

Chemical Mixing Roundtable Participants and Observers

Participants

Harold Fitch, Director of the Office of Oil, Gas, and Minerals, Michigan Department of Environmental Quality

Harold Fitch has served as Director of the Office of Oil, Gas, and Minerals (OOGM) of the Michigan Department of Environmental Quality since 1996. The OOGM regulates oil, gas, and brine wells and facilities, underground disposal wells, mineral exploration test wells, and surface and underground mines. He began his career as a geologist with the U.S. Geological Survey in Denver, Colorado, where he spent two years doing geologic mapping and resource evaluation. He then returned to his home state and joined the Geological Survey Division, predecessor of the OOGM. Prior to his appointment as Director of the OOGM, he worked as a field inspector, ground water specialist, and district supervisor, and was stationed at several field offices in northern Michigan as well as at Lansing. He earned a BS in Geology from Michigan Technological University in 1972 and did graduate work in Hydrology at the University of Arizona.

Christopher B. Hill, Environmental Engineer, Chesapeake Energy Corporation

Christopher Hill is an Environmental Engineer in the Environmental Health and Safety Regulatory and Scientific Affairs Department at Chesapeake Energy Corporation. At Chesapeake he has served as a technical lead on a number of scientific research initiatives related to hydraulic fracturing and other oil and gas activities, applying sound scientific and quality principles. He has actively participated in multiple aspects of US EPA's broader hydraulic fracturing research initiatives include the prospective and retrospective cases studies. Prior to joining Chesapeake, he worked for a major oil and gas company, as a Facility Engineer, supporting process safety initiatives for natural gas and natural gas liquid pipelines and facilities. He has a BS in Civil Engineering, a MS in Environmental Engineering and is currently pursuing a MS in Construction Management from North Dakota State University.

Joseph Lee, Jr., Manager, Division of Compliance and Data Management, Bureau of Oil and Gas Management, Pennsylvania Department of Environmental Protection

Joe Lee is Manager of the Division of Compliance and Data Management, Bureau of Oil and Gas Management, in the Department of Environmental Protection for the Commonwealth of Pennsylvania and a Licensed Professional Geologist. His present area of work is in the development and implementation of compliance programs and data management for the state's oil and gas management program. Prior to his present position, he managed the Source Water Assessment and Protection Program including the Wellhead Protection Program, and the state's Ground Water Protection Program. From 1988 to 1998, he supervised the development and implementation of the Filter Plant Performance Evaluation Program designed to optimize drinking water treatment plant operations. Prior to entering the Safe Drinking Water Program, he worked for the Bureau of Mining and Reclamation where he evaluated the impacts of coal

mining and quarries on surface and ground water systems. He has served on the Board of Directors of the Ground Water Protection Council for over ten years and is presently the immediate Past President.

Ann Maest, Managing Scientist, Stratus Consulting, Inc.

Ann Maest is a Managing Scientist at Stratus Consulting in Boulder, Colorado. She is an aqueous geochemist with expertise in the fate and transport of natural and anthropogenic contaminants in groundwater and surface water, with over 25 years of research and professional experience as a geochemist. She has worked on natural systems as well those that have been impacted by industrial activities, especially hard rock mining and oil and gas exploration and development. She has evaluated environmental conditions at many such sites in the United States and Latin America. After completing her PhD, she was a Research Geochemist in the U.S. Geological Survey's National Research Program, where she conducted research on oil-field brines, metal and metalloid speciation, analytical chemistry methodology and redox geochemistry in surface water and groundwater. She has served on a number of national and international committees, including several National Academy of Sciences committees related to mining and oil and gas research issues. She is a member of the American Chemical Society, the Society of Mining, Metallurgy, and Engineering, and the Geological Society of America. In the area of hydraulic fracturing and drinking water, she is especially interested in baseline water quality monitoring, produced and flowback water quality, and the potential transport of chemicals used in hydraulic fracturing to groundwater and surface water resources. She has a PhD in Geochemistry and Water Resources from Princeton University.

