deployable sensor platforms. In our research, we view flickr users as "sensors" that are "deployed" in the field to make "observations" and the photos they post as a "report" that we can harvest by accessing and mining their data. In this scenario, the sensors' reports consist of user generated and posted images of events related to the oil spill, such as oil tar balls washing up on the shore, oil sheen observed on the surface of the ocean, or birds, fish, and other wildlife suffering from exposure to oil. Since some flickr photos are taken

with cameras that support GPS geotagging, which provide latitude and longitude information, we can infer that oil was present at a certain location at least at the time the image was taken. In many cases, location information can be found in the title or description of a photo. Using Named Entity Recognizers and geolocation algorithms allows us to geotag the photos. Since all images have a timestamp that represents with certainty when the image was taken, we can add the time of observation to our data. Having time and location of the observed oil reaching shorelines enables the use of inverse methods to adjust certain parameters in the model to better fit these human sensor observations. To test our ideas, we employ the general operational modeling environment (GNOME) software of NOAA's Emergency Response Division of Office of Response and Restoration, which forecasts the movement of the sheen of oil on the ocean surface given surface winds, ocean currents, and type of oil pollutant. We use a 2-D variational analysis technique to assimilate the social media data mined from flickr with other geophysical data. We report on the results of GNOME model integrations which show the efficacy of these data to impact the forecast. By mining flickr data and applying geolocation algorithms, our oil spill model can produce more accurate forecasts that will in the future help emergency responders work more efficiently and effectively having better estimates of when the spills will reach various sites along the shores.

COMMUNICATION CHALLENGES AND SOLUTIONS

CC001 Ecosystem Health as a Basis for Human Health: Lessons Learned From the Deepwater Horizon Oil Spill. AS Kane, Dept of Environmental and Global Health, College of Public Health and Health Professions, and Emerging Pathogens Institute, Univ of Florida; GF Crozier, Dauphin Island Sea Lab; LM Grattan, Dept of Neurology, Univ of Maryland School of Medicine; B Mayer, Dept of Sociology and Criminal Law, College of Liberal Arts and Sciences, Univ of Florida; and JG Morris, Dept of Medicine, College of Medicine, and Emerging Pathogens Institute, Univ of Florida. The Gulf of Mexico (GOM) is one of the largest, diverse and most productive bodies of water on Earth. It occupies approximately 1.5 million km^2 of surface area and over 75,000 km of intricate shoreline (ca. 6,400 km as a straight line measurement), with a maximum depth of 3,850 meters. US Gulf states enjoy an annual GDP > $2.2 trillion, mostly linked to tourism, recreation, fishing, and petroleum production. Collapse of the Deepwater Horizon drilling rig off the southeastern coast of Louisiana in 1,500 meters of water, penetrating an additional 4,000 meters under the sea floor to the hydrocarbon reservoir below, killed 11 people and released over 750,000,000 liters of oil into the Gulf. Short-term impacts in many Gulf coastal ecosystems have been quantified and assessed, and much of the potential impact appears to have been abated due to the unprecedented application of more than 5 million liters of dispersant. The apparent resiliency of the coastal ecosystems, however, has not been matched within the human component of the system. We studied psychosocial outcomes associated with the oil spill in coastal communities with and without physical oil impact. Outcomes associated with the spill primarily indicated clinically significant depression and anxiety. Individuals with income loss associated with the spill further suffered significantly elevated tension, depression, fatigue, confusion, and mood disturbance, and were less resilient. Altered resiliency may have been exacerbated by eroded public trust in Federal agencies and media sources, linked with lack of transparency and inconsistencies in reporting of data. Current estimates of human health impact associated with the oil spill underestimate the psychological impact and need for services in Gulf Coast communities. Healthcare burdens associated with these mental health issues extend beyond areas of direct oil exposure, and income loss after the spill may have a greater psychological health impact than the presence of oil on immediately adjacent shoreline. Deep water oil drilling enterprises, now common in the GOM, are complex and even dazzling—meriting comparison with outer space exploration. Gross deficiencies in safety and communications, however, have yet to catch up with technology, and render both natural environments and human communities vulnerable to landscape-scale disasters. While long-term ecological impacts of this oil spill remain a subject of profound uncertainty, the resulting public health issues at this stage are no less significant, and are overwhelmingly slanted toward mental health problems. Our dramatic dependence on Gulf ecosystem services, like good seafood menus and clean beaches with beautiful sunsets, underscores the co-dependence of human economics and health, and the health of natural ecosystems.

