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IDENTIFYING OPPORTUNITIES TO UNDERSTAND, CONTROL, AND PREVENT EXPOSURE TO PFAS | September 26-27, 2019 | An Environmental Health Matters Initiative Workshop

Speakers and Panelists

Jennifer Field, Oregon State University
Jennifer Field is a Professor of Environmental and Molecular Toxicology in the College of Agricultural Sciences at Oregon State University. Her current research focuses on the development and application of quantitative analytical methods for organic micropollutants and their transformation products in natural and engineered systems. Early in her career, she focused on field-based research to investigate the fate and transport of surfactants in groundwater and wastewater treatment systems. She participated in interdisciplinary research with hydrologists and engineers to develop 'push-pull' tracer test methods for determining in-situ rates of reductive dechlorination and anaerobic biodegradation of aromatic hydrocarbons. She was a pioneer in the area of fluorochemical occurrence and behavior with a focus on groundwater contaminated by fire-fighting foams, municipal wastewater treatment systems, and municipal landfill leachates. Her current research in the area of environmental analytical chemistry focuses on the use of large-volume injections with liquid chromatography/mass spectrometry as a quantitative yet cost- and time-saving approach for the analysis of aqueous environmental samples. Applications of the large-volume injection technique include measurements of illicit drugs in municipal wastewater as an alternative indicator of community drug use, components of the Corexit oil dispersant in seawater, and newly identified fluorochemicals in groundwater and landfill leachate. Dr. Field serves as an Associate Editor for *Environmental Science and Technology* and was an editor for *Water Research* from 2004-2008. She received her PhD in Geochemistry from the Colorado School of Mines.

Exposure

Antonia Calafat, Centers for Disease Control and Prevention
Antonia Calafat is the Chief of the Organic Analytical Toxicology Branch in the Division of Laboratory Sciences of the National Center for Environmental Health of the U.S. Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia. She leads CDC's biomonitoring programs for assessing human exposure to per- and polyfluoroalkyl substances (PFAS); polybrominated diphenyl ethers; polychlorinated dibenzo-p-dioxins, furans, and biphenyls; pesticides; flame retardants; polycyclic aromatic hydrocarbons; and chemicals added to consumer and personal-care products, such as phthalates and phenols. Dr. Calafat has developed and maintained extensive collaborative research with leading scientists in the fields of exposure science, epidemiology, toxicology, and health assessment. Her research has made important contributions to biomonitoring science, including CDC's National Reports on Human Exposure to Environmental Chemicals. She received the 2019 Excellence in Exposure Science Award granted by the International Society of Exposure Science in recognition of her scientific contributions, service, and leadership to the field. Dr. Calafat earned her PhD in Chemistry from the University of the Balearic Islands, Spain. She was a Fulbright Scholar at the Department of Chemistry of Emory University where she completed her postdoctoral training.

Michael Focazio, U.S. Geological Survey
Michael Focazio is a Program Coordinator at the U.S. Geological Survey (USGS). During his early career, he worked as a scientist for water resource management related topics before going on to serve as a USGS Liaison to the U.S. Environmental Protection Agency Office of Groundwater and Drinking Water. Later in his career, Dr. Focazio worked as the Program Manager of congressional appropriations focused

on environmental health science with the Toxic Substances Hydrology Program and Contaminant Biology Program. He earned his Ph.D from the University of Connecticut.

Christopher Higgins, Colorado School of Mines
Christopher P. Higgins is an environmental chemist at the Colorado School of Mines (Mines). He joined the faculty at the Mines in 2009 and was promoted to Associate Professor in 2014 and later to Professor in 2019. He holds honorary appointments at the Colorado School of Public Health and the University of Queensland in Australia. He was a 2019 recipient of the Huber Prize in Civil Engineering Research, awarded by the American Society of Civil Engineers. His research focuses on the movement of contaminants in the environment. In particular, he studies chemical fate and transport in natural and engineered systems and bioaccumulation in and human exposure through plants and animals with a focus on poly- and perfluoroalkyl substances. Dr. Higgins has authored more than 75 peer-reviewed publications to date, and he has been an invited speaker at many national and international conferences. His research has been supported by the National Science Foundation, the National Institutes of Health, the U.S. Environmental Protection Agency, the U.S. Department of Agriculture, the U.S. Air Force, and the U.S. Department of Defense's Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP). Dr. Higgins received his AB in Chemistry from Harvard University and graduate degrees in Civil and Environmental Engineering from Stanford University.

