Flowback and Produced Water Technical Roundtable

Participants

John R. Baza, Director, Utah Division of Oil, Gas and Mining

John Baza is currently the Director of the Utah Division of Oil, Gas and Mining, having been appointed to that position on May 6, 2005. He is a Petroleum Engineer by education and work experience, with a career spanning over 33 years working with the energy and mineral extractive industries. His experience includes engineering positions with several major and independent petroleum companies including Phillips Petroleum Company, Amoco Production Company and Flying J Oil and Gas Incorporated. He has been involved in petroleum exploration and development in Wyoming, North Dakota and Utah, and he has also worked on geothermal power projects in Utah, Nevada and California. He has accumulated over 21 years of state government service at the Division of Oil, Gas, and Mining, with nearly 15 of those years working strictly in the Oil and Gas Program before assuming the role of Division Director. Among his duties as Director, he leads the Division's efforts in the areas of petroleum development. He has previously been responsible for regulation of the upstream oil and gas industry in Utah. Both his government and private industry experience have given him hands-on experience with flowback and produced water issues. He is a Registered Professional Engineer in Utah. He has been a member of the Interstate Oil and Gas Compact Commission and is currently the Vice Chair of that organization. He is also a 36-year member of the Society of Petroleum Engineers, having held various officers positions including section chairman, program chairman and scholarship committee chairman. He has MS and BS degrees in Petroleum Engineering from Stanford University.

Tim Buscheck, Chevron Fellow and Consulting Hydrogeologist, Chevron

Tim Buscheck is a Chevron Fellow and Consulting Hydrogeologist in the Site Assessment and Remediation Team of the Health, Environment and Safety Department with Chevron, where he has worked since 1985. Prior to this he worked with Sohio Petroleum Company, Energy Resources Company, and Exxon Research and Engineering Company. At Chevron, Buscheck leads a Remediation Strategic Research program and provides consulting to Chevron Operating Companies on site assessments and remediation for marketing, chemical, refining and upstream facilities throughout the United States and internationally. In 2008 he wrote a guidance document for Compound Specific Isotope Analysis, which has been widely distributed to Chevron consultants responsible for demonstrating monitored natural attenuation. Buscheck led an Oxygenates Research program from 1998 to 2003. He led a Remediation Long Range Research program from 1992 to 1997. He has authored papers on the subjects of compound specific isotope analysis, natural attenuation, ethanol fate and transport, and multi-site plume studies, as well as several Chevron protocols for monitoring natural attenuation of contaminants in groundwater. He has conducted numerous short courses for regulatory agencies across the country since 1990. Between 1998 and 2002 he taught a two-day oxygenates short course with a California State Water Resources Control Board (CA SWRCB) toxicologist, offered through the CA SWRCB, US EPA, the National Ground Water Association

and the University of California Extension Program. Between 1997 and 2000 he taught a one-day natural attenuation short course for regulatory agencies in six states. He holds a BS in Chemical Engineering from Lafayette College and a MS in Geological Engineering from the University of California, Berkeley.

Jason Clark, General Manager Drilling & Completions, HighMount Exploration & Production

Jason Clark started working in the oil and gas industry in 1998 with a primary focus on drilling and completions. He has been involved in most major unconventional resource plays across the US as well as several international plays, ranging from start-ups to established plays with 50-plus rigs operating in a basin. He is currently based in Oklahoma City, OK, as General Manager of Drilling and Completions for HighMount Exploration and Production, an independent oil and gas company. In addition to multiple leadership positions, he has experience as a technical lead with respect to tubular design and ground water protection. He has degrees in both Mathematics and Petroleum Engineering from Marietta College.

Veronica Foster, Project Manager and Senior Consultant, Golder Associates

Veronica Foster has been with Golder Associates for over 22 years, currently in the role of Project Manager and Senior Consultant. She is a Licensed Professional Engineer in New Jersey, Pennsylvania, Delaware and Maryland, with extensive experience with solid waste management, environmental compliance, mining, environmental restoration and traditional civil engineering. Her solid waste management and environmental restoration work includes the design of containment systems for solid waste and impacted soils and liquids. Her design and construction team has developed a containment system design and program management approach to demonstrate and document that containment systems have no leaks when installed. She has been the engineer-of-record for the installation over three million square feet of impoundment and pit liners for Marcellus Shale play sites since August 2011 and more than 100 acres of containment systems for landfill and remediation sites since joining Golder.

Lloyd Hetrick, Professional Engineer and Certified Safety Professional, Newfield

Lloyd Hetrick is a Registered Professional Engineer and a Certified Safety Professional with over 33 years of experience in the exploration and production industry, which includes drilling, completions, production operations and HSE. Prior to joining Newfield, he worked for a super major and several smaller exploration and production operators. His areas of expertise include well design, well construction, well operations and well failure analysis relevant to hydraulic fracturing as described more fully in a case study presented to the US EPA during their initial Hydraulic Fracturing Technical Workshop series during March 2011. His current role with Newfield includes establishing best practices for well design and construction, plus water and chemical management during hydraulic fracturing operations.

