

# Oil in the Sea, IV: Inputs, Fates, and Effects

## Committee

### Kirsi K. Tikka

#### Chair

Kirsi Tikka (NAE) is an Independent Director at Pacific Basin Shipping Limited and Ardmore Shipping. From September 2001 until July 2019, Dr. Tikka worked at the American Bureau of Shipping (ABS) where she held the position of Executive Vice President and Senior Maritime Advisor. Prior to joining ABS, Dr. Tikka was professor of Naval Architecture at Webb Institute from 1996 to 2001. Previously, she worked as a naval architect, operations planner, and analyst for Chevron. Her expertise and interests span many aspects of shipping and offshore oil and gas, including reducing and monitoring oil discharge from tankers and ships, regulatory processes, and decarbonization. Dr. Tikka is a Fellow of both the Society of Naval Architects and Marine Engineers (SNAME) and the Royal Institution of Naval Architects. In 2012, she was awarded SNAME's David W. Taylor Medal. In 2018, she was awarded an honorary doctorate of science by the Webb Institute, New York. She is a member of the National Academy of Engineering, and a member of the U.K. Women in Maritime Task Force. Dr. Tikka chaired the Committee for Evaluating Double Hull Tanker Design Alternatives (2001) and served as a member of the Committee on Oil Pollution Act of 1990 Implementation Review (1998) and as a member of the Special Nominating Committee on International Member Diversity (2019). Dr. Tikka holds a doctorate in Naval Architecture and Offshore Engineering, and master's degrees in Naval Architecture and Offshore Engineering from the University of California, Berkeley and Mechanical Engineering, Solid Mechanics and Naval Architecture from the University of Technology, Helsinki.

### Ed Levine

#### Vice Chair

Edwin ("Ed") Levine is recently retired from serving as the Regional Operations Supervisor – East, for the National Oceanic and Atmospheric Administration (NOAA) Office of Response and Restoration's Emergency Response Division, managing the Scientific Support Coordinators from Maine to Louisiana. Mr. Levine's expertise is in oil spill response, environmental and ecological risk assessments. He has responded to several hundred incidents at the request of federal, state and international officials, including working in Louisiana on the Deepwater Horizon oil spill and in Alaska on the Exxon Valdez oil spill. These hundreds of responses ranged from crude through refined oil, to chemicals, floatable debris, to potential radiological and biological threats, as well as to Hurricanes Katrina, Rita, Ike, and Sandy. In 1981, Mr. Levine received his MS in Marine Sciences from the University of Puerto Rico, Mayagüez, PR.

## **Akua Asa-Awuku**

### **Member**

Akua Asa-Awuku is an associate professor of chemical and environmental engineering at the University of Maryland. Her research interests include environmental aerosols and atmospheric hydrocarbon dispersal, inputs of oil with fuel emissions and ship going vessels, cloud formation and its effects on global climate change and health. Asa-Awuku is most well known for her work in trying to understand the impact that particle emissions (such as black carbon) have on cloud formation. She is the first in her field to study the parallels between cloud formation in the atmosphere and air formation and composition in human lungs. Dr. Asa-Awuku served as a Camille and Henry Dreyfus Postdoctoral Fellow at the Center for Atmospheric Particle Studies at the Carnegie Mellon University in Pittsburgh, Pennsylvania. She currently serves as member of the National Academies' Panel on Earth, Ocean, and Atmospheric Sciences. Dr. Asa-Awuku received her BS in Chemical Engineering from the Massachusetts Institute of Technology (2003), her MS and PhD in Chemical Engineering from the Georgia Institute of Technology (2008).

## **Cynthia J. Beegle-Krause**

### **Member**

Cynthia Juyne Beegle-Krause is an oceanographer at SINTEF Ocean addressing decision support questions related to oil spill response. Her current research focuses on how the next deepwater well blowout could be different than the Deepwater Horizon event and on aspects of Arctic research to improve oil spill trajectory models, understand fate of oil in and under ice, and access to data sets used in Arctic spill response. During her career, she has provided operational support for over 250 oil spills in the US and internationally, including the Deepwater Horizon oil spill, the T/V Prestige oil spill, and supported the U.S. military in the Persian (Arabian) Gulf. Dr. Beegle-Krause is a member of the International Spill Control Organization. She served as a reviewer for the 2013 National Academies report Oil in the Sea III, Inputs, Fates, and Effects. Dr. Beegle-Krause holds a PhD in physical oceanography from University of Washington, a MS in Physical Oceanography from University of Alaska Fairbanks, and a BS in biology from Caltech.