Rainer Lohmann, The University of Rhode Island
Rainer Lohmann is Professor of Oceanography at the University of Rhode Island (URI) Graduate School of Oceanography in Narragansett. He is the Director of the URI Superfund Research Center, which focuses on sources, transport, exposure and effects of PFAS. His SRP project is developing passive samplers for the detection and bioaccumulation of PFASs in water and porewater. His group conducts research into the sources, transport, and bioaccumulation of anthropogenic pollutants often relying on the use of passive samplers. Other than PFAS, his research covers dioxins, PCBs, legacy pesticides, and emerging contaminants. Dr. Lohmann initiated a global effort to monitor organic contaminants in the waters of the world, termed AQUA-GAPS, which started field trials in 2016. He serves as Editor for *Environmental Toxicology and Chemistry* and is on the Editorial Boards for *Environmental Science and Technology*, *Environmental Pollution*, and *Environmental Science and Technology Letters*. He was awarded fellowships by the German Academic Exchange Service (2000), the Max-Planck-Society (2003), the University of Bremen (2004), the Alexander-von-Humboldt Foundation (2010), and the Hanse-WissenschaftsKolleg (2017). He was honored for his mentoring of outstanding PhD (CH2M/AEESP in 2018) and MS students (Montgomery Watson Harza/AEESP in 2011) and was awarded the Roy F. Weston Environmental Chemistry Award by SETAC (2004) and the URI Research and Scholarship Excellence Award (2019). He was trained in Chemical Engineering at the Ecole Européenne des Hautes Etudes des Industries Chimiques de Strasbourg (France) and obtained his PhD in Environmental Science from Lancaster University (UK).

Laurel Schaider, Silent Spring Institute
Laurel Schaider is a Research Scientist at Silent Spring Institute, where she leads the Institute's water quality research on highly fluorinated chemicals (PFAS) and other contaminants of emerging concern. Her research focuses on characterizing PFAS exposures from drinking water; understanding health effects associated with PFASs; identifying other sources of PFAS exposure, such as food packaging; investigating socioeconomic disparities in exposures to drinking water contaminants; and working with communities to develop research studies and resources to address their concerns. Dr. Schaider is the principal investigator for the PFAS-REACH (PFAS Research, Education, and Action for Community Health) study, a researcher-community partnership that is evaluating PFAS exposures and immune system effects in children in communities with PFAS water contamination and is developing an online resource center for PFAS-affected communities. As co-leader of the Community Engagement Core for the STEEP (Sources, Transport, Exposure and Effects of PFASs) Superfund Research Program at the University of Rhode Island, she is leading a study to evaluate PFAS concentrations in private wells on Cape Cod and identify contamination sources.

She was the lead author of two papers documenting septic systems as sources of PFASs and other emerging contaminants to public and private drinking water wells and led a critical review of removal and discharges of emerging contaminants from septic systems, which treat the wastewater of nearly one in four Americans. Before joining Silent Spring, she was a research associate at the Harvard T.H. Chan School of Public Health, where she studied heavy metal contamination and exposures in affected communities. She led an NIEHS-funded community-based research study in northeastern Oklahoma that found consumption of local fish to be a major source of mercury exposure among anglers and their families, including members of local Native American tribes. As a research fellow in the Center for Children's Environmental Health project at the Tar Creek Superfund Site in Oklahoma, she was lead author on two papers that linked metal speciation—how metals are distributed among various chemical forms—to mobility in the environment and likelihood of exposure, notably in mine waste particles small enough to be inhaled. In addition, Dr. Schaider co-authored two papers that evaluated impacts from nutrient pollution and physical disturbance on mercury methylation in the "Dead Zone" of the Gulf of Mexico.

