

## **Technical Workshop on Case Studies to Assess Potential Impacts of Hydraulic Fracturing on Drinking Water Resources**

### **Greg Appleton, Corporate Energy Technology Group, Devon Energy**

Greg Appleton works in the Corporate Engineering Technology Group for Devon Energy. He is currently working to assist the operating divisions with well stimulation and completion best practices while evaluating new technology for strategic use within Devon. Additional responsibilities include support for corporate communications technical initiatives and oversight of Devon funded University research and consortium efforts in the United States. Appleton has worked in both geology and engineering roles within the Devon midcontinent, new ventures and corporate divisions. Prior to joining Devon in 2008, Appleton worked at Halliburton as a field engineer for oil/gas well stimulation, cementing, tools and testing. He served as District Engineer for the southeast New Mexico work area and then the global training manager for stimulation, tools and TCP engineers. At the onset of his career, Appleton worked for three years for Exxon as an exploration and operations geologist in Brazil, West Africa, South China Sea and the Permian Basin. Appleton is a licensed Geologist in the state of Texas and also is an active member in the American Association of Petroleum Geologists and the Society of Petroleum Engineers. He attained a MS degree in Petroleum Geology in 1997 from the University of Oklahoma.

### **Sina Arjmand, Graduate Assistant, University of Pittsburgh**

Sina Arjmand is currently a PhD student in the Water Resources Engineering program at the University of Pittsburgh. He is a hydrogeologist with expertise in the fate and transport of contaminants in groundwater, with over six years of research experience in hydrology and water resources engineering. His current research is on evaluation of potential environmental impacts of the unconventional gas drilling activities in Pennsylvania. Arjmand is particularly interested in modeling the environmental water deficit from excessive water withdrawals for the Marcellus Shale drilling activities. Arjmand is a member of the ShaleNetwork team where he is responsible for collecting surface and groundwater quality data on water resources that may be affected by gas exploitation to create an online database. He is also a member of the Environmental and Water Resources Institute, the International Association for Hydro-Environment Engineering and Research, the American Geological Union, and the American Society of Civil Engineers. He also served as a Water Resources Engineering Intern at Paul C. Rizzo Associates where he conducted engineering calculations and designs in hydro projects as well as surface water software verifications and validations. He received his BS in Civil Engineering and MS in Water Resources Engineering where he investigated environmental flows to provide in-stream flow regime requirements against extreme flow variations due to irrigation water withdrawals and dam constructions.

**Bruce Baizel, Energy Program Director, Earthworks**

Bruce Baizel is the Director of the Energy Program for Earthworks. He has participated in numerous state rulemakings in New Mexico and Colorado related to oil and gas exploration and waste management. He has advised local governments on regulation of natural gas in Colorado, New Mexico, Washington, Alaska and Pennsylvania. He is one of three environmental representatives on the board of directors of the State Review of Oil and Natural Gas Environmental Regulations, a multi-stakeholder national organization. He was an appointed member of the Governor's Pit Rule task force for the state of New Mexico. During the past two years, he was invited to make presentations on water quantity, natural gas and hydraulic fracturing issues to the Brookings Institute, American Bar Association national environmental conference, utility regulators in Canada, state environmental agency enforcement personnel from 15 western states, the district attorney association of California and the Colorado Rural Electric Association. Baizel received his law degree and Master's degree in International Relations from the University of Denver.

**Ronald Bishop, Lecturer, SUNY College at Oneonta**

Ronald Bishop has focused on chemical carcinogenesis, cancer biology and biosafety during his 17 years of full-time research, much of it with the National Cancer Institute. Over the last 14 years, Bishop has taught a variety of courses (biology, genetics, general and organic chemistry, biochemistry and environmental sciences) in high schools and colleges. He has taught chemistry and biochemistry at SUNY Oneonta for seven years, and is a nationally certified Chemical Hygiene Officer. Bishop has written and presented widely on technical and policy aspects of the petroleum industry and its regulation in New York. He is the author of several publications, including "Chemical and Biological Risk Assessment for Natural Gas Development in New York" (2011) and "History of Oil and Gas Well Plugging in New York: Is the Regulatory System Working?" (2013). In addition to academic, biotechnology industry and government science experience, Bishop has extensive experience in heavy construction, as a commercial/industrial electrician. Bishop holds a BA in Chemistry from Youngstown State University and a PhD in Biochemistry from the West Virginia University School of Medicine.