## **Victoria Broje**

### **Member**

Victoria Broje is an internationally recognized specialist with 20 years of experience in environmental science, emergency planning and response. Her dissertation was focused on mechanical recovery of oil spills and resulted in a patented technology which later won the Wendy Schmidt Oil Cleanup X-Challenge. Since 2006 Dr. Broje has been supporting Shell businesses worldwide as a Subject Matter Expert for spill response technologies and environmental impacts assessments. She also leads an Environmental Unit Network providing oil spill response training to Shell staff. Dr. Broje represents Shell at API, IOGP, CAPP and IPIECA committees developing best practices in emergency response and environmental protection. She is a Chair of the Board of the Clean Caribbean and Americas, a non-profit organization dedicated to outreach on spill response and environmental protection topics. She also chairs the API Science and Technology Working Group for oil spill prevention and response. In 2013 Dr. Broje served on NASEM Committee which produced a Letter Report "A Review of Genwest's Final Report on Effective Daily Recovery Capacity (EDRC)". She received her Master's degree in Offshore Engineering from the Saint-Petersburg State Technical University in Russia where she specialized in oil spill behavior under Arctic conditions. She received her Doctoral degree in Environmental Science and Management from the University of California Santa Barbara.

## **Dagmar Etkin**

### **Member**

Dagmar Schmidt Etkin is the owner of Environmental Research Consulting, established in 1999, specializing in data analysis, environmental risk assessment, cost analyses, and development of comprehensive databases on oil/chemical spill incidents and spill costs. Her interests include analysis of oil spill impacts, particularly in the areas of risk analysis, environmental risk assessment, spill statistics, and spill response and damage cost modeling and analysis. Dr. Etkin is a member of the UN International Maritime Organization Joint Group of Experts on the Scientific Aspects of Marine Protection as an oil spill data and analysis expert. She has provided analytical and data services to the National Academies of Sciences, Engineering, and Medicine (e.g., 2013's Oil in the Sea III, Inputs, Fates, and Effects), US Coast Guard, National Oceanic and Atmospheric Administration, Minerals Management Services, Environment Canada, and other agencies as well as industry. She holds a PhD from Harvard University in organismic and evolutionary biology and a BA in biology from University of Rochester.

## **John W. Farrington**

### **Member**

John Farrington is Dean emeritus at Woods Hole Oceanographic Institution (WHOI) with expertise in marine chemistry and geochemistry. He joined WHOI in 1971 as a postdoctoral investigator. He held successive positions in the chemistry department for 17 years and simultaneously served for six years as director of the WHOI Coastal Research Center. His research interests include: marine organic geochemistry, biogeochemistry of organic chemicals of environmental concern, and the interaction between science and policy. He has served on committees and panels for international, national, and local organizations, including the UNESCO-Intergovernmental Oceanographic Commission, the National Academies, the National Science Foundation, the Office of Naval Research, the Commonwealth of Massachusetts, and the Lloyd Center for Environmental Studies. Dr. Farrington is currently serving as a member of the Gulf of Mexico Research Initiative Research Board. He participated in seven National Academies' consensus studies, chairing three of the seven studies, and has been a member on the National Academies' Environmental Studies Board, Board on Environmental Studies and Toxicology, and the Marine Board. Dr. Farrington holds BS and MS degrees in chemistry and a PhD. in oceanography from University of Rhode Island.

## **Julia Foght**

### **Member**

Julia Foght is Professor Emerita at the University of Alberta, Canada where she was a Professor of Petroleum Microbiology in the Department of Biological Sciences from 1994 to 2014. Her expertise focuses on metagenomics of hydrocarbon-degrading microbial communities, biodegradation of petroleum hydrocarbons, fundamental studies on mechanisms of hydrocarbon transport across bacterial membranes, and the use of whole cell biocatalysts for biological upgrading of petroleum and refined products, and isolation and characterization of cold-adapted bacterial communities that live underneath glaciers. She received the Petro-Canada Young Innovators Award in 2001, a McCalla Professorship in 2011 from the University of Alberta, and in 2014 the Alberta Science & Technology Foundation (ASTech) award in Innovation in Oil Sands Research. She co-wrote a report on "The Behaviour and Environmental Impacts of Crude Oil Released into Aqueous Environments" with The Royal Society of Canada in November 2015. Dr. Foght received her PhD in Environmental Microbiology from the University of Alberta.