Anthony Spaniola, Ufer, Spaniola & Frost, PC
Tony Spaniola is a Detroit-area attorney, PFAS policy advocate, and impacted citizen. He developed extensive PFAS expertise after learning that his family's lake home is located in the "zone of concern" for PFAS contamination from the former Wurtsmith Air Force Base in Oscoda, Michigan. Wurtsmith was the first identified PFAS site in Michigan and the first identified PFAS sited operated by the U.S. military anywhere in the world. Drawing on his personal, professional and policy experience, Mr. Spaniola has worked with scientists, community leaders, and government officials at all levels on various PFAS projects. He is a founding member the Need Our Water (NOW) community group in Oscoda, Michigan and a founding director of the Michigan PFAS Alliance. Partnering with state and national NGOs, he has become a leading spokesperson on PFAS issues and provided PFAS briefings to Congress, Michigan's executive branch, and state legislature. He recently published a brief history of the PFAS problem in Michigan, entitled *"PFAS and the Au Sable: Missed Opportunities and Looming Challenges"* and has served as a panelist at various forums, including the 2nd National PFAS Conference at Northeastern University, the Fate of the Earth Symposium at Michigan State University, and the Great Lakes Conference in Detroit. He previously worked on public health issues in connection with Michigan's PBB contamination crisis, in which he initiated legislation (enacted as Public Act 82 of 1984) creating the Michigan Cancer Registry. Mr. Spaniola is a founding member of the Ufer, Spaniola and Frost, P.C. law firm in Troy, Michigan. He served as a Special Assistant to the Michigan Attorney General and a legal work group advisor to the Governor's Commission on Mental Health. He holds an undergraduate degree in government from Harvard, where his studies included cancer-related policy issues, and he holds a *juris doctorate* from the University of Michigan Law School, where he served on the Michigan Law Review editorial board.

Thomas Webster, Boston University
Thomas Webster is Professor of Environmental Health at Boston University's School of Public Health. Dr. Webster's main research areas are (1) exposure routes and health hazards of chemicals used in consumer products, especially flame retardants, plasticizers, emerging compounds, and perfluoroalkyl compounds (PFCs) that are also found in water; (2) health impacts of exposure to mixtures of chemicals with applications in toxicology and epidemiology; (3) endocrine disruption; (4) methodological aspects of environmental epidemiology, particularly causal inference, ecologic bias, the use of combinations of individual and group level data, and disease mapping and clusters. Dr. Webster served on the National Academies Committee on Fluoride in Drinking Water and the Committee on Making Best Use of the Agent Orange Exposure Reconstruction Model. The work of Dr. Webster and his colleagues and students has been featured in *Environmental Health Perspectives* ("PFCs and Cholesterol: A Sticky Connection," "Unwelcome Guest: PBDEs in Indoor Dust"), *Bostonia Magazine* ("Trouble at Home," "You Are What You Eat, Including Your Sofa"), Discovery News ("Handwashing Cuts Flame Retardant Exposure") and the National Public Radio show "Living on Earth," among other places.

Treatment

Jason Dadakis, Orange County Water District
Jason Dadakis is the Executive Director of Water Quality and Technical Resources for Orange County Water District (OCWD) in Fountain Valley, California. In this role, he manages water quality monitoring, laboratory analysis, regulatory compliance, and applied research in support of OCWD's groundwater management activities and recycled water projects, including the Groundwater Replenishment System. He currently leads a PFAS Workgroup comprised of local retail water agencies and regulators. He holds a BA in Earth Sciences from Dartmouth College and an MS in Hydrology from the University of Arizona.