**Uni Blake, Environmental Toxicologist, Hometown Energy Group**

Uni Blake is an independent environmental consultant in Otsego County, New York. She is an Environmental Toxicologist who specializes in regulation and compliance issues related to toxic substances in surface and groundwater resources. In serving as a technical consultant to the natural gas industry, she has developed both general and site specific Best Management Practices for Environmental and Community Stewardship, which includes designing and developing Water and Air Quality Monitoring Programs. She has testified in front of the New York State Assembly's Environmental Conservation Committee on the public health implications of shale gas exploration representing Interstate Oil and Gas Association of New York. Her work and research interests include evaluating the relationship between water quality and public health. She has appeared on panels discussing the subject and has written and submitted comments on her findings to regulatory agencies and legislative committees. Her current interest in natural gas development is the use of statistical procedures on ground and surface

water quality data to monitor water quality changes. Blake was appointed to serve on the Otsego County Natural Gas Advisory Committee. She has also worked as an adjunct lecturer in the Environmental Science Department at SUNY Oneonta, teaching Environmental Toxicology and Environmental Risk Assessment. She holds a BA in Chemistry and a MS in Environmental Toxicology from the American University in Washington, DC.

### **John Bolakas, Senior Principal Hydrogeologist, Stantec Consulting Services, Inc.**

John Bolakas, a Senior Principal at Stantec Consulting Services, Inc., has more than 27 years of experience directing and managing the delivery of environmental services to the oil and gas industry. In his position as Sub-Sector Lead, Upstream Oil and Gas, he is responsible for developing strategy and providing technical direction on environmental investigation and response projects related to oil and gas exploration, production and completion. Bolakas is the Senior Principal and Project Director on client confidential projects related to investigating the potential release of hydraulic fracturing and well completion fluids to surface and subsurface media. He has worked closely with experts in industry, chemical analytics, toxicology and data validation to develop methodologies, interpret data and provide technical recommendations for these investigations and response actions. He continues to work with industry clients and laboratory experts to develop an understanding of unique signature chemicals that may assist as reliable marker parameters for these investigations. Bolakas, as Senior Principal Hydrogeologist, provides technical expertise on groundwater and surface investigation and response cases related to stray gas, gas migration and shallow groundwater disturbance. Bolakas is Professional Geologist in DE, FL, PA, TX and WY and is a Licensed Site Remediation Professional in NJ. He has his BA from Franklin and Marshall College, where he majored in Geology, and his MS in Geology from University of Delaware.

### **Craig Cipolla, Senior Completions Engineering Advisor, HESS Corporation**

As a Senior Completions Engineering Advisor, Craig Cipolla provides hydraulic fracturing and completions support to HESS business units worldwide. Cipolla's current focus is the development of unconventional resources. Prior to joining HESS, Cipolla was Chief Engineering Advisor for Schlumberger-Hydraulic Fracture Monitoring and Optimization, focusing on the application of microseismic fracture mapping, complex hydraulic fracture models and reservoir simulation to improve stimulation designs and field development. Before joining Schlumberger in 2009, Cipolla's most recent positions were Vice President of Stimulation Technology for Carbo Ceramics (2008-2009) and Vice President of Engineering for Pinnacle Technologies (1996-2008). Cipolla also held positions with Union Pacific Resources, CER Corporation, and Dresser Titan. Cipolla's more than 30 years of worldwide experience includes the application of microseismic and tilt-meter fracture mapping technologies, the design and evaluation of hydraulic fracturing treatments, tight gas and oil reservoir engineering, integrated field studies, training and supervising stimulation treatments. Cipolla has co-authored over 60 technical papers and was an SPE Distinguished Lecturer on hydraulic fracturing in 2005-2006. Cipolla holds undergraduate degrees in Engineering and Chemistry from the University of Nevada-Las Vegas and a MS in Petroleum Engineering from the University of Houston.

**Isabelle Cozzarelli, Hydrologist, National Research Program, US Geological Survey**

Isabelle Cozzarelli is a Research Hydrologist in the US Geological Survey National Research Program located in Reston, VA. Cozzarelli conducts interdisciplinary long-term research on the fate and geochemical effect of organic contaminants in subsurface environments using a comprehensive, field and laboratory approach in a variety of hydrogeologic environments. Her research is highly interdisciplinary, focusing on the coupled hydrogeological, microbiological and geochemical processes that control the redox potential of subsurface systems and are a fundamental issue in understanding nutrient and contaminant biogeochemical cycles and in protecting drinking water and ecosystem health. The impact of chemical heterogeneity and the availability of electron acceptors on the extent of biodegradation have been a major thrust of her work. Cozzarelli is a USGS Toxic Substances Hydrology Program principal investigator of studies of aquifers and wetlands contaminated with hydrocarbons and landfill leachate, and most recently she is the Team Leader for a new project on the environmental impacts of wastewaters associated with unconventional oil and gas extraction activities. Cozzarelli holds an undergraduate degree in Geomechanics from the University of Rochester and a MS and PhD in Environmental Sciences-Geochemistry from the University of Virginia.