CC002 Who Turns to the Media for Reliable Environmental Health Information? New Insights into Journalist–Scientist–Public Health Collaboration. LM Grattan, Depts of Neurology, Psychiatry, Epidemiology and Public Health, Univ of Maryland School of Medicine; SM Roberts, Dept of Neurology, Univ of Maryland School of Medicine; B Mayer, Dept of Sociology, Univ of Florida; JG Morris, Emerging Pathogens Institute, Univ of Florida. There are a wide range of psychological responses to oil spill disasters. In the study of psychological reactivity during the Deep Water Horizon Oil Spill (DWHOS) we found resilience and psychopathology in NW Gulf community. Extant data suggests a relationship between television images and newspaper stories of disaster and stress and health symptoms. Presumably, the more time spent watching disaster related news stories, the greater likelihood of developing long term psychological or health symptoms. What is less well known are: the characteristics of people who, during oil spill disasters turn to the media (compared to other sources) for reliable information, and the psychological reactivity of people who get their information from the media vs. those who do not. Toward this end, we investigated the psychological status, environmental worry and health risk concerns of NW Gulf coastal residents who identified the media as the most reliable source of information during the DWHOS. Using a community-based participatory research model (CBPR), 94 adult volunteers from two NE Gulf Coast Communities (Baldwin County, AL and Franklin County, FL) were studied. Demographic, medical, psychiatric history, psychological status and information sources were obtained using well-validated standardized interviews and psychometric procedures. Participants were divided into two groups (media and non-media) based upon the information source they believed was most reliable for obtaining oil spill environmental and health information. Resilience, depression, anxiety and environmental health worry were similar between the media and non-media groups. People with a history of depression or symptoms of confusion were less likely to turn to the media for information while people who used "humor" as a coping strategy were more likely to use media sources. There was no difference in acute psychological reactivity (anxiety, depression) between people who turned to television and newspaper outlets for reliable information about the DWOS and those who did not. Findings are discussed within the context of "information seeking" coping theory; psychological distress and uncertainty in decision making; six month outcome data currently under analysis and the importance of including journalists in community-based participatory research models.

RISK AND DAMAGE ASSESSMENT

1C001 Physical, Chemical and Biological Stressors Influencing Baseline Environmental Conditions in the Gulf of Mexico Prior to the Deepwater Horizon Event. J Nicolette, ENVIRON International Corp; M Henning, ENVIRON International Corp; G Reub, ENVIRON International Corp; J Haasbeek, ENVIRON International Corp; K Merritt, ENVIRON International Corp; M Bock, ENVIRON International Corp; M Meaders, ENVIRON International Corp; A Clodfelter, ENVIRON International Corp; D Pelletier, ENVIRON International Corp. In evaluating the potential effect of a significant anthropogenic oil release on the environment, it is necessary to understand the baseline condition of the environment in the area potentially affected by the release. This understanding is necessary in order to accurately characterize the injury associated with the release. The baseline condition is the condition of the natural resources and services that would have existed had the incident not occurred -- that is, the condition of the natural resources and associated services "but for" the release. Over the past 6 months, the authors have conducted significant research compiling environmental baseline information related to the Gulf of Mexico. Baseline conditions in the Gulf of Mexico are influenced by a variety of physical, chemical and biological stressors. The authors will discuss some of those stressors and their influence on the baseline level of natural resources and services in the Gulf of Mexico prior to the Deepwater Horizon release. The presentation will include, but will not be limited to, a discussion of: • Natural resources and services: a brief overview; • Physical stressors such as wetland and shoreline losses associated with coastal development, shoreline modification, channelization, dredging, hurricane and storm events; and undersea energy extraction and utility siting; • Chemical stressors such as the occurrence of natural oil seeps, other petroleum releases from pipelines, wells, bilge releases, and/or platforms, non-petroleum releases, National Pollutant Discharge Elimination System (NPDES) permit discharges and exceedances, low dissolved oxygen concentrations; and • Biological stressors such as fish kills associated with disease and low dissolved oxygen concentrations related to a variety of non-DWH events.

