

The National  
Academies of

SCIENCES  
ENGINEERING  
MEDICINE

Workshop on

# ENVIRONMENTAL LEGACIES AND WATER CONSIDERATIONS

RELATED TO OIL AND GAS PRODUCTION

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MIDLAND, TEXAS

# PARTICIPANT PACKET

MAY 14, 2019



# TABLE OF CONTENTS



AGENDA	5
ROUNDTABLE ROSTER	7
ROUNDTABLE BIOGRAPHIES	9
WORKSHOP PARTICIPANT BIOGRAPHIES	18



Workshop on

# ENVIRONMENTAL LEGACIES AND WATER CONSIDERATIONS

RELATED TO OIL AND GAS PRODUCTION

The National  
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ENGINEERING  
MEDICINE

MAY 14, 2019 | AUDITORIUM

Petroleum Museum, Midland, TX

AGENDA

8:30 AM Doors Open / Registration

Continental Breakfast Available

9:30 AM Welcome, Introductions, and Objectives

**David Dzombak and  
Wendy Harrison**  
Roundtable co-chairs  
Carnegie Mellon University and  
Colorado School of Mines

## ENVIRONMENTAL LEGACIES

Moderated by: Marilu Hastings  
The Cynthia and George Mitchell Foundation

9:45 AM Environmental Legacy Video

9:55 AM Keynote: "Environmental Legacy Issues"

**Danny Reible**  
Texas Tech University

10:15 AM Environmental Legacy Panel

- Site planning (pre-development)
- Site restoration related to wells and surrounding environment
- Surface disturbances and considerations
- Challenge of orphaned/abandoned wells
- Evolution of regulation and bonding

**Melinda Taylor**  
University of Texas

**Joseph Fitzsimons**  
Uhl, Fitzsimons, Jewett, Burton  
& Wolff, PLLC

**Bo Vizcaino**  
Texas Railroad Commission

11:30 AM MUSEUM BREAK—Chance to tour museum

12:00 PM LUNCH

## WATER SOURCING AND PRODUCED WATER MANAGEMENT

Moderated by: Wendy Harrison  
Colorado School of Mines

1:00 PM Produced Water Video

1:10 PM Keynote: "Produced Water"

**Bridget Scanlon**  
Bureau of Economic Geology

<b>1:30 PM</b>	<b>Produced Water Panel</b> <ul style="list-style-type: none"> <li>Water sources</li> <li>Produced water quality and quantity</li> <li>Produced water management including treatment technologies, disposal well capacity, potential beneficial uses, induced seismicity</li> </ul>	<p><b>Nichole Saunders</b> <i>Environmental Defense Fund</i></p> <p><b>Rick McCurdy</b> <i>Chesapeake Energy Corporation</i></p> <p><b>Robert Bruant</b> <i>B3</i></p> <p><b>Aaron Velasco</b> <i>University of Texas El Paso/Texas Railroad Commission</i></p>
<b>3:00 PM</b>	<b>BREAK</b>	
<b>PLENARY SESSION</b>		
<b>3:15 PM</b>	<b>Plenary Discussion with Q&amp;A</b>	<b>Moderators from Roundtable</b>
<b>3:55 PM</b>	<b>Closing remarks</b>	<b>David Dzombak, Wendy Harrison</b>

4:00-5:00 PM

RECEPTION

## ROUNDTABLE ROSTER

**David A. Dzombak, NAE, Co-Chair**

Hamerschlag University Professor and  
Department Head  
Department of Civil and Environmental  
Engineering  
Carnegie Mellon University

**Wendy J. Harrison, Co-Chair**

Professor of Geology and Geological  
Engineering  
Department of Geology and Geological  
Engineering  
Colorado School of Mines

**Melissa Batum**

Senior Program Analyst  
Bureau of Ocean Energy Management  
U.S. Department of the Interior  
Division of Environmental Assessment

**Susan L. Brantley, NAS**

Distinguished Professor and Director  
Earth and Environmental Systems Institute  
The Pennsylvania State University

**David Cole**

Professor  
The Ohio State University

**David Curtiss**

Executive Director  
American Association of Petroleum Geologists

**L. David Glatt**

Section Chief, Environmental Health  
North Dakota Department of Health and  
Co-Chair, Environmental Council of the States'  
Shale Gas Caucus

**Julia Hobson Haggerty**

Assistant Professor  
Department of Earth Sciences  
Montana State University

**Steven P. Hamburg**

Chief Scientist  
Environmental Defense Fund  
Marilu Hastings  
Vice President, Sustainability Program  
The Cynthia and George Mitchell Foundation

**Joe Lima**

Director, Environmental Sustainability  
Schlumberger Services, Inc.

**Jan Mares**

Senior Policy Advisor  
Resources for the Future

**Elena S. Melchert**

Director  
Office of Fossil Energy  
Department of Energy

**Evan S. Michelson**

Program Officer  
Alfred P. Sloan Foundation

**Kris J. Nygaard**

Senior Stimulation Consultant  
ExxonMobil Upstream Research Co.

