Water Acquisition Roundtable Participants and Observers

Participants

Michael Baker, Chief of Drinking and Ground Waters Division, Ohio Environmental Protection Agency

Michael Baker is Chief of the Division of Drinking and Ground Waters at the Ohio Environmental Protection Agency where he has worked for over 26 years. He has served as Chief for 13 years responsible for characterizing and protecting Ohio's ground water resources and ensuring Ohio's citizens have access to adequate supplies of safe drinking water by administering the State of Ohio's Public Water Supply Supervision Program, Ground Water Characterization and Protection Programs, Class 1 and 5 Underground Injection Control Programs, Source Water Protection Program, the Drinking Water State Revolving Loan Program, and the Water and Wastewater Operator Certification Program. He has advised and directed numerous state drinking water and ground water protection initiatives including currently serving on an inter-agency work group established to ensure safe development of Ohio's unconventional oil and gas resources. He has also helped establish national water policy having served two terms on US EPA's National Drinking Water Advisory Council and is active in both the Ground Water Protection Council and the Association of State Drinking Water Administrators, having served as president of both associations. He has twice been invited to provide testimony on water related issues to the U.S. Senate Environment and Public Works Committee. He graduated with a BS from The Ohio State University School of Natural Resources.

Michael Dunkel, Director of Sustainable Development, Pioneer Natural Resources

Michael Dunkel is the Director of Sustainable Development for Pioneer Natural Resources. He is responsible for water and air initiatives that promote long-term sustainable development plans. A major focus of the initiatives is finding economically viable alternatives to reduce fresh water used for drilling and hydraulic fracturing. The group has evaluated approximately 100 companies' technologies for water treatment and water management. He is also responsible for technical innovations to measure air emissions, reduce leakage of gas and reduce Pioneer's carbon footprint. He has held positions with Pioneer Natural Resources in engineering management, project management and business development over the last 15 years. His experience with Pioneer includes projects and developments in Tunisia, South Africa, Gabon and Argentina, before joining the Sustainable Development Group. Prior to Pioneer, he was employed at Marathon Oil in a variety of engineering and business development roles for 15 years. His involvement in successful developments covered Texas, Louisiana and North Africa. He is a 30-year member of the Society of Petroleum Engineers (SPE). He was a founding SPE member and officer of the Tunisia Section. He earned a BS in Mechanical Engineering from Rose-Hulman Institute of Technology.

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.

Stephen Jester, Senior Principal Environmental Engineer, ConocoPhillips

Stephen Jester is a Senior Principal Environmental Engineer with ConocoPhillips based in Houston, TX. He is recognized in the oil and gas industry for his experience in water issues related to hydraulic fracturing. He has 29 years of experience in managing projects related to characterization and remediation of soil and groundwater, and water and wastewater treatment, including 15 years in the oil and gas industry. He is currently responsible for managing water issues related to hydraulic fracturing for ConocoPhillips' Lower 48 region, including evaluating recycle and reuse opportunities, fresh water and alternative water sourcing, and regulatory changes. He formed and led the Eagle Ford Water Consortium, a group of experts from 18 oil and gas companies who manage water issues for hydraulic fracturing in the Eagle Ford Shale. This group funded a study that provided more accurate and timely water use data to the University Of Texas Bureau Of Economic Geology to enable a more robust analysis of water use in hydraulic fracturing in Texas. He has studied and presented on water supply and demand for hydraulic fracturing in Eagle Ford, including presentations to the US EPA Hydraulic Fracturing Work Group (March 2011), and various conferences and groups in Texas. He is currently working with the American Petroleum Institute to update the "Water Management Associated with Hydraulic Fracturing" guidance document to include recommended practices on baseline water sampling. He has extensive experience in groundwater contamination and remediation throughout the United States, with past responsibilities that included a large project portfolio and remediation technology

development. In addition to his experience above, he is the President of Harris County Municipal Utility District, a public office in the State of Texas with responsibilities that include managing the community's water supply and wastewater treatment systems. He has also designed water and wastewater treatment plants for municipal systems. He holds a BS in Civil and Environmental Engineering from Cornell University and an MBA from Villanova University.