1C002 Environmental Conditions in Northern Gulf of Mexico Estuaries: Before and After the BP Oil Spill. VD Engle, US Environmental Protection Agency; LC Harwell, US Environmental Protection Agency; LM Smith, US Environmental Protection Agency. When conducting an environmental assessment to determine the ecological effects of the BP Oil Spill, baseline environmental data is essential to establish ecosystem condition prior to the incident. USEPA's National Coastal Assessment (NCA) monitored the ecological condition of estuaries in the Gulf of Mexico (GOM) annually from 2000 to 2006. The environmental data collected through this program provided an historical baseline for water quality, sediment quality, and biological condition in northern GOM estuaries, prior to the BP Oil Spill in 2010. This assessment is based on indicators of nutrients, chlorophyll, dissolved oxygen, water clarity, sediment chemistry and toxicity, total organic carbon, benthic macroinvertebrate communities, and fish tissue contaminants. Immediately following the Deepwater Horizon explosion, USEPA mobilized teams in Regions 4 and 6 to collect samples in estuaries before oil or oil-related contaminants were transported into nearshore environments. This oil spill response monitoring effort provided a recent baseline for water and sediment chemistry in northern GOM estuaries prior to exposure to contaminants from the BP Oil Spill. USEPA continued monitoring efforts through fall 2010 to determine exposure and potential ecosystem effects from the BP Oil Spill. We present a summary of baseline ecological conditions in northern GOM estuaries and comparisons of sediment chemistry data from historical and recent baseline surveys and post-impact monitoring. We also demonstrate the applicability of the data to compare conditions at multiple spatial scales (e.g., region, state, site).

1C003 The Effect of Oiling on Avian Survival Rates. JR Wakefield, Cardno ENTRIX. A question repeatedly encountered during Oil Pollution Act (OPA) Natural Resource Damage Assessment (NRDA) activities relates to the fate of live oiled birds that are not recovered for rehabilitation. Cardno ENTRIX has reviewed 16 oil spill incidents spread across 4 continents where the degree of oiling and fate of individual birds was known and where the incremental mortality rates among oiled birds could be determined with a high level of certainty. While we continue to look for additional data sets, we believe our current effort has identified the majority of such data sets in existence today. This information is being supplemented with the results of ongoing telemetry studies of more than 350 birds telemetered in response to the Deepwater Horizon incident. The data suggest that, among terrestrial birds, wading birds, and shorebirds with less than about 20% oil coverage, mortality is unlikely. That mortality rates increase rapidly as percentage of oiling increases. While data describing potential reproductive effects among birds oiled during the Deepwater Horizon incident are not available, existing literature and data from other incidents suggest reproductive success among surviving oiled birds varies by guild from levels no different from un-oiled counterparts among wading and shorebirds to a 13% reduction in petrels. The meta-analysis covered in this paper addresses a critical data gap in several ongoing NRDAs where a necessary element of avian impact calculations is the probability that an oiled bird experiences acute mortality.

1C004 Defining the Proper Role of Toxicity Monitoring in Oil Spill Response Activities. G Coelho, Ecosystem Management & Associates Inc, Lusby MD; D Aurand, Ecosystem Management & Associates Inc, Lusby MD; J Clark, Ecosystem Management & Associates Inc, Lusby MD. During the Deepwater Horizon MC252 oil release, subsea dispersant injection was utilized as part of an overall spill response strategy. BP was directed to develop and implement a water column monitoring program which included shipboard toxicity testing. The commercial aquatic toxicity screening kit (Rotoxkit M) that utilizes the rotifer, *Brachionus plicatilis*, was selected based on results of prior monitoring work to evaluate shipboard toxicity testing. Even though prior studies indicated that any of the tests considered for shipboard work were difficult to implement, the Rotoxkit M test had the greatest likelihood of success for this effort. The criteria developed for inclusion in the Directive were arbitrary, and were made without specific data on the organism's sensitivity to crude oil. As expected, when weather conditions were not good, shipboard conditions were not optimal for culture and testing the animals, leading to decreased control survival. However, as they gained experience, technicians were able to achieve acceptable (and reproducible) results. Rotifer mortality was never sufficiently high to initiate discussions about restricting injection. In 99% of the 900 samples tested there was 75% or greater survival relative to controls. Concurrently with the field monitoring, laboratory toxicity testing indicated that the 24-hour LC50 for *B. plicatilis* in multiple tests ranged from 7.6 to 16.9 ppm. The fact that mortality in the shipboard tests was low is a positive result, but had there been significant mortality it is unclear how that information would have been used in making risk decisions. In short, there is little to recommend such tests, and many reasons to question their utility as a decision tool during emergency response operations. Estimates of hydrocarbon exposure concentrations, initially determined with a CDOM fluorometer and later using shipboard GC MS units, provide a better basis to assess environmental risk than shipboard test results for one species with responses to a variety of shipboard stresses. Field hydrocarbon concentrations can be compared to laboratory results for multiple species and other oils. Even so, neither approach, by itself, can be used to evaluate the appropriateness of dispersant use. While these data are useful, they must be tied back to Net Environmental Benefit Analysis (NEBA) or Ecological Risk Assessments (ERA) to reach management decisions. These need to be prepared as part of the planning process, and then reexamined during the spill (using whatever information has been obtained) to determine if the approach still appears to be valid.