**Amy Pickle**

Director, State Policy Program  
Nicholas Institute for Environmental Policy  
Solutions  
Duke University

**Walter Guidroz**

Associate Director  
U.S. Geological Survey

**Craig Simmons**

Distinguished Professor and Chair  
Flinders University

**Berry H. (Nick) Tew, Jr.**

Alabama State Geologist and Oil and Gas  
Supervisor  
Geological Survey of Alabama/State Oil and  
Gas Board and  
Official Representative, Interstate Oil and Gas  
Compact Commission and Groundwater  
Protection Council

**Scott W. Tinker**

Director and State Geologist  
Bureau of Economic Geology  
Professor and Allday endowed Chair  
Jackson School of Geosciences, UT Austin  
Association of American State Geologists,  
official representative and past-president  
American Association of Petroleum Geologists,  
past president  
American Geosciences Institute, president

**Sandra Wiegand**

Petroleum Engineer  
Bureau of Safety and Environmental  
Enforcement  
Department of the Interior

**STAFF MEMBERS AT WORKSHOP****Elizabeth Eide**

Senior Board Director  
Board on Earth Sciences and Resources  
Water Science and Technology Board

**Elizabeth Boyle**

Program Officer  
Board on Population Health and Public Health  
Practice

**Eric Edkin**

Program Coordinator  
Board on Earth Sciences and Resources  
Water Science and Technology Board

**Michael Hudson**

Senior Program Assistant / Research Assistant  
Board on Atmospheric Sciences and Climate



## ROUNDTABLE BIOGRAPHIES

### CO-CHAIRS

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**DAVID A. DZOMBAK** NAE, is the Hamerschlag University Professor and Head of Civil and Environmental Engineering at Carnegie Mellon University. He conducts research in water quality engineering and science on topics pertaining to water resource sustainability and the water-energy nexus. Dr. Dzombak is a member of the National Academy of Engineering, a registered professional engineer in Pennsylvania, a Board Certified Environmental Engineer, a Diplomate Water Resources Engineer, and a fellow of the American Society of Civil Engineers and Water Environment Federation. He has served on a number of WSTB committees, including service as chair of the Committee on Mississippi River Water Quality and the Clean Water Act, the Committee on Mississippi River Water Quality and Interstate Collaboration, and the Committee on the U.S. Army Corps of Engineers Water Resources Science, Engineering, and Planning. He served on the U.S. EPA Science Advisory Board from 2002-2016, and on the Science Advisory Board of the U.S. DOD Strategic Environmental Research and Development Program from 2013-2016. Dr. Dzombak holds a BA degree in mathematics from Saint Vincent College, B.S. and M.S. degrees in civil engineering from Carnegie Mellon University, and a Ph.D. degree in civil engineering from the Massachusetts Institute of Technology.

**WENDY J. HARRISON** is professor of geology and geological engineering at Colorado School of Mines (CSM). Her fields of scholarly expertise are in geochemistry and hydrology as well as geoscience education. She has published papers in topics that range from impact shock metamorphism in lunar materials, the formation of gas hydrates and their role in CO<sub>2</sub> sequestration, metals uptake by trees in mined lands, and mitigating respiratory quartz dust hazard. During her career in academia at CSM, she has served as President of the Faculty Senate, Director of the McBride Honors Program in Public Affairs for Engineers, Associate Provost and Dean of Undergraduate Studies and Faculty, and Faculty Trustee of the CSM Board of Trustees. Dr. Harrison recently completed an appointment at the National Science Foundation as Division Director for Earth Sciences in the Geosciences Directorate. She currently serves as an advisor to the Petroleum Institute, Abu Dhabi and Nazarbayev University, Kazakhstan, in the foundation of in-country educational and research programs in earth resources. Dr. Harrison is a member of the Kazakhstan-U.S. Joint Commission on Scientific and Technological Cooperation. She received her B.Sc. and Ph.D. in geology from the University of Manchester, United Kingdom. Dr. Harrison held a pre-doctoral fellowship at The Geophysical Laboratory of the Carnegie Institution of Washington and a National Research Council research fellowship at NASA-Johnson Space Center. Her work experience includes 8 years as a senior research geologist for Exxon Production Research Company in Houston, Texas.

## MEMBERS

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**MELISSA BATUM** is a senior program analyst and technical subject-matter expert for the Department of the Interior (DOI) Bureau of Ocean Energy Management (BOEM). As a Senior Analyst she manages complex program issues and initiatives, drives strategic planning, and influences policy decisions and procedure development. With her education in geology, she serves as the BOEM principal representative for policy and technical issues regarding sub-seabed CO<sub>2</sub> use and sequestration on the Outer Continental Shelf (OCS). She is a liaison for and within the Department and Bureau and works collaboratively across other federal agencies, state and local governments, foreign governments, and international groups. She also works on policy and technical issues regarding hydraulic fracturing on the OCS. She received her B.S. in geology from the University of Alabama at Birmingham and her M.S. in geology from Texas Tech University. She is also a Licensed Professional Geologist (P.G.) in the Commonwealth of Virginia