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.

Thomas Kropatsch, Natural Resource Analyst, Wyoming Oil and Gas Conservation Commission

Thomas Kropatsch is a Natural Resource Analyst with the Wyoming Oil and Gas Conservation Commission (WOGCC). He is responsible for the implementation and regulation of the WOGCC environmental programs and oil and gas operator's compliance with the WOGCC's rules and regulations. He provides technical and regulatory assistance to oil and gas operators within the Wyoming on remediation and/or disposal of exploration and production generated wastes, including petroleum contaminated soils, produced water and flowback water. He is also a Commission Hearing Examiner for pit closure contractors requesting approval to chemically and/or mechanically treat drilling reserve and other produced water retention pits in the state. The pit treatment hearings include review and approval of contractor's methods to treat or recycle produced or flowback water to ensure that proposed methods of treatment, recycling or closure meet state rules and regulations. He has over 11 years of experience managing projects, conducting soil and ground water investigations and providing technical knowledge and review of site investigation and remediation work at pipeline, bulk storage terminal, storage tank and oil and gas exploration and production sites. He has a BS in Geology and is a Wyoming Registered Professional Geologist.

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.

Mark Mazoch, Manager of Water Team, Fayetteville Shale Division, Southwestern Energy

Mark Mazoch is a Professional Engineer with Southwestern Energy where he is the Manager of the Water Team for the Fayetteville Shale Division. The Water Team is focused on both operations of the water life cycle as well as planning and executing water infrastructure development projects (water sourcing, reuse/recycling, treatment and disposal) in support of the development of the Fayetteville Shale in Arkansas. The primary objectives of these projects are to reduce the development cost while providing secure sources of water and treatment operations, which may be accomplished in a long-term, sustainable manner. He has over 20 years of engineering and consulting experience, which includes the development of large scale, complex infrastructure and environmental restoration projects. He has led complex projects that required extensive regulatory agency coordination and public involvement. He is particularly interested in investigating/developing small scale, cost effective desalination plants and finding beneficial uses of both freshwater and concentrated brine. He is a member of the Society of Petroleum Engineers and has a BS in Civil Engineering and a MS in civil/geotechnical engineering from Texas A&M University.

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

Woldezion Mesghinna founded Natural Resources Consulting Engineers, Inc. (NRCE) in 1989 after17 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, 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.

Glenn Miller, Professor of Environmental and Resource Science, University of Nevada, Reno

Glenn Miller is a Professor of Environmental and Resource Sciences at the University of Nevada, Reno (UNR). He is also presently Director of the Graduate Program in Environmental Sciences and Health at UNR. Current areas of research include precious metals pit water quality and acid mine remediation using anaerobic sulfate reducing systems. He also is working on a variety of issues related to the measurement and fate of organic contaminants in the environment. He was also involved in a project providing comments on the New York Environmental Impact Statement on hydraulic fracturing. He has a BS in Chemistry from the University of California, Santa Barbara and a PhD in Agricultural and Environmental Chemistry from the University of California at Davis. After completing his graduate studies, he spent a year of postdoctoral study at US EPA's Environmental Research Laboratory in Athens, Georgia.

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 CO_2 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. This work 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 including 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.

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 project 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.

Peter Pope, Assistant Director, Site Remediation Section, Oil & Gas Division, Railroad Commission of Texas

Peter Pope is the Assistant Director of the Site Remediation Section, Oil & Gas Division, Railroad Commission of Texas. He has over 20 years of experience practicing hydrogeology and performing risk-based environmental assessments for private industry and public sector clients. He has expertise in aquifer characterization, fate and transport of chemicals in soil and groundwater, numerical simulations of subsurface transport processes and statistical analysis of environmental data. He has worked for the Railroad Commission of Texas since September 2001. He has a BS in Geology from Purdue University and a MA in Geology from Rice University.

David R. Stewart, Stewart Environmental Consultants

David Stewart has over 35 years of experience in the water quality and water/wastewater treatment industry. He has developed and patented several treatment systems for the produced water and hydraulic fracturing flowback waters for reuse in both the industry as well as for domestic and industrial/agricultural uses. He also is working on harvesting other valuable minerals and constituents from produced water and hydraulic fracturing flowback waters. He also has two patents for heavy metal removal utilizing ceramic microfiltration. He has testified before the US Congress on the topic of beneficial reuse of produced water on three different occasions. He has also been a contributor and technical reviewer for the National Academy of Sciences on desalination and produced water for beneficial reuse. He is a technical reviewer for the Research Partnership to Secure Energy for America with the Colorado School of Mines (CSM). He is also an adjunct facility member at Colorado State University (CSU) and a Technical Advisor for CSM on the subject of beneficial use of produced water. In addition, he teaches industrial wastewater treatment and hazardous waste treatment and management at CSU. He received his BS, MBA and PhD from CSU in Environmental Engineering. He received his MS in Environmental Engineering from the University of Arizona.