1C005 Assessing Ecological Risks Posed by the Macondo 252 Oil Spill Using the Comprehensive Aquatic Systems Model. SM Bartell, E2 Consulting Engineers Inc, Maryville TN; SK Nair, E2 Consulting Engineers Inc, Maryville TN; Y Wu, E2 Consulting Engineers Inc, Maryville TN. A spatially explicit, large-scale version of the Comprehensive Aquatic Systems Model (CASM) was developed to assess ecological risks posed by oil and dispersants in relation to the Macondo 252 spill. The current modeled spatial domain includes Lake Borgne, Biloxi Marsh, the Chandeleurs Islands, east to Bay St. Louis, and out to the Gulf shelf. The spatial resolution is 1 km^2. The CASM is a bioenergetic-based model that simulates the daily biomass (carbon) production for representative primary producers including phytoplankton, submerged aquatic vegetation, and emergent wetland plants. The model also simulates production of zooplankton, zoobenthos, and multiple life stages of oysters, shrimp, blue crab, bay anchovy, Gulf menhaden, Gulf sturgeon, red drum, spotted sea trout, and Atlantic croaker. The model is capable of addressing near term (1–5 y) and longer term (up to 55 y) risks and recovery

for alternative exposure scenarios for oil and dispersants. Baseline CASM simulations of population production dynamics were developed for pre-spill conditions using available data. Time to recovery was defined as population production returning to the pre-spill baseline values. Resulting risks and recovery differed substantially in relation to the population growth rates, sensitivity to oil and dispersants, and the characteristics of exposure. The CASM stands as a useful framework for assessing risks posed by oil and dispersants in coastal Louisiana ecosystems and offshore regions. The model could be implemented for other Gulf coastal areas between Texas and Florida.

RESPONSE TECHNOLOGY EFFECTIVENESS

2D001 An Interagency Team Evaluates the Fate and Effects of Remnant Oil in Beach Environments, Focusing on Risk to Human Health and Environmental Resources. AC Bejarano, Research Planning Inc; MC Boufadel, Temple Univ; GE Eckert, US National Park Service; MK Nannan, Bureau of Ocean Energy Management, Regulation and Enforcement; AC Nye, Center for Toxicology and Environmental Health; G Shigenaka, National Oceanic and Atmospheric Administration; WM Starkel, US Fish and Wildlife Service. As part of the Deepwater Horizon MC-252 oil spill response, the Federal On-Scene Coordinator (FOSC) assembled an interagency team of ecologists, toxicologists, chemists, and risk assessors to study oil remaining in sandy beach environments following cleaning to established standards. The study focused on three types of remnant oil: supratidal buried oil (SBO), small surface residue balls (SSRBs), and submerged oil mats (SOM). These oil residues are challenging to remove but could represent an environmental risk if left in place. The beaches in question are primarily natural area beaches (e.g., within US Fish and Wildlife Service or National Park Service units), which have much more conservative treatment standards compared to high-use amenity beaches. The FOSC charged the scientific team, known as the Operational Science Advisory Team (OSAT-2), with answering three questions: 1) What is the fate of the oil residue if it remains in the environment? 2) Are there any human health concerns from remnant oil? 3) Does a Net Environmental Benefit Analysis (NEBA) support removal of the oil, or leaving it in place? The study of oil fate determined that weathered oil samples were 86%–98% depleted of total polycyclic aromatic hydrocarbons (PAHs). Modeling results showed that the likelihood of supratidal buried oil leaching into groundwater is minimal. A separate model predicted that PAH concentrations in supratidal buried oil will decrease to 20% of current levels within 5 years in most beach environments. The human health risk assessment showed that all cancer and non-cancer health effects from short and long-term exposures were below US Environmental Protection Agency (USEPA) acceptable health-based risk and hazard levels. Ecological risk assessors evaluated the impact of oil on aquatic invertebrates, fish, sea turtles, birds, and terrestrial mammals. A NEBA suggested a greater risk to resources from further cleanup beyond the established guidelines than from exposure to remaining oil. Two particular routes of exposure posed potentially elevated risks to aquatic and wildlife resources: 1) Ingestion of SSRBs by subsurface-probing shore birds, and 2) Contact between SBO and sea turtle eggs and hatchlings. However, the risks from continued cleanup to reduce oil exposure was judged to be an even higher risk to the resources. Further study and mitigation strategies may help reduce the threat to these resources.