**SUSAN L. BRANTLEY** is Distinguished Professor of Geosciences in the College of Earth and Mineral Sciences at Pennsylvania State University where she is also the director of the Earth and Environmental Systems Institute. She has been on the faculty at Penn State since 1986. Dr. Brantley's career as a geochemist focuses on the chemistry of natural waters both at the surface of the earth and deeper in the crust. Dr. Brantley and her research group investigate chemical, biological, and physical processes associated with the circulation of aqueous fluids in shallow hydrogeologic settings. She has published more than 160 refereed journal articles and 15 book chapters. Professor Brantley is a fellow of the American Geophysical Union (AGU), the Geological Society of America (GSA), the Geochemical Society, the European Association of Geochemistry, and the International Association for GeoChemistry. She was president of the Geochemical Society from 2006 to 2008. Professor Brantley was awarded the Arthur L. Day Medal from the GSA in 2011, the Presidential Award from the Soil Science Society of America in 2012, and an honorary doctorate from the Paul Sabatier University (Toulouse III, France) in 2012. Dr. Brantley was appointed to the U.S. Nuclear Waste Technical Review Board on September 21, 2012, by President Barack Obama. Also in 2012, she was elected to membership in the National Academy of Sciences. Dr. Brantley received her A.B. in chemistry (1980) and her M.A. and Ph.D. in geological and geophysical sciences in 1983 and 1987, respectively, all from Princeton University.

**DAVID R. COLE** is a professor at The Ohio State University (OSU). His research interests span a number of sub-disciplines in the geosciences and chemistry, and includes both low temperature and high temperature studies. His work has focused on six fundamental challenge areas in the Earth Sciences: a) reaction mechanisms, rates and transport processes of elements and isotopes in minerals, glasses and melts; b) quantifying the spatial and temporal evolution of natural water-rock systems; c) chemical, mineralogical and isotopic behavior during biomineralization; d) use of isotopic and mineralogical proxies to reconstruct past climates; e) CO<sub>2</sub> sequestration in geologic formations; and f) development of nanoporosity and the molecular-level behavior of fluids in nanopores. He employs microscopy, spectroscopy, mass spectrometry and neutron scattering tools in

concert with numerical models to quantify complex fluid-gas-matrix interactions. He has applied these tools to quantifying geochemical processes associated with CO<sub>2</sub> storage, oil and gas generation and migration, geothermal exploitation, and ore deposition. He has published over 150 journal articles, book chapters and proceedings papers. He has served as an Associate Editor of *Geochimica et Cosmochimica Acta* and the *American Mineralogist*. He was co-organizer of the 2010 Goldschmidt Conference held in Knoxville, Tennessee in 2010. He is Director of the OSU Subsurface Energy Materials Characterization and Analysis Laboratory (SEMCAL) and Chair of the Deep Energy Community of the Sloan Foundation funded Deep Carbon Observatory. He is a Fellow of the Mineralogical Society of America. Dr. Cole earned his B.S. from The State University of New York and his M.Sc. and Ph.D. in geochemistry and mineralogy from The Pennsylvania State University.

**L. DAVID GLATT** is the section chief for the environmental health section of the North Dakota Department of Health. Over a career spanning more than 30 years with the Department, David has worked within the Division of Water Quality, and as division director for the Division of Chemistry and Division of Waste Management. His extensive experience includes regulatory compliance issues for the Safe Drinking Water Act, groundwater protection, and the North Dakota Arsenic Trioxide Superfund Project. He is the state representative for North Dakota in the Environmental Council of the States (ECOS), a national non-profit, non-partisan association of state and territorial environmental agency leaders. The purpose of ECOS is to improve the capability of state environmental agencies and their leaders to protect and improve human health and the environment. David is also a board member of the North Dakota Water Well Contractors Board and the Red River Basin Commission, and serves as the state representative for the International Souris River Basin Commission. He received his B.S. in biology and his M.S. in environmental engineering from North Dakota State University.

**JULIA HOBSON HAGGERTY** is an assistant professor of geography in Montana State University's Earth Science Department and holds a joint appointment with the Montana Institute on Ecosystems. Haggerty's research focuses on interactions between natural resource use and the social and economic well being of rural communities. Her specific research interests include underserved and tribal communities, metrics and theories of community resilience, participatory research, and longitudinal impact assessment. Haggerty currently directs "Escaping the Resource Curse," a multi-institutional research project funded by the U.S. Department of Agriculture to assess local costs and benefits of unconventional oil and gas development in the Bakken, Powder River Basin, and Marcellus shale regions. She is co-Director of energyimpacts.org, an NSF-funded Research Coordination Network focused on cross-disciplinary social science research on energy development. Prior to joining Montana State University in 2013, Haggerty worked for five years as a policy analyst for the regional non-profit research group Headwaters Economics. There she gained extensive experience working directly with decision-makers in local, state and regional contexts. Haggerty is a native of Boston and a graduate of Colorado College. She received her Ph.D. in history from the University of Colorado-Boulder in 2004 and was a post-doctoral fellow at the Centre for the Study of Agriculture, Food and Environment at the University of Otago (New Zealand) from 2005-2007.