Nathan Kuhnert, Strategic Services Division, Devon

Nathan Kuhnert has 16 years of experience in hydrology and water resources planning. He has spent five of his seven years at Devon involved developing water management plans, administering NPDES permits, and leading an operators' group to coordinate Coal Bed Methane (CBM) effluent releases in the Powder River Basin of Wyoming. Prior to Devon, he worked for the Oklahoma Water Resources Board as a Hydrologist and Planner to assist in the development of drinking water supplies. He also worked as a Research Scientist at the National Severe Storms Laboratory in Hydrometeorology. He currently works in Devon's Strategic Services Division supporting business unit teams at integrating sustainable water management practices into the drilling and completion of hydrocarbon resources. Core components of these practices include measurement and reporting of water use, evaluation of water reuse and recycling technologies and compilation of comprehensive source water supply plans. In particular, brackish aquifers, wastewater sewage effluent and abundant surface water in lieu of fresh groundwater have been recently developed with his leadership. He serves on the American Society of Chemical Engineers Environmental and Water Resources Institute's Atmospheric Water Management Standards Committee. He is also an active American Exploration and Production Council water metrics and hydraulic fracturing subcommittee member and represents Devon on multiple state and regional trade group associations tasked with evaluating industry's fresh water consumption and conservation efforts to satisfy regulatory and stakeholder needs. He was recently invited to a Conference of Experts by The Nature Conservancy on reducing energy's impacts to water and biodiversity and will assist in the Conservancy's ultimate goal of outreach and a communication plan based on the recommendations. In 2009-2010, he was a member of the Wyoming Department of Environmental Quality CBM Working Group tasked with evaluating irrigation protection limits for CBM produced water. He attained a MS in Environmental Science from the University of Oklahoma and earned a BS in Meteorology and Minor in Mathematics from the University of Oklahoma.

Lisa Lindemann, Administrator, Ground Water Division, Wyoming State Engineer's Office

Lisa Lindemann is the Ground Water Division Administrator in the Wyoming State Engineer's Office and oversees groundwater permitting, hydrogeologic and groundwater interference investigations, water supply data acquisition, and management of groundwater resources for the State of Wyoming. She has over 30 years of technical experience in mineral exploration, environmental consulting, and water resource management and has recently focused her efforts on conjunctive use of groundwater and surface water as well as groundwater management activities. Recent hydrogeologic investigation oversight includes a study of the

High Plains Aquifer System in Southeast Wyoming (in conjunction with the U.S. Geological Survey) and a current study of hydraulic connection between the High Plains Aquifer and underlying aquifers in Southeast Wyoming. She has also provided expert witness testimony related to water availability within special groundwater management areas of Wyoming, which coincide with the Niobrara Shale play. She is a member of the Wyoming State Geological Survey Advisory Board, the Wyoming Geological Association, and the National Groundwater Association and is a past member of the State Board of Examining Water Well Drilling Contractors and Water Well Pump Installation Contractors, the Wyoming Environmental Quality Council, and the Wyoming Water and Waste Advisory Board. She is particularly interested in issues surrounding water acquisition for hydraulic fracturing, particularly within arid areas, areas under "prior-appropriation doctrine," and areas already experiencing limited water availability. She has a BS in Geology from the University of Wyoming and is a Professional Geologist.

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.

Roger Miller, Groundwater Protection Program, Arkansas Department of Environmental Quality

Roger Miller manages the Groundwater Protection Program at the Arkansas Department of Environmental Quality (ADEQ), overseeing the Ambient Groundwater Monitoring program and providing technical assistance to ADEQ staff and other agencies and organizations. He has 30-

plus years of experience in groundwater resource evaluation. Before joining ADEQ, he was the Geologist Supervisor in the Public Drinking Water program at the Arkansas Department of Health (ADH), overseeing well capture zone calculations and subsurface construction specifications for new wells, GIS analyses and database management, and public outreach in the Wellhead Protection and Source Water Assessment programs. Previously he was a Regional Hydrogeologist for the West Virginia Department of Environmental Protection, assessing effects of surface and underground mining on groundwater and surface water resources. Prior to government service, he spent 13 years in the private sector, holding technical and supervisory positions specializing in applications of borehole geophysics to environmental assessment and mineral exploration, on projects in the United States, Canada, and Australia, and later on RCRA and Superfund projects at various industrial sites and defense installations. He then worked as a project manager for a geological and environmental consulting firm with offices in the eastern United States. Recent research projects include a groundwater quality study of 70 wells and springs in the Fayetteville Shale gas play, presented at the 2012 Fayetteville Shale Symposium, and a previous groundwater study of land application sites in the north central region of Arkansas. He is currently interested in how well siting in relation to natural fracture patterns in bedrock aquifers affects the potential for quality or quantity changes during the "spud" phase of drilling (initial open-hole drilling and surface casing emplacement). He has a BS in Geology from the University of Arkansas and a year of graduate work focused on Geohydrology and Geochemistry.