2D002 Enhancing Biodegradation of Crude Oil from the Macondo Well in Alabama Beaches. A Horel, Univ of Alabama, Dept of Biological Sciences, Dauphin Island Sea Lab; B Mortazavi, Univ of Alabama, Dept of Biological Sciences, Dauphin Island Sea La; PA Sobecky, Univ of Alabama, Dept of Biological Sciences. The objective of this study was to determine the affects of oil/hydrocarbon contamination on sandy beach sediment systems in Alabama impacted by the recent Gulf of Mexico oil spill. Bioremediation of crude oil from the Macondo Well in the Gulf of Mexico was compared to that of conventional diesel in microcosms at variable fuel amounts and at different inorganic nutrient concentrations. Changes in aerobic microbial communities over time were estimated by monitoring the number of alkane, total hydrocarbon, and polycyclic aromatic hydrocarbon (PAH) degraders during a 6-week study period. Within a week of hydrocarbon additions, alkane and total hydrocarbon degrading microbial numbers increased by 5 orders of magnitude relative to uncontaminated samples. Hydrocarbon degrader numbers in the diesel and crude oil contaminated samples were similar. However, PAH degrader numbers were considerably higher in the crude oil compared to the diesel contaminated samples. The hydrocarbon degradation rates were similar for both fuel types and were 2 and 3 times higher in inorganic nutrient amended microcosms compared to the controls for the 2000 and 4000 mg/kg contamination levels, respectively. The study confirmed that Alabama sandy beach sediment systems exhibit intrinsic microbial biodegradation capabilities that facilitate hydrocarbon remediation.

2D003 Testing and Implementation of Treatment Methods for Marshes Heavily Oiled during the Deepwater Horizon Spill. SA Zengel, PBS&J, Tallahassee FL; J Michel, Research Planning Inc, Columbia SC. During the Deepwater Horizon oil spill, 1,055 miles of shoreline were oiled, including 465 miles of marshes. In Louisiana, there were 430 miles of marshes oiled, with 81 miles classified as Heavy, 95 miles as Moderate, 115 miles as Light, and 141 miles as Very Light. In the Eastern States (AL, MS, and FL), there were 35 miles of marshes oiled, with 1 mile classified as Heavy, 4 miles as Moderate, 17 miles as Light, and 13 miles as Very Light. Most of the oiling occurred along the marsh fringe, although there was interior pooled oil in the Phragmities marshes in the Mississippi birdsfoot (during the initial stranding in May) and patches of oil coating on Spartina marshes (as a result of high water generated by Hurricane Alex). During the Stage I/II of the response (May–September), cleanup in marshes consisted mostly of recovery of floating oil adjacent to marshes because of the potential for re-oiling and the concern for damages from repeated treatments. Once the threat of re-oiling was reduced, Stage III cleanup was initiated. Most of the marshes classified as Very Light to Moderate oiling did not require additional treatment; wave and tidal flushing proved effective at removing the stranded oil. However, along the most heavily oiled shorelines in northern Barataria Bay, the vegetation has formed into a hard tarry debris mat on the marsh surface to tens of centimeters thick. The heavily oiled wrack line is also typically hardened and tarry. In some locations, thick (to several cm), relatively fresh mousse (emulsified oil) is trapped under the oiled vegetation mat and/or wrack line and is not substantially weathering or degrading over time. Previous studies have shown that vegetative recovery is very slow when there is thick oil on the marsh surface. The following methods were tested in randomly located plots in this area: flushing, surface washing agents followed by flushing, vacuum, raking, cutting, and various combinations of these treatments. After several months of monitoring, it was decided to proceed with a combination of raking and cutting, and operational raking and cutting began in February 2011. This paper will present the results of the tests and operational cleanup and discuss the trade-off decisionmaking process.