**Timothy Fields, Senior Vice President, Remediation/Hazardous Waste Sites Practice, MDB, Inc.**

Timothy Fields is a national expert on Superfund, Hazardous Waste Sites, Brownfields, Environmental Justice, Worker Training and Emergency Response. He manages a variety of public health and environmental management mission support projects in support of the US EPA, Department of Health and Human Services, the Department of Energy and various private sector clients. He has managed complex site assessment, cleanup, reuse and waste management programs in the public sector (US EPA for 30 years) and the private sector (environmental consulting for ten years) for 40 years. His last position at US EPA was as Assistant Administrator for Solid Waste and Emergency Response (1997-2001), where he provided national direction and oversight of the Superfund toxic waste sites, Hazardous and Solid Waste Management, Brownfields, Underground Storage Tanks, Emergency Management, Technology Innovation and Federal Facilities Site Remediation programs. He graduated with a BS degree in Industrial Engineering from Virginia Tech and a MS Degree in Operations Research from George Washington University.

**Tad Fox, Research Leader, Battelle Memorial Institute**

Tad Fox is a Research Leader and Senior Hydrogeologist in Battelle's Energy and Environmental Solutions Group with more than 23 years of experience in groundwater investigations, characterization and numerical modeling. He served as Battelle's technical project director for American Petroleum Institute performing initial characterization at five retrospective case study areas under investigation by the US EPA for potential impacts to drinking water resources from hydraulic fracturing. He has also conducted internal research on linking the geologic framework of the Marcellus and Utica shale with near-surface water resources, land uses and geographic features. Fox received his BS and MS degrees in Geology from the Ohio State University.

**Lloyd Hetrick, Operations Engineer, Newfield Exploration**

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, Hetrick worked for a super major and several smaller exploration and production operators. Hetrick's 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 its initial Hydraulic Fracturing Technical Workshop series during March 2011. He has a BS in Ocean Engineering from Texas A&M University.

**Christopher Hill, Senior Environmental Engineer, Federal Regulatory and Technical Affairs Department, Chesapeake Energy Corporation**

Christopher Hill is a Senior Environmental Engineer in the Federal Regulatory and Technical Affairs Department at Chesapeake Energy Corporation in Oklahoma City. At Chesapeake, Hill 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 including cases studies. Prior to joining Chesapeake, Hill 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. Hill holds a Professional Engineer license in the State of Oklahoma. He has a BS in Civil Engineering and a MS in Environmental Engineering, and is currently pursuing a PhD in Engineering from North Dakota State University.

**Anthony Ingraffea, Professor of Engineering, Cornell University**

Anthony Ingraffea is the Dwight C. Baum Professor of Engineering and Weiss Presidential Teaching Fellow at Cornell University where he has been since 1977. Ingraffea's research concentrates on computer simulation and physical testing of complex fracturing processes. He and his students performed pioneering research in the use of interactive computer graphics and realistic representational methods in computational fracture mechanics. He has authored with his students and research associates over 250 papers in these areas, and is Director of the Cornell Fracture Group. For his research achievements in hydraulic fracturing he has won the International Association for Computer Methods and Advances in Geomechanics "1994 Significant Paper Award" for one of five most significant papers in the category of Computational/Analytical Applications in the previous 20 years, and he has twice won the National Research Council/US National Committee for Rock Mechanics Award for Research in Rock Mechanics (1978, 1991). His group won a National Aeronautics and Space Administration (NASA) Group Achievement Award in 1996 and a NASA Aviation Safety Turning Goals into Reality Award in 1999 for its work on the aging aircraft problem. He became Co-Editor-in-Chief of Engineering Fracture Mechanics in 2005. In 2006, he won American Society for Testing and Materials' George Irwin Award for outstanding research in fracture mechanics, and in 2009 was named a Fellow of the International Congress on Fracture. TIME Magazine named him one of its "People Who Mattered" in 2011. He holds a BS in Aerospace Engineering from the University of

Notre Dame, a MS in Civil Engineering from Polytechnic Institute of New York and a PhD in Civil Engineering from the University of Colorado.