Joann McMahon, Manager of Environmental Services Group, Baker Hughes

Joann McMahon is Manager of the Environmental Services Group for Baker Hughes. She has 32 years direct experience in ecotoxicological research related to the petrochemical industry. She is co-author of several patents and technical publications on development of environmentally acceptable oilfield chemistries. She is also co-developer of the Chemical Evaluation Process Review (CEPR) assessment program to support the Baker Hughes SmartCare™ family of environmentally responsible solutions. She has a MS in Environmental Studies.

Woldezion Mesghinna, Founder, Natural Resources Consulting Engineers, Inc.

Woldezion Mesghinna founded Natural Resources Consulting Engineers, Inc. (NRCE) in 1989 after 17 years of domestic and international experience in water resources. Since this time, he has worked as President and Principal Engineer at NRCE on a variety of projects for Indian Tribes and the Government of Eritrea related to groundwater wells, energy development, water acquisitions and detailed hydrologic and water quality modeling. He is an expert and has significant experience in surface water and groundwater hydrology, water quality and constituent mixing, water demands and planning, water infrastructure project design and water marketing and acquisition. Relevant projects have included analysis of mixing of groundwater and water quality constituents as part of a well testing program of groundwater quality and flow characteristics; subsurface investigations, soil sampling, rock coring, and permeability testing; design of a dewatering system through groundwater hydrologic analysis for a sub-aqueous tunnel; investigation of groundwater resources for development potentials; design of

and utilization of embankment grouting injection wells for several dam projects in the United States and Eritrea to prevent subsurface seepage flows; and water treatment and wastewater treatment feasibility design studies in Eritrea and the western United States. Recently, he presented *Water Based Constraints on Tribal Energy Development in the Southwest* at a Tribal Energy conference hosted by Law Seminars International. He is a Licensed Professional Engineer in Arizona, California, Colorado, Wyoming and a member of the National Society of Professional Engineers, American Society of Civil Engineers, and American Society of Testing & Materials, American Water Works Association and the Colorado River Water Users Association. He has a MS in Civil Engineering, with a concentration in Hydraulics and Hydrology and a PhD in Irrigation and Drainage Engineering.

Briana Mordick, Staff Scientist, Natural Resources Defense Council

Briana Mordick is a Staff Scientist at the Natural Resources Defense Council (NRDC). Prior to joining NRDC, she worked for Anadarko Petroleum for six years as a Petroleum Geologist on projects including shale gas, tight gas sands, and CO₂ enhanced oil recovery. At NRDC, she serves as a technical advisor on issues related to oil and natural gas extraction and geologic sequestration of carbon dioxide, which includes the identification of regulatory solutions and industry best practices to address the environmental impacts of oil and natural gas extraction. She has written and spoken frequently on these topics to the National Academies of Science, US EPA and the Yale Environmental Law Conference. She served as a representative to the Operations and Environment and Policy Subgroups of the 2011 National Petroleum Council study on the Prudent Development of North American Resources and is currently a member of the Unconventional Resources Technology Advisory Committee, a Federal Advisory Committee to the Secretary of Energy. She is particularly interested in the fate and transport of fluids in the subsurface through both manmade and natural pathways related to hydraulic fracturing and drinking water. She holds a BA in Earth Sciences from Boston University and a MS in Geological Sciences from the University of North Carolina at Chapel Hill.

Jeff Noe, Senior Staff Completion and Well Intervention Engineer, Shell

Jeff Noe is Senior Staff Completion and Well Intervention Engineer with Shell in Houston, TX. He has spent 18 years in various Production Engineering positions with Mobil Oil Company. While with Mobil, he spent seven years working both Central and Western GoM projects, three years in the Dallas Technical Center supporting international projects and eight years in Saudi Arabia as a loanee to Aramco supporting high rate, high pressure/high temperature gas development projects. In 1997, he joined Saudi Aramco as a direct hire, again supporting their gas development projects. In 2002, he returned to North America and worked as a Completions Consultant with APA Petroleum Engineering in Houston. He joined Shell in 2005 and has been supporting Southwestern Energy Production Company's Onshore Gas Exploration program, with primary emphasis on unconventional gas and hydraulic fracturing. He was appointed Shell's global principal technical expert for hydraulic fracturing operations in September 2011. In this capacity, he has been actively engaged in developing hydraulic fracturing fluid design criteria, chemical evaluation and selection protocols and product stewardship practices. He has a BS in Petroleum Engineering from Mississippi State University.