Rula Deeb, Geosyntec
Rula Deeb is a Senior Principal Civil and Environmental Consultant for Geosyntec and has more than 25 years of experience focused on private practice and academia addressing the cross-media fate and transport of contaminants and the remediation of complex soil and groundwater sites impacted by nonaqueous phase liquids. Following teaching assignments at Berkeley and Stanford University between 1992 and 2000, Dr. Deeb was selected as a National Science Foundation Engineering Education Scholar for Excellence in Engineering Education. Focusing on emerging contaminants in natural and treatment environments, she has led many research and demonstration efforts. Her work has promoted awareness and improved the understanding of the sources, occurrence, fate and transport, and behavior of several of the most challenging environmental contaminants to date, including per- and polyfluoroalkyl substances (PFAS), 1,4-dioxane, MTBE, perchlorate, and others. She is heavily engaged in the National Academy of Engineering's Frontiers of Engineering program, which brings together emerging engineering leaders from industry, academia, and government to discuss pioneering technical work and leading edge research in various engineering fields and industry sectors. She has served as a member of U.S. Environmental Protection Agency's Science Advisory Board Environmental Engineering Committee. In 2010, Dr. Deeb earned an Industry Recognition Award for her outstanding contribution as a member of the Interstate Technology and Regulatory Council's Remediation Risk Management team. She is the recipient of the 2008 Berkeley Engineering Innovation Young Outstanding Leader Award and was recently inducted into Berkeley's Civil and Environmental Engineering Academy of Distinguished Alumni (Class of 2019). Dr. Deeb earned her PhD in civil and environmental engineering from the University of California, Berkeley, where her research focused on substrate interactions of gasoline aromatics and oxygenates.

Detlef Knappe, North Carolina State University
Detlef Knappe is the S. James Ellen Distinguished Professor of Civil, Construction, and Environmental Engineering at NC State University, where he is also a member of the NIEHS-funded Center for Human Health and the Environment. He has taught and conducted research for the last 23 years at NC State University. Current efforts in the Knappe group focus on (1) developing and evaluating physical-chemical (and sometimes biological) treatment processes for the control of organic contaminants in drinking water and (2) overcoming gaps between the Clean Water Act and the Safe Drinking Water Act by developing information about the effects of reactive and unregulated wastewater contaminants on drinking water quality and treatment. Dr. Knappe serves on the North Carolina Secretaries' Science Advisory Board that was convened by the NC Departments of Environmental Quality and Health and Human Services. Until recently, he served on the Drinking Water Committee of the U.S. Environmental Protection Agency Science Advisory Board. He also serves as Trustee for the Water Science and Research Division of the American Water Works Association (AWWA), and he is a member of AWWA's Organic Contaminants Research Committee and Activated Carbon Standards Committee. Dr. Knappe received his PhD in Environmental Engineering from the University of Illinois at Urbana-Champaign.

Linda Lee, Purdue University
Linda S. Lee is a professor in the Purdue University Department of Agronomy, Program Head for the Ecological Sciences & Engineering Interdisciplinary Graduate Program, and a Faculty Affiliate in the Division of Environmental Ecological Engineering. Her research focuses on understanding the processes that

govern environmental fate and remediation of contaminants in various media for use in contamination mitigation, decision tools, and management guidelines in industrial and agricultural settings. Dr. Lee has more than 15 years of experience conducting PFAS research across a range of PFAS subclasses with numerous PFAS-specific publications spanning PFAS solubility, sorption, biotransformation, ecotoxicity, remediation and occurrence in soils, various aqueous matrices, water, biosolids, and biota. She has served on multiple national and international advisory groups addressing water quality issues, fair land-applied biosolid policies, and chemical risk prediction and management. Her newest advisory role is serving as a Project Advisor for the National Biosolids Data Project being led by NEBRA, NW Biosolids, CASA and Biocycle. She joined the faculty at Purdue in 1993 after completing a BS (Chemistry), MS (Environmental Engineering) and PhD (Soil chemistry & Contaminant hydrology, Soil & Water Sciences Dept.) at the University of Florida.

Andrea Leeson, SERDP and ESTCP
Andrea Leeson is the Deputy Director of the Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP) and the Program Manager for SERDP and ESTCP's Environmental Restoration program area. Dr. Leeson has been with SERDP and ESTCP since 2001. Prior to that, she was a Research Leader at Battelle Memorial Institute where she conducted scientific research on in situ bioremediation and the design and implementation of innovative biological, chemical, and physical treatment technologies for site remediation and industrial wastewater. She received her PhD in Environmental Engineering from John Hopkins University.