### **George King, Engineering Advisor, Apache Corporation**

George King is a Distinguished Engineering Advisor in Houston, TX at Apache Corporation. King is a Registered Professional Engineer specializing in well construction, hydraulic fracturing, unconventional resource development and well postmortems, with over 42 years of research and professional experience as a scientist and engineer. He has worked with hundreds of reservoirs and well development projects worldwide. He has written, presented and published documented environmental risk evaluations on hydraulic fracturing and well construction using both industry cooperative data and government data sources that encompass over seven hundred thousand wells from major and minor fields worldwide. He has served on well study forums on nearly every phase of well construction and stimulation and has presented and published 70 papers and book chapters on the subjects. He taught Well Completion and Stimulation (Fracturing) at the University of Tulsa as an Adjunct Professor for 11 years (1988 to 1998). He is a member of Society of Petroleum Engineers, National and Texas Professional Engineers, American Association of Petroleum Geologists, Society of Petrophysicists and Well Log Analysts, National Association of Corrosion Engineers and American Chemical Society. In the area of hydraulic fracturing and drinking water, he is especially interested in: rank of factors impacting well barrier failure (with containment maintained) and well integrity failure (with loss of containment); documented limit factors of hydraulic fracture height growth; and fate of treating chemicals in formations. He has a BS (major Chemistry, minor Physics) from Oklahoma State University, a BS in Chemical Engineering and a MS in Petroleum Engineering from the University of Tulsa.

### **Holly Kneeshaw, Special Assistant to the Commissioner, New York State Department of Environmental Conservation**

Holly Kneeshaw is a Special Assistant to the Commissioner, assigned to the Division of Mineral Resources, Bureaus of Oil and Gas Permitting and Management and Resource Development and Reclamation at the New York State (NYS) Department of Environmental Conservation in Albany, NY. Her most recent work has been related to the analysis and preparation of the Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs in NYS and preparation and processing of associated new regulations. She is a geologist and hydrogeologist with expertise in oil field exploration, groundwater protection and groundwater contamination remediation, development of water supplies for potable and industrial uses and environmental impact review, sand and gravel mining, hard rock mining, technical writing and permitting. She has worked as a geologist and hydrogeologist in the private sector as a consultant with an environmental, landscape architecture and engineering firm (16 years) in Saratoga Springs, NY working for operators and developers in NYS and around the country and as a senior manager with two different agencies within NYS government (11 years). She has worked on natural systems as well as those that have been impacted by industrial activities, especially mining and

well development. She is especially interested in baseline water quality monitoring, produced and flowback water quality, and the chemicals used in hydraulic fracturing. She is a Certified Professional Geologist as recognized by American Institute of Professional Geologists. She has taught at Albany Law School in the area of NYS's State Environmental Quality Review Act regulations for continuing education credits for attorneys. She has a BA in Geology from the State University of New York at Geneseo and attended Kansas State University where she worked on her master's degree in oil field petrology.

### **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) and 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 manages the WOGCC wastewater treatment program, which requires pre-approval of oil and gas operators or contractors who treat wastewater for re-use or recycling. The approval process includes a hearing to review the proposed treatment methods, equipment and sampling/analytical program. Kropatsch acts as the hearing examiner to review the proposed treatment process and prepares orders authorizing the companies to treat flowback or produced waters for re-use, recycling or disposal. He also reviews post-work treatment reports and analytical data to monitor compliance with the WOGCC rules and regulations. Kropatsch is also a hearing examiner for the WOGCC's Class II UIC program. As an examiner, he provides regulatory review and approval of new injection/disposal wells, requested increases in well injection pressure and approval for disposal of new sources of produced water or flowback water into Class II wells. Kropatsch provides technical and regulatory assistance to oil and gas operators within the state on remediation and/or disposal of exploration and production generated wastes, including petroleum contaminated soils, produced water and flowback water. He has a BS in Geology from Oklahoma State University.

### **George Lukert, Chief Project Manager, Ecology and Environment, Inc.**

George Lukert has 21 years of technical and managerial experience in the areas of petroleum and hazardous waste investigations, remedial actions, underground storage tank site compliance projects, carbon sequestration demonstration projects, solid waste disposal facility compliance evaluations, remedial system design and installation, Phase I and II environmental regulatory compliance assessments and subsurface investigations for both federal and private clients. Under Ecology and Environment's Superfund Technical Assessment and Response Team program for EPA Region 10, Lukert is providing key support to a multiyear federal study addressing the environmental impacts of hydraulic fracturing on underground sources of drinking water in southwestern Pennsylvania. The study is being conducted in conjunction with the natural gas industry for an active drilling location in Louisiana. Lukert is responsible for designing and implementing a soil and groundwater monitoring program including monitoring-well installation and sampling as well as soil, sediment, surface water, and domestic well sampling. The effort includes the installation of nested groundwater wells to depths of 1,000 feet below ground surface and the use of horizontal directional drilling to monitor groundwater

conditions beneath the well pad. Lukert also developed the Quality Assurance Project Plan and is providing coordination between federal agencies and private industry. Lukert has a BS in Geology from the Edinboro University of Pennsylvania and a MS in Geology from the University of Idaho in Moscow, ID.