**STEVEN P. HAMBURG** is chief scientist at the Environmental Defense Fund (EDF). In this role, he works to ensure that EDF's advocacy is based on the best available science. He is currently coordinating 16 studies on methane emissions from along the natural gas supply chain. Prior to joining EDF he spent 25 years on the faculty of Brown University and the University of Kansas, published extensively on biogeochemistry, climate change impacts on forests and carbon accounting, and served as a lead author for the Intergovernmental Panel on Climate Change. He currently co-chairs the Solar Radiation Management Governance Initiative (joint project of Royal Society, The World Academy of Sciences, EDF) and serves on the Hubbard Brook Research Foundation, U.S. Environmental Protection Agency's Science Advisory Board, the National Academies of Sciences, Engineering, and Medicine's Board on Environmental Science and Toxicology as well as many university/government advisory bodies.

**MARILU HASTINGS** is vice president of Sustainability Programs for the Cynthia and George Mitchell Foundation in Austin, Texas where she leads all of the foundation's strategic grantmaking programs. Current programs include clean energy, natural gas sustainability, water, and sustainability science. She has a 25-year career specializing in the interaction of science, public policy, and philanthropic investment as they relate to environmental decision making. Ms. Hastings convenes high-profile, collaborative efforts to promote Texas's transition to sustainability, including initiatives to modernize its oil and gas regulations, address ongoing drought, and adopt clean energy policies. She is also a sought-after strategic and organizational development advisor to nonprofit organizations, foundations, and academic organizations. Ms. Hastings leads a number of national efforts with other prominent U.S. foundations to develop environmental grantmaking strategies, define program evaluation protocol, and co-convene conferences and workshops on key issues related to water, natural gas, clean energy, and sustainability science. Prior to moving to the foundation, she held leadership positions from 1996 to 2008 at the Houston Advanced Research Center, a non-profit research organization founded by George P. Mitchell. Her work focused on enhancing the integration of social sciences into environmental decision-making. She analyzed the dynamics of environmental decision-making within the oil and gas industry, especially in sensitive and remote environments. Ms. Hastings is a member of the Roundtable on Science and Technology for Sustainability at the National Academy of Sciences; member of the Board of Visitors at the Bureau of Economic Geology at the University of Texas at Austin; member of the Energy Institute Advisory Board of the University of Texas at Austin; member of the Science Advisory Board of the Environmental Law and Policy Center in Chicago; a trustee of the Regional Endowment for Sustainability Science; and a stakeholder advisor to the Southern Climate Impacts Planning Program, a Regional Integrated Science Assessment Team of the National Oceanic and Atmospheric Administration. Ms. Hastings is a Fellow of the Houston Advanced Research Center. She earned a B.A. in economics and political science from Duke University, her M.B.A. from the University of Texas at Austin, and her M.P.A. from the University of Texas at Austin.

**JOE LIMA** is the Global Environmental Solutions Manager and Director of Environmental Sustainability for Schlumberger Services, Inc. Before this role, Mr. Lima served as the Unconventional Resources Theme Manager for North America where he was responsible for directing technology development and application throughout the region specifically for shale and tight gas environments. From 2004 through 2008 he was the Oilfield Services Marketing Manager for the western United States, developing strategic growth plans for Schlumberger as well as managing the sales organization and executive level client relationships. Previously, he was the Business Development Manager for Schlumberger's multistage hydraulic fracturing technologies. Mr. Lima also served in various management roles for Well Services facilities throughout the United States hydraulic fracturing markets including the San Juan, Anadarko and Arkoma Basins. He spent four years as an in-house completions engineer for various Schlumberger clients and has served on the Boards of Colorado Oil and Gas Association, Interstate Petroleum Association of Mountain States and California Independent Petroleum Association. He holds a B.S. in petroleum engineering from Marietta College, Marietta, Ohio.

**JAN MARES** is a senior policy advisor at Resources for the Future. He was previously a business liaison and deputy director at the Private Sector Office of the Department of Homeland Security (DHS). During the Reagan administration, Mares was an assistant secretary of commerce for import administration and a senior policy analyst at the White House, where he was involved with environment, energy, trade, and technology issues. He also served as assistant secretary of energy for international affairs and energy emergencies; assistant secretary of energy for policy, safety and environment; and assistant secretary of energy for fossil energy. For six months, he was the acting under secretary of energy. Before entering federal service, Mares was with Union Carbide Corporation for 18 years, half in the Law Department, working on antitrust compliance and purchasing issues, and half in its chemical business, including leading an effort for three years to create a chemicals joint venture with a Middle East government company and being the operations/profit manager for several groups of industrial chemicals. Subsequent to his service in the Reagan administration, he worked with the Washington, DC, law firm Shaw Pittman, the Synthetic Organic Chemical Manufacturers Association, and the EOP Group (a Washington, DC, environment, energy, and budget consulting firm). He received his B.A. in chemistry from Harvard College, his M.S. in chemical engineering from the Massachusetts Institute of Technology, and his LL.B. from Harvard Law School.