Kurt Pennell, Brown University
Kurt Pennell is the 250th Anniversary Professor of Engineering in the School of Engineering at Brown University. Previously, Dr. Pennell was Chair of the Department of Civil and Environmental Engineering at Tufts University, and the Bernard M. Gordon Senior Faculty Fellow in Environmental Engineering. Before moving to Tufts, Dr. Pennell was a Professor in the School of Civil and Environmental Engineering at the Georgia Institute of Technology and held an adjunct faculty appointment in the Department of Neurology at the Emory University School of Medicine. Dr. Pennell's research addresses soil and groundwater remediation, engineered nanomaterials, and environmental toxicology. His current research focuses on the remediation of per- and polyfluoroalkyl substances (PFAS), environmental exposure metabolomics, and the use of engineered nanomaterials for subsurface characterization. Dr. Pennell has published over 150 referred journal articles and book chapters, is a registered Professional Engineer, a Board Certified Environmental Engineer, a Fellow of the American Society of Civil Engineers, and a Fellow of the Association of Environmental Engineering and Science Professors. His work has received numerous awards, including the Strategic Environmental Research and Development Program (SERDP) Project of the Year in Environmental Restoration (2006, 2012).

Prevention

Mike Belliveau, Environmental Health Strategy Center
Michael Belliveau is the founder, president, and executive director of the Environmental Health Strategy Center, a nonprofit that works to create a world where all people are healthy and thriving with equal access to safe food and drinking water and to products that are toxic-free and climate friendly. As a chemical policy reformer, he played a leadership role in the passage of California's Proposition 65, Maine's Kid Safe Products Act, and the recent overhaul of the federal Toxic Substances Control Act. He co-authors the annual Retailer Report Card that marks progress on corporate chemical policies and practices, published by Safer Chemicals, Healthy Families. He coordinates the national Coalition for Safer Food Processing and Packaging, which encourages brands to phase out food-contact chemicals of concern. Mike also co-founded Biobased Maine, a trade association that promotes investment in commercial production of renewable chemicals and bioplastics made from woody biomass instead of fossil carbon from oil and

gas. He received the Frank Hatch Award for Enlightened Public Service from the John Merck Fund. Mike graduated from the Massachusetts Institute of Technology with a degree in environmental science.

Holly Davies, Washington Department of Health
Holly Davies is trained as a geneticist and now evaluates scientific studies to support chemical policy for the state health agency. She leads multi-agency working groups, with the participation of external stakeholders, to evaluate chemical usage and recommend actions to protect human health and the environment. She received her PhD in genetics from the University of Washington in 2000.

Elizabeth Harriman, TURI
Elizabeth Harriman is Deputy Director of the Toxics Use Reduction Institute (TURI) at University of Massachusetts, Lowell, and is responsible for managing the operations and technical functions of the Institute and for working with the other Massachusetts Toxics Use Reduction Act (TURA) agencies to set direction for the program. In more than 25 years working at the Institute, she has provided technical research and support services to Massachusetts companies and communities with the goal of identifying safer alternatives to toxic chemicals used in manufacturing and products. Recent technical work includes prioritization and hazard evaluation of chemicals, chemical alternatives assessment, flame retardants, and fluorinated chemicals (PFAS). Ms. Harriman has been involved with PFAS for about 3 years, assisting with TURI's Science Advisory Board as they evaluate and consider recommending the addition of selected PFAS to the TURA reportable chemical list. This work spans from researching environmental health and safety information to understanding uses, precursors, and degradation chains and strategizing how to approach the large class of chemicals to avoid regrettable substitutions. She also participates in PFAS workgroups of the Interstate Chemicals Clearinghouse and the Green Science Policy Institute. Ms. Harriman is a registered Professional Engineer (Civil/Structural) and has a BS and ME from Cornell University in civil engineering and a MS in civil engineering focused on hazardous materials management from Tufts University.