Jeffrey Oxenford, Principal and Owner, Oxenford Consulting, LLC

Jeffrey Oxenford is the Principal and Owner of Oxenford Consulting, LLC. He has worked for Stratus Consulting, the American Water Works Association Research Foundation and the New Jersey Department of Environmental Protection. He has over 25 years' experience in water quality and treatment and has managed and directed cutting edge water quality research on issues such as volatile and synthetic organic chemicals, natural organic matter, disinfectants and disinfection by-products, arsenic, algal toxins, taste and odor, *Cryptosporidium*, and distribution system water quality. He has also led research on water treatment technologies that include source water protection strategies, alternative disinfectants, granular and powdered activated carbon and membrane technology. He is particularly interested in the potential impact of hydraulic fracturing on drinking water quality and strategies that utilities should employ to protect water quality. He has a MSE in Environmental Engineering from the University of North Carolina at Charlotte and a BA in Chemistry and Environmental Management from Warren Willson College.

Jim Richenderfer, Director, Technical Programs, Susquehanna River Basin Commission

Jim Richenderfer is Director of Technical Programs at the Susquehanna River Basin Commission (SRBC). His responsibilities include oversight of all technical programs at the commission, which include Project Review, Compliance and Enforcement, Planning and Operations (including Flood Management and Drought Coordination), Monitoring and Protection, Grants and Research and Policy Implementation and Outreach. The commission's technical staff is comprised of engineers, geologists, hydrogeologists, hydrologists, environmental scientists, and biologists. Under his direction, the technical staff focuses on the long-term sustainable utilization of the basin's shared water resources. The SRBC has primary responsibility for regulating water acquisitions by all water users throughout the Susquehanna River Basin, including the natural gas industry. In addition, the SRBC shares responsibility along with several other resource agencies for conducting various water quality monitoring programs throughout the Basin, including some areas in which hydraulic fracturing activities have occurred. To date, there have been approximately 2,000 unconventional natural gas wells hydraulically fractured within the Susquehanna River Basin, all of which have relied upon water acquisitions regulated by the SRBC. Before joining the SRBC in 2008, he spent over 25 years working as a private consultant serving many Fortune 500 companies located throughout North America. The consulting company he co-founded conducted a wide range of investigations addressing both the quantitative and qualitative aspects of surface water and ground water resources. He specialized in the investigation of ground water and surface water problems associated with petro-chemical manufacturing, materials storage, mining and mineral extraction, municipal and industrial waste disposal, and agricultural operations. His academic training includes undergraduate degrees in Forestry from Paul Smith's College, in Natural Resource Management from SUNY College of Environmental Science and Forestry, and Geology from Dickinson College. He also holds MS and PhD degrees in Hydrology from Pennsylvania State University.

James Saiers, Professor of Hydrology and Associate Dean of Academic Affairs, Yale University School of Forestry and Environmental Studies

James Saiers is a Professor of Hydrology and Associate Dean of Academic Affairs at Yale University's School of Forestry and Environmental Studies. He has 16 years of experience in teaching and leading research in numerous theoretical and applied aspects of surface water and groundwater hydrology. He has published extensively on factors affecting groundwater and surface-water flow and on the role of coupled processes in governing the migration of contaminants in soils, aquifers, streams, and wetlands. This research has been supported by numerous grants from federal agencies, including the National Science Foundation, the Department of Energy, the Army Research Office, and the United States Geological Survey. He has served on the editorial boards of *Water Resources Research* and *Geophysical Research Letters* and is a member of the National Research Council Committee on the Scientific Review of Everglades Restoration Progress. He is also a member of the American Geophysical Union and American Chemical Society. He is particularly interested in issues surrounding the lifecycle of freshwater that is used to support shale-gas extraction and in improving understanding of the subsurface fate and transport of fluids used in the hydraulic stimulation of shale-gas reservoirs. He holds a BS in Geology from Indiana University of Pennsylvania and a MS and PhD in Environmental Sciences from the University of Virginia.