John Stolz, Professor and Director, Center for Environmental Research and Education, Duquesne University

John Stolz is Professor and Director of the Center for Environmental Research and Education at Duquesne University. He has investigated the physiology and biochemistry of anaerobic bacteria that metabolize arsenic, selenium, nitrate, and chromate; the ecophysiology of microbial communities in hypersaline and marine environments; and microbe/mineral interactions. He is currently investigating the microbiology of flowback and produced waters and the contamination of drinking water wells near Marcellus and Utica gas well operations in Western Pennsylvania. He has published 64 journal articles, 30 book chapters, and author-edited two books. He has a BS in Biology from Fordham University and a PhD from Boston University in Microbial Ecology and Evolution. He was a National Research Council Post Doctoral

Fellow at the National Atmospheric and Space Administration Jet Propulsion Laboratory, Visiting Associate in Geology at Cal Tech and a National Science Foundation Postdoctoral Fellow in Plant Biology at the University of Massachusetts, Amherst.

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.

Observers

Adam Carpenter, Government Affairs, American Water Works Association

Adam Carpenter works in American Water Works Association (AWWA) District of Columbia Government Affairs Office and serves as an expert on a diverse set of drinking water issues including climate change, hydraulic fracturing, consumer confidence reports, carbon capture and storage, the energy-water nexus, and other water and environmental issues. Along with his colleagues, he works to further AWWA's mission of supporting clean, affordable drinking water through sound application of science into policy, source water protection, sensible regulation, public awareness, and building stakeholder consensus. He holds a BS from George Washington University in Biology, a MS from Johns Hopkins in Environmental Sciences and Policy and is pursuing a PhD in Environmental Policy from George Mason University.

Dan Hill, Haudenausaunee 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 Haudenausaunee 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.

Stephanie Meadows, Senior Policy Advisor, Upstream Department, American Petroleum Institute

Stephanie Meadows is Senior Policy Advisor in the Upstream Department of the American Petroleum Institute (API), a national trade association representing over 500 companies involved in all aspects of the oil and natural gas industry. She currently manages and coordinates API's upstream environmental advocacy activities. In this role, she focuses on the impact of federal and state regulations and legislation on operations, the development of industry standards and best practices and cultivating strong relationships with other aligned industries, associations, and government. She joined API in March 1987 and has gained extensive industry experience in several different roles within the organization. She has been API's point person on hydraulic fracturing since 2007. She received her BS from Bowling Green State University and completed her graduate studies in Marine Affairs at the University of Virginia.

Maya Van Rossum, Delaware Riverkeeper Network

Maya van Rossum has been the leader for the Delaware Riverkeeper Network since 1996. She has been heavily involved in analyzing the life cycle of the gas drilling process from land disturbance, to extraction, to transmission, to waste disposal, and delivery to the final consumers in the United States and abroad. The Delaware Riverkeeper Network has been involved with assessing and applying legal requirements to the industry at the state, regional and federal level. This work has required her and her staff to research every element of the shale gas development process from cradle to grave; reviewing existing and emerging scientific and legal literature, and applying it to the organization's activities with regards to this industrial activity. She was appointed to Pennsylvania's Delaware River Basin Regional Water Resources Committee (2003 to 2009), New Jersey's Flood Mitigation Task Force (2005 to 2006), Delaware River Basin Flood Mitigation Task Force (2006 to date), Pennsylvania's Stormwater Best Management Practices Manual Oversight Committee (2003 to date), and the Heinz Center's Coastal Zone Innovations Committee. In 2008 she was appointed by the Commandant of the Coast Guard as an official member of the Delaware River and Bay Oil Spill Advisory Committee. She has also served on a number of the region's water quality committees. From spring 2002 to 2006, she served as an Adjunct Professor and Director of the Environmental Law Clinic at Temple University's Beasley School of Law, a clinic she founded in her role as the Delaware Riverkeeper, which she still oversees. She has served multiple times as faculty for the Pennsylvania Bar Institute's Environmental Law Forum. She is an environmental attorney, with a JD from Pace University School of Law and an LLM from Widener University School of Law.

Craig Sundstrom, National Governors Association

Craig Sundstrom is a Senior Legislative Associate with the National Governors Association (NGA) Office of Federal Relations, where he manages the work of the governor's Natural Resources Committee. The NGA Natural Resources Committee has jurisdiction over energy, environmental,

agriculture, and natural resources issues. Before joining NGA, Craig practiced energy and environmental law in Oklahoma City and served for a short time on Capitol Hill. Craig earned his undergraduate degree in Political Science with a Certificate in Leadership Studies from Marietta College and his JD from Oklahoma City University School of Law.