**ELENA S. MELCHERT** is director for the Upstream Oil and Gas Research Division at the Department of Energy. She was a Program Manager at Department of Energy Headquarters from 1990 - 2013, and led the development of several DOE technology research plans and research programs including: Advanced Drilling, Completion and Stimulation Research Program Plan, and the Offshore Technology Roadmap. Starting in 1985, she was a production engineer at the Department of Energy's commercial oilfield, producing oil and natural gas for 4 years, after spending 5 years in field operations for Getty Oil/Texaco, all in California. From 1995 through 2000, she served as the Department of Energy's US Coordinator for Natural Gas in the Western Hemisphere under the President's Summit of

the Americas/Western Hemispheric Energy Initiative. In 2001, she served as a member of the Senior Professional Staff for oil and gas technology at the Executive Office of the President of the United States/National Energy Policy Development Group, and provided subject matter expertise for the President's National Energy Policy. In 2010, she served as the Committee Manager for the President's National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling where she also served as the Designated Federal Officer for several of the Commission's Subcommittees, and at times for meetings of the full Commission. In 2011, she supported the Shale Gas Subcommittee, Secretary of Energy Advisory Board. In 2012, she served as a Subject Matter Expert on the Spill Prevention Subcommittee of the Department of the Interior's Ocean Energy Safety Advisory Committee. In 2014, she led the development of the "fuels" section of the Department's Quadrennial Technology Review. Ms. Melchert received her B.S. in soil science at California Polytechnic State University, San Luis Obispo and her M.Sc in petroleum engineering from the University of Southern California in Los Angeles. She earned an Executive Certificate in international business at Georgetown University and is a graduate of the Federal Executive Institute.

**EVAN S. MICHELSON** is a program officer, Energy and Science at the Alfred P. Sloan Foundation. Dr. Michelson is responsible for overseeing strategy development and grant-making in support of original, high-quality research on the economic, technological, and environmental consequences of energy production and consumption. He also manages grantmaking associated with the Sloan Digital Sky Survey (IV) focused on advancing understanding of the evolutionary history of the universe as well as providing support for basic research in the natural sciences across a diverse array of disciplines. Dr. Michelson has experience designing trend monitoring, horizon scanning, and strategic foresight processes in the social sector. Previously, Dr. Michelson was Director at the Markle Foundation, overseeing research activities and the systemic collection, analysis, and dissemination of forward-looking information covering a wide range of technology, economic, and policy issues. Dr. Michelson was an associate director at the Rockefeller Foundation, where he co-created and implemented a global network of horizon scanning organizations and guided the Foundation's early stage idea generation efforts. Dr. Michelson served as a research associate for the Project on Emerging Nanotechnologies at the Woodrow Wilson International Center for Scholars and has worked as a visiting researcher in the Korea Science and Engineering Foundation. He also developed public science and technology outreach and education programs as a Mirzayan Science and Technology Policy Graduate Fellow at the National Academy of Sciences. Dr. Michelson has published a range of articles and book chapters in journals and collections such as *Review of Policy Research*, *International Journal of Foresight and Innovation Policy*, *Public Administration Review*, *Science and Public Policy*, *Development*, *Journal of Industrial Ecology*, *Technology in Society*, and *The Innovation Imperative*. Dr. Michelson is a term member of the Council on Foreign Relations. He received his Ph.D. at the Robert F. Wagner Graduate School of Public Service at New York University. He also received a M.A. in international science and technology policy from The George Washington University, a M.A. in the philosophical foundations of physics from Columbia University, and a B.A. in philosophy of science from Brown University.

**KRIS J. NYGAARD** is Senior Stimulation Consultant, ExxonMobil Upstream Research Co. In his Senior Technical Professional role, Kris is the Corporation's recognized expert on hydraulic fracturing and related well construction technologies. Kris advises the research and development program at ExxonMobil's Upstream Research Company and works with ExxonMobil's business units on technology strategy, deployment, and applications. He began his career at Exxon Production Research in 1992 following a post-doctoral research and teaching assignment at the University of Arizona. During his 23 years with ExxonMobil, he has held technical and management positions in the areas of drilling, subsurface engineering, well completions, and unconventional resources. In 2010, he was assigned to lead the Upstream Fracturing Center of Excellence, coordinating ExxonMobil's worldwide hydraulic fracturing resources and fracturing related technical interfaces. During the last 3 years he has also led ExxonMobil's efforts to address risks of induced seismicity, serves as chair of the American Petroleum Institute's induced seismicity workgroup, and is currently a technical advisor to several oil and gas regulators in the United States (via the StatesFirst initiative). In addition, he has served as consultant to U.S. Environmental Protection Agency related to studies associated with hydraulic fracturing and underground injection. He is a member of the Society of Petroleum Engineers, American Society of Mechanical Engineers, and the Seismological Society of America. He holds a B.S. in mechanical engineering, an M.S. in aerospace engineering, and a Ph.D. in mechanical engineering all from the University of Arizona.