2D004 Alternative Response Technology Program for the Deepwater Horizon - An Overview. MJ Cortez, BP America. This paper discusses the innovative approach utilized by the Alternative Response Technology (ART) Program for the MC252 Deepwater Horizon response in the Gulf of Mexico during 2010. The ART program was sponsored by the Unified Area Command, and was an integral part of the successful deployment of several new technologies. This paper focuses on the spill response technologies that were implemented offshore, near shore, and on-shore and covers technologies related to booming, skimming, separation, sand cleaning, surveillance, and detection. The following topics will be covered: a) a description of the ART program and organization; b) the timeline of key events during the response; c) the comprehensive "triage" process that was used to evaluate technology submittals from the public; d) the list of successful technologies that were field tested and, in many cases, deployed operationally; and e) future plans and studies. An innovative and inclusive process was designed and implemented for capturing ideas real time, which leveraged the public's ingenuity and entrepreneurial spirit. More than 123,000 individual ideas were submitted by the public globally from more than 100 countries. More than 43,000 of these ideas were related to addressing the spill response, of which more than 100 new technologies were field tested, and more than 30 of those tested were successfully implemented across the spill response area. The ART team included numerous BP technical experts, as well as a number of oil spill consultants and experts from various federal agencies such as the USCG, NOAA, OSPR, and the USEPA, many of whom had previous experience in oil spills around the world. The ART program identified several lessons learned in the areas of organization and process. Highlights of these will also be presented.

ABSTRACTS PRESENTING AUTHORS

Adams, Julie TP002
Anderson, Brian 1A004
Anderson, Kim A WP008
Aulov, Oleg 2C003
Barker, Christopher H WP007
Bartell, Steven M 1C005
Beegle-Krause, CJ 2B002
Benfield, Mark C 1A009
Benton, Laurie WP015
Boda, LCDR, USCG, Kenneth J 2D001
Bodensteiner, Scott WP010
Boehm, Paul D 2B005
Bornstein, Jason RP007
Bouldin, Jennifer L TP004
Brown, Ashli 1B001
Brown, John WP006
Brown, John S 2C002
Carriger, John F RP008
Cejas, Mark WP005
Coelho, Gina 1C004
Corrales, Jone TP005
Cortez, Michael J 2D004
Dailey, Meghan TP007
Daling, Per S 2A002
Engle, Virginia 1C002
Getzinger, Gordon J WP004
Goff, Kendra 1B002
Grattan, Lynn M CC002
Greer, Colleen RP001
Hagood, Gale H WP001
Harney, Jodi WP013
He, Luning TP014
Henning, Miranda 1C001
Hepner, Brent WP012
Hodson, Peter V RP002
Horel, Agota 2D002
Jackson, W Andrew 2B006
Jenkins, Kenneth TP011
Johns, Mark W WP003
Kane, Andrew S CC001
Kleinow, Kevin TP001, TP006
Kurtz, Jan 2C001
Lee, Richard TP013
Lewis, Michael TP012
Liu, Chao-Xuan WP014
Lotufo, Guilherme TP010
Mabile, Nere' 2A001
Martin, Jonathan 1A005
McGowan, Greg WP019
Michel, Jacqueline 2D003
Mitchelmore, Carys L 1A003
Overton, Edward B 2B001
Palagyi, Tony 1A008
Pardue, John WP009
Ramirez, Cesar E WP018
Rand, Gary RP005
Redman, Aaron 2B003
Riege, Laura E RP003
Ringwood, Amy H TP009
Schuessler, Hans A WP017
Shaw, Susan D RP006
Shea, Damian 2B004
Smith, Philip N TP008, WP016, 1A006
Stearns, Bryce WP002
Stubblefield, William A 1A001
Sweeten, David W RP009
Wakefield, Jeffrey R TP003, 1C003
Wetzel, Dana L 1A002