## **Bernard D. Goldstein**

### **Member**

Bernard D. Goldstein, M.D. (NAM), University of Pittsburgh (ret.) is Emeritus Dean and Emeritus Professor of Environmental and Occupational Health at the University of Pittsburgh Graduate School of Public Health. He is an elected member of the National Academy of Medicine (NAM), and has chaired over a dozen NAM or National Research Council Committees. He has also chaired committees related to environmental health for the World Health Organization and the United Nations Environmental Program. His past experience includes service as Assistant Administrator for Research and Development of the U.S. Environmental Protection Agency, 1983-1985, and President of the Society for Risk Analysis. His involvement in the Deepwater Horizon oil spill includes serving as an Advisory Board member of the NAS Gulf Research Program and as the original chair of the Coordinating Committee of the Gulf Research Health Outreach Program. He is also active on shale gas issues and on issues related to the science/policy interface.

## **Carys Mitchelmore**

### **Member**

Dr. Carys L. Mitchelmore is a Professor at the University of Maryland Center for Environmental Science, Chesapeake Biological Laboratory in Solomons, Maryland. Her expertise is in environmental health and toxicology and her research emphasis is on understanding the fate and effects of chemicals and other pollutants on resident organisms. Her work focuses on the detection of pollutants in various environmental matrices and understanding their uptake, routes of exposure, metabolism, mechanisms of toxicity, bioaccumulation and trophic transfer of chemical contaminants and their implications to organism health, including humans. She also carries out toxicity testing and application for risk assessment, regulation and management activities. Investigations have focused on the chemical partitioning and fate and effects of crude oils, oil spill dispersants, organic disinfection by-products and organic UV filters (components of sunscreens) in numerous invertebrate and vertebrate species, but especially sensitive and/or understudied species like corals and reptiles. Dr. Mitchelmore has served on two previous National Academies Studies: the Committee on the “Effects of Diluted Bitumen on the Environment: A Comparative Study (2016) and the Committee on “Understanding Oil Spill Dispersants: Efficacy and Effects” and was also a review coordinator for the recent 2020 Committee on “The Use of Dispersants in Marine Oil Spill Response”. Dr. Mitchelmore received her Ph.D. from the University of Birmingham (U.K.) in 1997 investigating the metabolism and effects of organic contaminants, including polycyclic aromatic hydrocarbons, to aquatic organisms.

## **Nancy N. Rabalais**

### **Member**

Nancy Rabalais is Professor and Shell Oil Endowed Chair in Oceanography and Wetland Studies at the Louisiana State University's College of the Coast and Environment. Dr. Rabalais' research includes the dynamics of hypoxic environments, interactions of large rivers with the coastal ocean, estuarine and coastal eutrophication, environmental effects of habitat alterations and contaminants, and the impacts of the Macondo oil on the Louisiana continental shelf, in coastal waters and on intertidal wetlands. Dr. Rabalais is an AAAS Fellow, an AGU Fellow, an Aldo Leopold Leadership Program Fellow, and a National Associate of the National Academies. She received the 2002 Ketchum Award for coastal research from the Woods Hole Oceanographic Institution and shares the Blasker award with R.E. Turner. She was awarded the American Society of Limnology and Oceanography Ruth Patrick Award and the National Water Research Institute Clarke Prize in summer 2008. She was named a MacArthur Fellow in 2012. Dr. Rabalais has served on thirteen National Academies committees and served as member and chair of the National Academies' Ocean Studies Board (2000-2005). Dr. Rabalais received her PhD in zoology from the University of Texas at Austin in 1983.