**AMY PICKLE** directs the State Policy Program at Duke University's Nicholas Institute for Environmental Policy Solutions. She focuses on state and local roles in developing energy resources; state energy planning; the interaction among federal, state, and local water management policies; the role of water utilities in green infrastructure implementation; and local governments' efforts to adapt to climate change and improve urban sustainability. Her research interests include governance of unconventional oil and gas exploration and development; water resources management; state administrative law; energy law and climate adaptation law. Ms. Pickle has served on the North Carolina Ecological Flows Science Advisory Board, which was tasked with reviewing the current science on ecological impacts associated with reduction of surface water flows. She has also served on the North Carolina Environmental Management Commission, which is the state's primary air and water resource regulatory commission, and the North Carolina Mining and Energy Commission (MEC). As vice-chair of the MEC and chair of the Rules Committee, Ms. Pickle played a critical role in developing North Carolina's rules for unconventional oil and gas exploration and development. She holds a J.D. from the University of North Carolina at Chapel Hill, a B.A. in English and chemistry from the University of Florida.

**CRAIG SIMMONS** is Matthew Flinders Distinguished Professor of Hydrogeology and Schultz Chair in the Environment at Flinders University, Adelaide, South Australia. He is a leading groundwater scientist, recognized for major national and international contributions to groundwater science, education and policy reform. As Director of the National Centre for Groundwater Research and Training, he is one of Australia's foremost groundwater academics and has been a significant contributor to global advances in the science

of hydrogeology for many years. He is a Fellow of the Australian Academy of Technological Sciences and Engineering and is a member of the Statutory Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC). Professor Simmons' work has been recognized by numerous national and international research and teaching awards including the Anton Hales Medal for outstanding contributions to research in the Earth Sciences by the Australian Academy of Science. He was named the 2015 South Australian Scientist of the Year. Professor Simmons has served as an Editor and Associate Editor for numerous major international journals including *Water Resources Research*, *Journal of Hydrology*, *Hydrogeology Journal*, *Groundwater*, *Environmental Modeling and Assessment* and *Vadose Zone Journal*. He received his B.E. in Electrical and Electronic Engineering from the University of Adelaide, his B.Sc. double major in theoretical and experimental physics from the University of Adelaide, and his Ph.D. in hydrogeology from Flinders University/CSIRO.

**BERRY (NICK) TEW, JR.** is Alabama's State Geologist and Oil and Gas Supervisor. In these capacities, he directs the Geological Survey of Alabama (GSA) and the staff of the State Oil and Gas Board (OGB) of Alabama. He also serves as an Adjunct Professor in the Department of Geological Sciences at the University of Alabama. Nick has been with GSA and OGB for over 30 years and has served in his present capacity since 2002. Dr. Tew has extensive knowledge of Alabama's surface and subsurface geology and the state's rich endowment of geologically related natural resources and has published extensively on the geology of the state and region. He is an expert in Gulf Coastal Plain stratigraphy, petroleum geology, and the regulation of oil and gas operations and is a frequent speaker on these and other topics, nationally and internationally. Dr. Tew has served as President of the American Geosciences Institute, a federation of organizations representing approximately 250,000 geoscientists worldwide, and is on the Executive Board of the Council of Scientific Society Presidents. He has previously served as President of the Association of American State Geologists, Vice-Chairman of the Interstate Oil and Gas Compact Commission, and Chairman of the U.S. Department of the Interior Outer Continental Shelf Policy Committee. He also serves on the Board of Directors of the Groundwater Protection Council and is member of the National Petroleum Council and the National Ocean Council Governance Coordinating Committee, in addition to many other geoscientific and service activities. Dr. Tew is a Fellow in the Geological Society of America and was awarded the 2013 E.W. Marland Award by the Interstate Oil and Gas Compact Commission. Recently, Alabama Governor Robert Bentley appointed Tew as Chairman of the Alabama Water Agencies Working Group to continue to study water issues in the state and to undertake activities toward development of recommendations relative to water policy and management. He received a B.A. in anthropology and B.S., M.S., and Ph.D. in geology from the University of Alabama.



**SCOTT W. TINKER**'s passion is bringing academe, government, industry and NGOs together into what he calls the "radical middle" to objectively address major societal issues in energy, the environment and the economy. Scott is director of the 250-person Bureau of Economic Geology (BEG), the State Geologist of Texas, and a professor holding the Allday Endowed Chair in the Jackson School of Geosciences at the University of Texas at Austin. Scott is past president of the American Association of Petroleum Geologists, the Association of American State Geologists, the Gulf Coast Association of Geological Societies, and is the current president of the American Geosciences Institute. Tinker has visited over 50 countries and given over 600 keynote and invited lectures on energy, the environment and the economy to government, industry, academia and the public. He will receive the Halbouty Leadership Medal from the AAPG in 2016, is a Fellow of the Geologic Society of America, an honorary member of the AAPG, and has been awarded by AIPG, AGI, TIPRO and other societies for his balanced efforts to educate the public. He received his B.S. in geology and business administration from Trinity University; M.S. in geological sciences from the University of Michigan; and his Ph.D. in geological sciences from the University of Colorado, Boulder.