Steve Korzeniowski, Fluorocouncil, ACC
Stephen Korzeniowski was employed by DuPont/Chemours for over 37 years. His last position was as a Global Technology Manager in the fluorotechnology area. Dr. Korzeniowski has over 30 years of experience involving fluorotelomer-type surfactants, repellent coating chemistry, and the U.S. Environmental Protection Agency Stewardship Program. He is a co-author of publications on such topics as environmental sources, fate and transport, toxicology, pharmacokinetics, analytical methods, and AFFF fluorosurfactants. He has presented at various meetings and scientific conferences, including Fluoros, DIOXIN, SETAC, The Toxicology Forum, global webinars, NPFA and international firefighting foam conferences. In addition, he has given talks on fluorotechnology and product stewardship to various global regulatory bodies. Dr. Korzeniowski has served as a member and chair of the Telomer Research Program (2000-2011); member of the FluoroCouncil (2011-present) and currently chair of its Science Work Group; founding board member and chair of the Fire Fighting Foam Coalition (2001-2015) and member (2017-present); and an ITRC PFAS Team Member (2017- present). He is currently the principle of BeachEdge Consulting, LLC with clients in fluorotechnology and other industries and an adjunct professor teaching Corporate Finance at a local commonwealth campus of Penn State University. Dr. Korzeniowski received his PhD in Organic Chemistry from Penn State University, an MBA in Finance from Widener University and BA from Rutgers University.

Carla Ng, University of Pittsburgh
Carla Ng is an Assistant Professor in the Department of Civil and Environmental Engineering at the University of Pittsburgh, with a secondary appointment in Environmental and Occupational Health in the Graduate School of Public Health. The research in Dr. Ng's group focuses on the development of models for the fate of chemicals in organisms and ecosystems at the intersection of chemistry, biology and engineering. She has a particular focus on the development of mechanistic toxicokinetic models of PFAS in organisms and using protein-PFAS interactions to understand and predict their impacts across different PFAS structures and species of interest. She was recently awarded an NSF CAREER award to support her

ongoing work on PFAS with particular application to molecular modeling and drinking water treatment. Other areas of research include tracking the evolution of complex chemical mixtures in the environment and exploring the role of the industrial food system on the fate of contaminants with implications for human exposure. Dr. Ng received her PhD in Chemical & Biological Engineering from Northwestern University.

Meredith Williams, California Department of Toxic Substances Control
Meredith Williams is the Acting Director of the California Department of Toxic Substances Control (DTSC). She was selected to serve as Acting Director by California Secretary of Environmental Protection Jared Blumenfeld on January 9, 2019. Dr. Williams joined DTSC in 2013 as Deputy Director of the Department's Safer Consumer Products Program to lead the implementation of California's groundbreaking effort to reduce toxic chemicals in consumer products. She has expertise in research and development, product management, and operations for Fortune 500 companies in the technology, consumer product, and chemical sectors, including 3M and Applied Materials, a leading semiconductor manufacturer. Following her work in the private sector, Meredith held a number of leadership positions at the nonprofit San Francisco Estuary Institute, a nationally recognized center for science in support of aquatic resource management. Meredith strives for collaborative solutions to complex problems and has a track record of championing interdisciplinary project management approaches. She holds a BS from Yale University and a PhD in physics from North Carolina State University.

Workshop Planning Committee

Chair

Jonathan M. Samet, MD, MS, a pulmonary physician and epidemiologist, is Dean of the Colorado School of Public Health. Dr. Samet's research has focused on the health risks posed by inhaled pollutants. He has served on numerous committees concerned with public health: the U.S. Environmental Protection Agency Science Advisory Board; committees of the National Academies, including chairing the Biological Effects of Ionizing Radiation VI Committee, the Committee on Incorporating 21st Century Science in Risk-Based Evaluations, the Committee on Research Priorities for Airborne Particulate Matter, the Committee to Review EPA's Draft IRIS Assessment of Formaldehyde, the Committee to Review the IRIS Process, and the Board on Environmental Studies and Toxicology, among others; and the National Cancer Advisory Board. He is a member of the National Academy of Medicine. Dr. Samet received his MD from the University of Rochester, School of Medicine and Dentistry.