Austin Mitchell, PhD Candidate, Department of Engineering and Public Policy, Carnegie Mellon University

Austin Mitchell is a PhD candidate in the Department of Engineering and Public Policy at Carnegie Mellon University. In this roundtable, he will share his research experience related to water acquisition for hydraulic fracturing in the Marcellus Shale. His research in this area gives him an understanding about the quantity of water used for hydraulic fracturing and trends in water-use intensity. He has assessed existing and proposed regulatory frameworks for water withdrawal in Pennsylvania and New York, which involved a statistical analysis of the data and methods available to set water withdrawal thresholds. To complete this work, he conducted multiple reviews of water management plans on file with the Pennsylvania Department of Environmental Protection. His research is the subject of a manuscript in preparation for publication. He has a BS in Mechanical Engineering from the University of Dayton and an MS from the Department of Engineering and Public Policy at Carnegie Mellon University.

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.

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.

Ethan Timothy Smith (Retired), Water Resources Division of the U.S. Geological Survey

Ethan Timothy Smith is retired from the Water Resources Division of the U.S. Geological Survey, after 36 years of federal service. Since retirement, he has carried out a program of research and publication in Sustainable Water Resources, often as a member of such professional associations as the Water Environment Federation, the American Water Resources Association (AWRA), the American Society of Mechanical Engineers and others. He is an Associate Editor with AWRA. He has worked for many years in the areas of water resources conditions and trends, interagency coordination, water modeling, and environmental dispute resolution. He holds a BS (physics), Masters of City and Regional Planning, and Doctor of Planning and Policy Development from Rutgers University. He maintains a web site on Sustainable Water Resources at http://sites.google.com/site/sustainablewaterresources. His most recent publication is *Hydraulic Fracturing in the Context of Sustainable Water Management* (with Harry X. Zhang), which was presented at the October 2012 WEFTEC conference of the Water Environment Federation (WEF), and included in the recent WEF report on hydraulic fracturing.

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).

Robert M. Summers, Secretary, Maryland Department of the Environment

Robert Summers was appointed Secretary of the Maryland Department of the Environment by Governor Martin O'Malley on April 28, 2011. He leads the Department's planning, regulatory, management and financing programs to protect public health, ensure a safe and reliable water supply, restore and protect air quality, water quality, wetlands and waterways, clean up contaminated land and ensure proper management of hazardous and solid wastes. He has served the citizens of Maryland for over 28 years in various capacities within Maryland's progressive and nationally recognized environmental programs, with emphasis on scientific and technical issues related to water pollution control, drinking water protection and federal, state and local government environmental laws and regulations. He received his BA (1976) and PhD (1982) in Environmental Engineering from the Johns Hopkins University.

James Thomas, Professor and Executive Director of Hydrologic Sciences, Desert Research Institute

James Thomas is a Professor and the Executive Director of the Division of Hydrologic Sciences at the Desert Research Institute in Reno and Las Vegas, Nevada. He has over 32 years of experience in hydrology, with research focused on ground water availability and quality, groundwater age dating, hydrogeology, and watershed studies. His research projects have included the evaluation of water resource amounts, sources, and management, developing potable water supplies in rural villages of West Africa, and watershed groundwater and surface waters flow and quality. He teaches graduate courses in water chemistry, isotope hydrology, and water development in developing countries. He is a member of the American Geophysical Union, Geological Society of America, International Association of Geochemistry and Cosmochemistry, International Association of Hydrology, Nevada Water Resources Association, Phi Kappa Phi National Honor Society, and The Geochemical Society. He is particularly interested in the issues of the effects of water withdrawals from aquifers and water quality problems related to hydraulic fracturing and drinking water. He has a BS in Geology, a MS in Geology and a PhD in Hydrology/Hydrogeology.

Andrew Wharton, Environment Manager, BG Group

Andrew Wharton is an Environment Manager with BG Group. He has over 17 years of experience in environmental management and is currently leading BG Group's strategic response to water management issues globally. As Group Technical Authority for Water Management, he brings to this role previous experience in working for Severn Trent Water plc in their United Kingdom based strategic planning department and since then, 12 years of working on environmental engineering issues within the oil and gas industry, predominantly with BP and BG. He is based in Houston, Texas and is a Chartered Scientist and Member of the Chartered Institution of Water and Environmental Management. His previous BG Group role was as Manager Environment of the Queensland Curtis Liquefied Natural Gas Project based in

Brisbane, Australia. He has a BSc (Honors) in Physical Geography, an MSc in Environmental Studies and a Diploma in Water and Environmental Management.

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.

Jessica Ennis, Legislative Representative, Earthjustice

Jessica Ennis is a Legislative Representative in the Washington, D.C. office of Earthjustice. She advocates protecting people, our public lands, and the environment from the potentially devastating impacts of oil and gas development. She graduated from the University of Maryland, College Park, with dual bachelor's degrees in Journalism and Government & Politics with a citation in Environmental Studies.

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, 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.

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.