Wilma Subra, President, Subra Company

Wilma Subra is president of Subra Company and provided technical assistance to Louisiana Environmental Action Network. She has over 45 years of experience in sampling and chemical and microbiologic analysis of ground water and surface water resources, monitoring of impacts on water resources, monitoring the environmental impacts of oil and gas drilling and production activities, oil and gas waste treatment and disposal practices and associated environmental and human health impacts, environmental and human health impacts of injection well operations, analysis of chemical components in drilling fluids, pit construction and resulting contamination from pit operations, and environmental and human health impacts of shale development. Her current work is focused on the environmental impacts of various aspects of shale development, the human health impacts associated with various specific units and activities of shale development, the development of appropriate parameters for monitoring ground water and surface water resources to detect impacts of shale development, and the development of guidelines for the regulation of state programs dealing with shale gas development. She is a member of the American Chemical Society. She has a BS and MS in Microbiology and Chemistry from the University of Southwestern Louisiana (University of Louisiana at Lafayette).

Ching-Tzone Tien, Chief, Groundwater Discharge Permit Division, Maryland Department of the Environment

Ching-Tzone Tien is currently Chief of the Groundwater Discharge Permit Division of the Maryland Department of the Environment and Program Manager for Maryland's Underground Injection Control Program. He has been with the Maryland Department of the Environment since July of 1975, and has over 30 years of experience in groundwater hydrology and groundwater pollution control. He has authored or co-authored 32 research papers, book

chapters, conference proceedings and governmental publications relating to environmental engineering and water pollution control. He is a faculty member of the Office of Advanced Engineering Education at the University of Maryland, College Park, teaching two graduate courses including a course entitled Groundwater Hydrology and Pollution Control. His specialties include but are not limited water and wastewater treatment, water pollution control, waste management, groundwater hydrology and water quality protection. Maryland's Underground Injection Control Program will support the State's Mining Program in implementing mechanical integrity testing and will require a permit for any discharge of hydraulic fracturing wastewater into the subsurface. He has a BS in Civil Engineering, a MS and a PhD in Environmental Engineering and is a Professional Engineer licensed in the State of Maryland.

Denise Tuck, Senior Product Champion for Production Enhancement, Halliburton

Denise Tuck is a Senior Product Champion for Production Enhancement at Halliburton. She provides technical support on chemistry and fluids for stimulation and hydraulic fracturing. Formerly, she held the positions of Environmental Compliance and Permitting Manager and Global Chemical Compliance Manager in Health, Safety and Environment for Halliburton. She joined Halliburton in 1990 and has over 30 years of experience in environmental pollution control systems design and regulatory permitting and compliance for the upstream and downstream oil and gas industry. She co-authored two sections in the National Petroleum Council Report on Prudent Development – Realizing the Potential of North America's Abundant Natural Gas and Oil Resources and participates on several American Petroleum Institute and Society of Petroleum Engineers committees. She has a BS in Chemical Engineering from Auburn University.

John Veil, Founder, Veil Environmental, LLC

John Veil founded Veil Environmental, LLC, a consulting practice specializing in water issues affecting the energy industries, upon his retirement from Argonne National Laboratory in January 2011. He spent more than 20 years as the manager of the Water Policy Program for Argonne National Laboratory. Before joining Argonne, he managed Maryland's regulatory programs for industrial wastewater discharge and injection and served as a faculty member of the University of Maryland. He has been recognized by the Society of Petroleum Engineers as a Distinguished Lecturer in 2008-2009 and 2013-2014 and as the recipient of the 2009 international award for Health, Safety, Security, Environment and Social Responsibility. He has 32 years of experience in wastewater treatment and water quality, 22 years of experience in managing produced water, and five years of experience with flowback water and hydraulic fracturing. He has published many articles and reports and is frequently invited to make presentations on produced water and flowback water management, shale gas, hydraulic fracturing, and chemical disclosure, among other topics. He was invited to testify before Congress in 2007 on produced water as an alternate water supply. He has a BA degree in Earth and Planetary Science and MS degrees in Zoology and Civil Engineering.