Members

John L. Adgate is Professor and Chair of the Department of Environmental and Occupational Health at the Colorado School of Public Health. His research on exposure science, risk analysis, and children's environmental health has focused on improving exposure estimation in epidemiologic studies by documenting the magnitude and variability of human exposures to chemical and biological stressors. His current funded research focuses on the risks, health, and community impacts of oil and gas development; the impact of heat and air pollution on the development of chronic kidney disease in Guatemalan sugarcane workers; the impact of residential weatherization and wildfires on indoor environments; and health effects stemming from perfluoroalkyl chemical (PFAS) exposure. Dr. Adgate has served on multiple science advisory panels for the U.S. Environmental Protection Agency and National Academies committees exploring technical and policy issues related to residential exposure to pesticides and air pollutants, impacts of energy development, lead-exposure interventions, children's environmental health, and the impacts of climate change on indoor air quality. He received an MSPH in environmental science from the School of Public Health of the University of North Carolina at Chapel Hill and a PhD in environmental health sciences granted jointly by the University of Medicine and Dentistry of New Jersey and Rutgers University.

Rula Deeb is a Senior Principal Civil and Environmental Consultant for Geosyntec and has more than 25 years of experience focused on private practice and academia addressing the cross-media fate and transport of contaminants and the remediation of complex soil and groundwater sites impacted by nonaqueous phase liquids. Following teaching assignments at Berkeley and Stanford University between 1992 and 2000, Dr. Deeb was selected as a National Science Foundation Engineering Education Scholar for Excellence in Engineering Education. Focusing on emerging contaminants in natural and treatment environments, she has led many research and demonstration efforts. Her work has promoted awareness and improved the understanding of the sources, occurrence, fate and transport, and behavior of several of the most challenging environmental contaminants to date, including per- and polyfluoroalkyl substances (PFAS), 1,4-dioxane, MTBE, perchlorate, and others. She is heavily engaged in the National Academy of Engineering's Frontiers of Engineering program, which brings together emerging engineering leaders from industry, academia, and government to discuss pioneering technical work and leading edge research in various engineering fields and industry sectors. She has served as a member of U.S. Environmental Protection Agency's Science Advisory Board Environmental Engineering Committee. In 2010, Dr. Deeb earned an Industry Recognition Award for her outstanding contribution as a member of the Interstate Technology and Regulatory Council's Remediation Risk Management team. She is the recipient of the 2008

Berkeley Engineering Innovation Young Outstanding Leader Award and was recently inducted into Berkeley's Civil and Environmental Engineering Academy of Distinguished Alumni (Class of 2019). Dr. Deeb earned her PhD in civil and environmental engineering from the University of California, Berkeley, where her research focused on substrate interactions of gasoline aromatics and oxygenates.

Elizabeth Harriman is Deputy Director of the Toxics Use Reduction Institute (TURI) at University of Massachusetts, Lowell, and is responsible for managing the operations and technical functions of the Institute and for working with the other Massachusetts Toxics Use Reduction Act (TURA) agencies to set direction for the program. In more than 25 years working at the Institute, she has provided technical research and support services to Massachusetts companies and communities with the goal of identifying safer alternatives to toxic chemicals used in manufacturing and products. Recent technical work includes prioritization and hazard evaluation of chemicals, chemical alternatives assessment, flame retardants, and fluorinated chemicals (PFAS). Ms. Harriman has been involved with PFAS for about 3 years, assisting with TURI's Science Advisory Board as they evaluate and consider recommending the addition of selected PFAS to the TURA reportable chemical list. This work spans from researching environmental health and safety information to understanding uses, precursors, and degradation chains and strategizing how to approach the large class of chemicals to avoid regrettable substitutions. She also participates in PFAS workgroups of the Interstate Chemicals Clearinghouse and the Green Science Policy Institute. Ms. Harriman is a registered Professional Engineer (Civil/Structural) and has a BS and ME from Cornell University in civil engineering and a MS in civil engineering focused on hazardous materials management from Tufts University.

Philip R.S. Johnson is Director of The Heinz Endowments' Environment & Health Program, which is part of the foundation's sustainability team and focuses on clean economy and environmental and public health goals. He currently manages a grants portfolio and community initiatives that focus on environmental systems (including air and water), public health, susceptible populations and at-risk communities, energy impacts and alternative energy, green infrastructure, community resilience, and climate change. Before joining the Endowments, Dr. Johnson worked for government agencies and nonprofits in fisheries and ecological restoration, public health, and environmental science. He is chair emeritus of the Health & Environmental Funders Network and serves on the board of Environmental Grantmakers Association. Dr. Johnson received his MPH in environmental health, MS in environmental science, and PhD in risk analysis and management from Yale University.