## **Jeffrey Short**

### **Member**

Jeffrey Short runs the consulting firm, JWS Consulting, in Alaska. Dr. Short began his career in oil pollution research in 1972, working for the National Marine Fisheries Service, NOAA on oil toxicity effects on Alaskan marine fauna prior to development of the Prudhoe Bay oil field and marine oil terminal in Valdez, Alaska. In investigating the Exxon Valdez spill, Dr. Short led numerous studies on the distribution, fate and effects of the oil over two decades; these studies led to discovery of embryotoxic effects of oil pollution affecting fish at much lower concentrations that had been recognized previously, and quantitative assessments of lingering oil stranded on beaches and of other pollution sources in the Exxon Valdez spill region. He also worked on evaluating oil dispersant effectiveness under sub-arctic conditions, and contributed to the oil budget for the Exxon Valdez spill, which provided a basis for evaluating the effectiveness of response measures. Dr. Short received his PhD in fisheries from the University of Alaska, Fairbanks in 2006, his MS in physical chemistry from the University of California, Santa Cruz, and his B.S. in biochemistry & philosophy from the University of California, Riverside.

## **Scott Socolofsky**

### **Member**

Scott Socolofsky is a Professor in the Zachry Department of Civil Engineering at Texas A&M University. His research is in the broad area of Environmental Fluid Mechanics, with emphasis on laboratory experiments and data analysis to elucidate mixing mechanisms by turbulence and coherent structures. Dr. Socolofsky's expertise includes oil spill modeling, marine natural seeps, and physical/chemical characteristics of oil. He received his PhD and MS in Civil and Environmental Engineering from Massachusetts Institute of Technology and his BS in Civil, Environmental, and Architectural Engineering from University of Colorado Boulder.

## **Berrin Tansel**

### **Member**

Berrin Tansel is a Professor of Environmental Engineering and Undergraduate Program Director for the Department of Civil and Environmental Engineering at Florida International University. She has conducted extensive research on oil-water emulsions and remediation of contaminated media (water, sediments and soil). Her research interests include land-based inputs of oils, weathering of crude and refined oils, formation and treatability of oil-water emulsions, partitioning and persistence of oil based fractions in different phases (slick, emulsion, dispersed, sediment and tar) and their mobility. Dr. Tansel is a Fellow of the American Society of Civil Engineers and Diplomate of the American Academy of Water Resources Engineers. She received her PhD in Civil and Environmental Engineering, with a Minor in Chemical Engineering, from the University of Wisconsin-Madison in 1985, an MS in Civil and Environmental Engineering from the University of Wisconsin-Madison in 1979 and a BS in Chemical Engineering from Middle East Technical University in Ankara, Turkey in 1978.

## **Helen White**

### **Member**

Helen White is an Associate Professor of Chemistry at Haverford College in Haverford, Pennsylvania. Dr. White's research interests are centered in biogeochemistry, with a focus on examining the sources, sinks, and cycling of organic matter. More specifically, she is interested in the persistence of human-derived compounds in the marine environment and how chemical structure, physical associations, and bioavailability of specific organic compounds determine their cycling and eventual fate. Before joining the Haverford faculty, she completed the Microbial Science Initiative Postdoctoral Fellowship at Harvard University. In 2015, she received the National Academies Gulf Research Program Early-Career fellowship and served as a member of the National Academies study, Committee on the Evaluation of the Use of Chemical Dispersants in Oil Spill Response (2018). Dr. White received her Ph.D. in Chemical Oceanography from the Massachusetts Institute of Technology and the Woods Hole Oceanographic Institution.

# **Michael H. Ziccardi**

## **Member**

Michael Ziccardi is the Co-Director of the Karen C. Drayer Wildlife Health Center (WHC). Dr. Ziccardi has been an oil spill response veterinarian and oiled wildlife response director during more than 50 spills nationally and internationally – most notably as the Marine Mammal and Sea Turtle Group Supervisor for NOAA during the Deepwater Horizon spill in 2010. He has worked as a Contract Veterinarian for the California Department of Fish and Game/Wildlife, a Research Epidemiologist for the Lincoln Park Zoo, and as both a Program Coordinator and Senior Wildlife Veterinarian for the WHC. Currently, in addition to being the Co-Director of the WHC, he is Director for California's Oiled Wildlife Care Network (OWCN) as well as a Health Science Clinical Professor in the Department of Medicine & Epidemiology. Dr. Ziccardi received his DVM, as well as his MS and PhD in epidemiology, from the University of California, Davis.