AFFILIATIONS

Aqualytical Services Inc Center for Environmental Research, Maple Valley WA WP012
ARCADIS-US Inc WP019
BP - GCRO RP009
BP America 2D004
BP America (GCRO - Technology Theme Leader) 2A001
Cardno ENTRIX TP003, WP005, WP013, RP003, 1A008, 1C003
Chemistry Dept, Tulane Univ, New Orleans LA TP014
Dept of Biology, Queen's Univ, Kingston ON RP001, 1A005
Dept of Civil & Environmental Engineering, Louisiana State Univ WP009
Dept of Civil and Enviromental Engineering, Texas Tech Univ 2B006
Dept of Comparative Biomedical Sciences, Louisiana State Univ, Baton Rouge LA TP001, TP006
Dept of Electrical and Computer Engineering, Louisiana State Univ, Baton Rouge LA WP014
Dept of Environmental and Global Health, College of Public Health and Health Professions, and Emerging Pathogens Institute, Univ of Florida CC001
Dept of Environmental Sciences, Louisiana State Univ 2B001
Dept of Environmental Toxicology, The Institute of Environmental & Human Health, Texas Tech Univ TP008, WP016, 1A006
Dept of Environmental Toxicology, UC Davis 1A004
Dept of Pharmacology and Environmental Toxicology Research Program, Univ of Mississippi, University MS TP007
Dept of Pharmacology, Univ of Mississippi, University MS TP005
Depts of Neurology, Psychiatry, Epidemiology and Public Health, Univ of Maryland School of Medicine CC002
Duke Univ, Nicholas School of the Environment, Durham NC WP004
E2 Consulting Engineers Inc, Maryville TN 1C005
Ecosystem Management & Associates Inc, Lusby MD 1C004
Ecotoxicology Research Facility, Arkansas State Univ TP004
Emergency Response Division, National Oceanic and Atmospheric Administration WP007
ENVIRON International Corporation 1C001
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Exponent Inc WP003, WP006, WP015, 2B005, 2C002
Florida Dept of Health 1B002
Florida International Univ, Dept of Chemistry and Biochemistry WP018
Florida International Univ, North Miami FL RP005
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Marine Environmental Research Institute (MERI) RP006
Mississippi State Chemical Laboratory, Mississippi State Univ WP001
Mississippi State Univ 1B001
Mote Marine Laboratory, Sarasota FL 1A002
NOAA Office of Response and Restoration 2B002
North Carolina State Univ 2B004
Oregon State Univ, Corvallis OR 1A001
Oregon State Univ, Dept of Environmental and Molecular Toxicology, Corvallis OR WP008
Queen's Univ at Kingston RP002
Queen's Univ Chemistry Dept RP007
Research Planning Inc, Columbia SC 2D003
School of Environmental Studies, Queen's Univ, Kingston, ON, Canada TP002
SINTEF, Marine Environmental Technology Dept, Trondheim, Norway 2A002
Skidaway Institute of Oceanography TP013
TDI-Brooks International Inc. 1A009
TestAmerica WP002
Texas A&M Univ Dept of Physics WP017
Univ of Alabama, Dept of Biological Sciences, Dauphin Island Sea Lab 2D002
Univ of Maryland Baltimore County 2C003
Univ of Maryland Center for Environmental Science, Chesapeake Biological Laboratory, Solomons MD 1A003
Univ of North Carolina at Charlotte, Charlotte NC TP009
US Army Engineer Research and Development Center, Vicksburg MS TP010
US Coast Guard 2D001
US Environmental Protection Agency 1C002
US Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Gulf Ecology Division, Gulf Breeze FL RP008
USEPA Gulf Ecology Division, Gulf Breeze FL 2C001
USEPA, Gulf Breeze FL TP012
Weston Solutions Inc WP010

Posters

TP Tuesday Posters
WP Wednesday Posters
RP Thursday Posters

Platform Starting Tuesday

1A Ecosystem Effects
2A Control and Abatement
2B Oil Fate and Transport Measurements and Modeling

Platform Starting Wednesday

1B Seafood Contamination, Safety, and Human Health
2C Oil Tracking Technology
CC Communication Challenges and Solutions

Platform Starting Thursday

1C Risk and Damage Assessment
2D Response Technology Effectiveness

NOTES

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Environmental Toxicology and Chemistry Virtual Issue:

Oil Spills: The Exxon Valdez and other Environmental Impacts

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