Observers

Amy Farrell, Vice President of Regulatory Affairs, America's Natural Gas Alliance

Amy Farrell is the Vice President of Regulatory Affairs at America's Natural Gas Alliance (ANGA), an educational and advocacy organization formed by North America's leading independent natural gas exploration and production companies. She is the organization's lead advocate on federal regulatory policy that has the potential to impact natural gas demand or operators' ability to develop this clean and abundant domestic resource. Prior to joining ANGA, she worked in ExxonMobil's Public and Government Affairs Department as an Issues Advisor, providing policy and strategic advocacy advice on topics ranging from U.S. greenhouse gas policy to process safety. Before joining the private sector, she spent nearly a decade in the government, most recently serving in the George W. Bush White House National Economic Council as a Special Assistant to the President for Economic Policy handling energy policy. She also served as an Associate Director for Environment and Regulation in the White House Council on Environmental Quality. Prior to moving to the White House, she served in two different positions at the US EPA. She was the Deputy Assistant Administrator for the Office of Prevention, Pesticides and Toxic Substances (now the Office of Chemical Safety and Pollution Prevention) and a Policy Advisor to Administrators Stephen Johnson and Michael Leavitt. She began her government career as a policy analyst in the Office of Management and Budget's Office of Information and Regulatory Affairs, where she reviewed environmental and energy regulations. She graduated from Indiana's School of Public and Environmental Affairs with a MS in Public Policy in 2000. She earned her BS in Biology from Illinois Wesleyan University in 1998.

Dan Hill, Haudenosaunee Environmental Task Force

Dan Hill is known for his music, art and performances in Native and Non-Native audiences. As a Cayuga Nation Council Member and Cayuga Nation Representative for the Haudenosaunee Environmental Task Force and as an Environmental Technician, he is responsible to speak out for the Natural World according to his Grandmother's teachings. As a Cayuga Nation Citizen, the protection of the waters is only part of the Cycle of the Natural World and the teachings of protecting the Earth and the Life Cycle that supports us for seven generations. We are to leave the earth better than what we were given.

Lynn Thorp, National Campaigns Coordinator, Clean Water Action

Lynn Thorp is the National Campaigns Coordinator for Clean Water Action and oversees the organization's national work on water, global warming and energy and chemical policy. She is particularly involved in drinking water issues and has served two terms on the National Drinking Water Advisory Committee, which advises the US Environmental Protection Agency on drinking water policy. She has also served on a number of other Federal Advisory Committees and other bodies working on drinking water regulation. Before coming to Clean Water Action in 1999, Lynn worked at Greenpeace for nine years with an emphasis on toxics and health issues. She began work in the advocacy community after completing undergraduate and graduate work at Georgetown University.

Aliza Wasserman, Senior Policy Analyst for Energy, Environment and Transportation Division, National Governors Association

Aliza Wasserman is a Senior Policy Analyst in the Energy, Environment and Transportation Division at the National Governors Association (NGA) Center. Aliza writes issue briefs, technical assistance memos and organizes conferences for governors' energy advisors on state policy. Her areas of focus are shale development and hydraulic fracturing, energy efficiency, renewable energy, economic development, and water policy. She authored NGA's 2012 report *Ten Trends to Track: State Policy Innovations to Advance Energy Efficiency and Renewable Energy*. She is currently writing a report on economic development in the clean energy sector based on a series of workshops she helped organize on the topic for governors' energy and economic advisors. Previously, she worked as a research associate at Business for Social Responsibility, advising multinational companies on their environmental and social practices. Aliza received her MPA from Princeton University, with a concentration in Science, Technology and Environmental Policy.