Patricia L. Mabry is an interdisciplinary scientist who specializes in using nonexperimental methods aimed at understanding whole systems (e.g., network science, modeling and simulation, deep learning) to address health research questions with behavioral and social underpinnings. Dr. Mabry is a Core Research Investigator at the nonprofit, HealthPartners Institute. Her current research areas include developing simulation models to improve decision making in tobacco control policy and colorectal cancer screening, understanding career trajectories in the biomedical research workforce through deep learning and social network analysis, and developing a dental-practice-based behavioral intervention to improve HPV vaccination rates in children. She is also a Co-Project Director on a federally funded project to develop a cloud-based platform for sharing public and proprietary data and research resources. Previously, Dr. Mabry was the Executive Director of the Indiana University Network Science Institute, where she supported a variety of interdisciplinary network science-focused research projects. She also spent over a decade working at the National Institutes of Health (NIH) where she founded the first systems science program out of the NIH Office of Behavioral and Social Sciences Research. Dr. Mabry's has published in peer reviewed journals, such as *Science*, *The Lancet*, *PLoS Computational Biology*, *Nicotine and Tobacco Research*, the *American Journal of Public Health*, and she has delivered nearly 160 presentations, including six conference

keynotes and five invited presentations to the National Academies. She has served as Guest Editor of several journal issues, contributed to the Surgeon General's Report, co-founded and co-directed the Envision obesity modeling network, chaired the 3rd International Meeting on Social Computing Behavioral Modeling and Prediction, chaired the federal interagency Tobacco Policy Modeling Meeting in 2014, and mentored AAAS Fellows and junior faculty. Her work has been recognized through teaching awards, election to Fellow of the Society of Behavioral Medicine, awards for federal service, the Applied Systems Thinking Award, and federal grant funding.

Elsie Sunderland is an environmental chemist and the Gordon McKay Professor of Environmental Chemistry at Harvard University with expertise in the fate and transport of contaminants, human exposure modeling, and risk analysis. She holds faculty appointments in the Harvard John A. Paulson School of Engineering and Applied Sciences, the Harvard T.H. Chan School of Public Health, and the Department of Earth and Planetary Sciences. She is a faculty associate in the Harvard University Center for the Environment and the Harvard Center for Risk Analysis. Her research group focuses on how releases of persistent environmental contaminants are transformed by the physical environment and biological processes and how this affects human exposures and risk of adverse health outcomes. Before joining the faculty at Harvard, she spent 5 years working to inform environmental policy decisions with best-available science at the U.S. Environmental Protection Agency (EPA) in various offices. Her work at EPA included regulatory impact assessments and development of guidance on how best to use environmental models to inform regulatory decisions. In 2010, she was the lead author of a chapter on human and ecological health concerns associated with hemispheric transport of air pollution as part of the United Nations Convention on Long Range Transport of Air Pollution. She worked closely with the EPA delegation informing the U.S. position on UNEP's development of the first global treaty regulating anthropogenic mercury releases to the environment in 2013 and is now an ad hoc expert on the technical group working on effectiveness evaluation. Her recent work has focused on characterizing diverse exposure sources for per- and polyfluoroalkyl substances (PFASs), including drinking water and seafood, and developing chemometric indicators for source attribution. Her group has developed and applied physiologically based toxicokinetic models for a variety of pollutants to interpret exposure data and evaluate the importance of different sources for diverse human populations. She is a project leader for an NIH funded Superfund Center on Sources, Transport, Exposure, and Effects of PFASs led by the University of Rhode Island. Dr. Sunderland has received EPA's Highest Level Scientific and Technological Achievement Award, the EPA Gold Medal for Exceptional Service, the Smith Family Foundation Award for excellence in biomedical research, and the Harvard Star Family Award for promising scientific research. She is a member of the advisory board for several journals, including *Environmental Science and Technology* and *Environmental Science Processes and Impacts*. Dr. Sunderland received a PhD in environmental toxicology from Simon Fraser University.