**SANDRA WIEGAND** is a petroleum engineer in the Houston office of the Bureau of Safety and Environmental Enforcement (BSEE) – part of the Houston Engineering and Technology Center (HETC), which evaluates new or current technologies and provides guidance and recommendations on current or potential technical challenges. Prior to BSEE, she spent 14 years in the oil and gas industry with Petrobras America Inc. and Shell where she focused on production engineering and, specifically, production surveillance, inflow/outflow modeling, production optimization, and decommissioning projects. She has extensive experience interfacing with non-operated ventures as the liaison between international and domestic partnerships. She received her M.S. in engineering management from the University of Texas at Austin and her B.S. in petroleum engineering from Universidad Surcolombiana, Colombia. Fluent in three languages (English, Spanish, and Portuguese), she was also an exchange student at the University of Oklahoma and has a certificate in advanced international affairs with emphasis in diplomacy from Texas A&M University.

## WORKSHOP PARTICIPANT BIOGRAPHIES

### SESSION ON ENVIRONMENTAL LEGACY ISSUES

#### KEYNOTE SPEAKER

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**DANNY REIBLE** is currently the Donovan Maddox Distinguished Engineering Chair at Texas Tech University. He previously served as Director of the multi-university consortium, the Hazardous Substance Research Center South and Southwest (1995-2007), while at Louisiana State University and as the Bettie Margaret Smith Chair of Environmental Health Engineering (2004-2013) and Director of the Center for Research in Water Resources (2011-2013) at the University of Texas. Dr. Reible was inducted into the National Academy of Engineering in 2005 for his work in identifying management approaches for contaminated sediments. He has led the development of in-situ sediment capping and has evaluated its applicability to a wide range of contaminants and settings including PAHs from fuels, manufactured gas plants and creosote manufacturing facilities, PCBs, and metals. His current research activities are focused on sustainable water management and the assessment and remediation of contaminated sites. He is a Fellow of the American Institute of Chemical Engineers and the American Association for the Advancement of Science. He received his B.S. from Lamar University, and his M.S. and Ph.D. in chemical engineering from the California Institute of Technology.

#### MODERATOR AND PANELISTS

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**MARILU HASTINGS** - [See Roundtable Biographies](#)

**MELINDA TAYLOR** is on the faculty of the University of Texas School of Law, where she teaches courses on environmental and energy law, including the environmental impacts of energy development. She founded the Kay Bailey Hutchison Center for Energy, Law, and Business at U.T. in 2014. Prior to joining the faculty of the University of Texas in 2006, Taylor was the Director of the Ecosystem Restoration Program for the Environmental Defense Fund, a national, nonprofit conservation organization. She focused on incentive-based approaches to conserve habitat for rare species on private lands. Taylor was a partner at the law firm Henry, Lowerre, Kelly & Taylor from 1991-1993. She served as Deputy General Counsel of the National Audubon Society from 1988-1991. At Audubon, she was responsible for managing the organization's litigation docket and supervising a project aimed at reducing pollution from oil and gas drilling. She was an associate at Bracewell & Patterson in Washington, DC from 1986-1988. Taylor graduated from the University of Texas School of Law in 1986. She also holds a B.A. from the University (Plan II, cum laude, Phi Beta Kappa) (1983).

**JOSEPH B.C. FITZSIMONS** is a natural resources, oil and gas and water law attorney and third-generation South Texas rancher. Mr. Fitzsimons is a graduate of Deerfield Academy, Lewis & Clark College, and the University of Texas School of Law. He has served as Vice-President of the Texas Wildlife Association and is a Director of the Texas and Southwestern Cattle Raisers Association. He is a former Chairman of the Parks and Wildlife Department's Private Lands Advisory Board and, in 1999, was named by then Governor George W. Bush to serve on the Governor's Task Force on Conservation. In May of 2001, Governor Rick Perry appointed Mr. Fitzsimons to the Texas Parks and Wildlife Commission for a six year term, and Mr. Fitzsimons is now a Past Chairman of that agency. In January of 2002, he was named to represent the Texas Parks and Wildlife Commission on the Texas Water Advisory Council, which has the statutory responsibility to advise the Office of the Governor, Speaker of the House and the Lieutenant Governor on issues affecting Texas water policy. In October 2003, Governor Perry appointed him as Chairman.

**BO VIZCAINO** is an Engineering Tech at the Railroad Commission of Texas.

## SESSION ON WATER SOURCING AND PRODUCED WATER MANAGEMENT

### KEYNOTE SPEAKER

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**BRIDGET SCANLON** is a senior research scientist in the Bureau of Economic Geology of the Jackson School of Geosciences of the University of Texas at Austin. The primary objective of her research group is to assess sustainability issues with respect to water resources in the context of climate variability and land-use change in semiarid regions. Her group is working in the southwestern United States, India, and China and collaborating with groups in West Africa and Australia. Her research focuses on evaluation of the effects of land-use change on groundwater resources; quantification of groundwater recharge on the basis of soil physics, environmental tracers, and numerical simulations; assessment of paleoclimate effects on groundwater recharge in semiarid and arid regions; and evaluation of groundwater contamination related to geogenic and anthropogenic sources. Dr. Scanlon has participated in focus groups on global recharge in the International Atomic Energy Agency and has served on National Research Council committees on radioactive-waste disposal and integrated observations in the hydrologic sciences. She was elected to the National Academy of Engineering in 2015. Dr. Scanlon received a B.S. degree in geology from Trinity College, Dublin (Ireland), an M.S. degree from the University of Alabama, and a Ph.D. degree from the University of Kentucky.

## MODERATOR AND PANELISTS

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**MODERATOR: WENDY HARRISON** - [See Roundtable Biographies](#)

**NICHOLE SAUNDERS** is a Senior Attorney for the Environmental Defense Fund's Energy Program, where she works on oil and gas issues and contributes to EDF's development and implementation of law and policy objectives as well as scientific and technical research priorities. Her work is focused on minimizing upstream development-related impacts to water, land, and communities by advocating for science-based improvements to state and federal policies and leading industry practices. In particular, Nichole's work is dedicated to identifying and reducing health and environmental risks associated with produced water management and disposal through advancements in science, technology, policy, and practice. Nichole earned her J.D. in Sustainable Energy and Resources Law from the University of Tulsa College of Law. Prior to earning her J.D., Nichole completed her M.S. and B.S. in Environmental Biology at Tulane University in New Orleans. Nichole lives in Austin and is a member of the Texas State Bar.

**RICK McCURDY** currently leads the team that oversees Chesapeake's production and completion chemical usage. He is also one of the primary architects of Chesapeake's Industry-leading GreenFrac® program that focuses on environmentally friendly hydraulic fracturing additives and Chesapeake's initiative championing reuse of produced water – AquaRenew®. During his career, Rick has worked with chemical and water issues from the North Slope of Alaska to the Gulf of Mexico and from offshore California to the Northern Marcellus Shale. Rick is an active member of SPE, NACE International and Mensa International, has served as a technical expert during the U.S. EPA workshops on hydraulic fracturing and has presented to the National Academy of Sciences, the Government Accountability Office and the Department of Energy regarding water use in the Energy Sector. Rick has an AAS degree in Petroleum Technology.

**ROBERT BRUANT** currently serves as Director of Product for B3, providing the overall product vision, strategy, and roadmap for B3's suite of data, information products, and solutions. Previously, Rob served in a variety of roles for BP and Pioneer Natural Resources, including Strategy Manager, Subsurface Manager, Reservoir Engineer, and Petroleum Systems Analyst. Rob also held positions of Instructor and Research Associate in the Department of Civil and Environmental Engineering at Princeton University, focusing on carbon sequestration and groundwater remediation. Rob received a B.A. in Geosciences from Franklin and Marshall College, a Ph.D. in Hydrology from the University of Arizona, and a M.B.A. from the University of Chicago's Booth School of Business. Rob serves on the Board of Directors for the Produced Water Society and the Dallas Section of the Society of Petroleum Engineers (SPE). He is also Membership Chairperson for SPE's Carbon Capture, Utilization, and Sequestration (CCUS) Technical Section. He is the recipient of SPE's Outstanding Technical Editor, Regional Service, Regional HSSE, Section Service, and Engineer of the Year awards. Rob is licensed as a Professional Geoscientist, Professional Hydrologist (Ground Water and Water Quality), and Certified Petroleum Engineer.

**AARON VELASCO** is professor of geological sciences–computational science at the University of Texas at El Paso. His research has spanned a variety of seismological and interdisciplinary subjects, including earthquake source modeling, seismotectonics, earthquake hazards, 3-D Earth modeling, and nuclear treaty monitoring research (seismic event detection, location, and discrimination). He has also studied hydroacoustic wave propagation and explored military applications of seismology. His current projects include: determining 3-D Earth structure from analysis of US Array data and other data in the southern Rio Grande Rift; exploring techniques for joint inversion; studying aftershocks of large earthquakes in Nepal and Mexico; studying volcanic structure in the East African Rift System in Kenya; studying local earthquakes in the El Paso, TX region; and understanding the link between earthquakes, in particular, the mechanisms for dynamic triggering. He also has projects that focus on educational aspects of science; in particular, programs that fund early geoscience undergraduates as part of the Academic Year – Pathways Research Experience Program (AY-PREP), and National Science Foundation grant. He received his B.S. in applied geophysics from the University of California, Los Angeles and his Ph.D. in geophysics from the University of California, Santa Cruz.