### **Greg Manuel, Senior Staff Completions Engineer, Pioneer Natural Resources**

Greg Manuel is a Senior Staff Completions Engineer at Pioneer Natural Resources. As a completions engineer, Manuel has worked in the Barnett, Fayetteville, Eagle Ford, Edwards Lime, Wolfcamp Shale, North Slope Alaska (Kuparuk, Torok, and Nuiquisit formations), Cook Inlet (Starichkoff and Hemlock formations) and West Texas Permian. Currently, Manuel is also the lead Sustainable Development Engineer at Pioneer. In this role, Manuel studies water recycling, disposal, federal and state legislation, air and other sustainability issues. Prior to Pioneer, he worked as a Senior Operations Engineer at Devon Energy in Oklahoma City, where he completed new wells in the Woodford and Caney Shale play of Eastern Oklahoma. Manuel has worked for Pinnacle Technologies doing microseismic and surface mapping work. From 1998-2002, he worked for ConocoPhillips as a completion engineer in South Texas, Louisiana and East Texas Cotton Valley. He has a Petroleum Engineering Degree from Montana Tech and a MBA from the University of Texas Dallas.

### **Mike Nickolaus, Special Projects Director, Ground Water Protection Council**

Mike Nickolaus has over 30 years of geologic experience, including 20 years as a state regulatory official. He is responsible for the coordination of activities to support state underground injection control programs including project development, presentation preparation, technical document preparation and review and special report development in areas such as arsenic contamination in groundwater, environmental regulations for oil and gas exploration and production and CO<sub>2</sub> geo-sequestration. Nickolaus is the lead staff person for FracFocus. Nickolaus has worked as the Special Projects Director for the Ground Water Protection Council (GWPC) since May 2005. In this capacity he is responsible for development and management of projects related to water/energy issues and underground injection control. Prior to joining GWPC, Nickolaus worked for the Indiana Division of Oil and Gas for nearly 20 years in program enforcement, permitting and underground injection control. In his final two years with the division, Nickolaus served as the state Director of Oil and Gas. Nickolaus received his Bachelor's degree in Geology from Indiana University and has been a Licensed Professional Geologist since 1986.

### **Kathleen Nolan, Regional Director for the High Peaks, Catskill Mountainkeeper**

Kathleen Nolan is a Board-certified pediatrician with training in epidemiology and research design, who has published her work in numerous medical journals, including the *New England Journal of Medicine*, *The American Journal of Public Health* and *Pediatrics*. She works as an independent bioethics consultant and over the past three years has been studying the health impacts of hydraulic fracturing, while serving as Regional Director for the High Peaks for Catskill Mountainkeeper in Woodstock, NY.



**Kris Nygaard, Senior Stimulation Consultant, ExxonMobil Production Company**

Kris Nygaard is the Senior Stimulation Consultant at ExxonMobil Production Company. He is the company's recognized expert on hydraulic fracturing and is responsible for coordinating ExxonMobil's Upstream Fracturing Center of Excellence. During the last 20 years at ExxonMobil, he has held numerous technical and management positions and has extensive background and expertise in unconventional resources, hydraulic fracturing, subsurface engineering and related technologies. In 2009, he became Senior Supervisor of URC's Unconventional Resources - Recovery Section responsible for developing ExxonMobil's next generation completion and reservoir recovery technologies focused on unconventional resources (tight gas, shale gas, tight oil and coal-bed methane) and providing global technical support to business units in the broad area of unconventional resources. In 2010, Nygaard moved to ExxonMobil Production Company to form and lead ExxonMobil's Upstream Fracturing Center of Excellence. In his current role, he is relied upon widely across ExxonMobil for his expertise in stimulation technology and applications to new and existing business opportunities. He holds a BS in Mechanical Engineering, a MS in Aerospace Engineering and a PhD in Mechanical Engineering all from the University of Arizona.

**M. Seth Pelepko, Subsurface Activities Section Chief, Bureau of Oil and Gas Planning and Program Management, Pennsylvania Department of Environmental Protection**

M. Seth Pelepko is the Subsurface Activities Section Chief for the Pennsylvania Department of Environmental Protection's Bureau of Oil and Gas Planning and Program Management. His areas of interest include stray gas migration case work and gas well integrity. He has previously worked as a petrographer and hydrogeologist and received a BS in Earth Sciences in 1998 from the Pennsylvania State University. He is preparing to defend his Master's thesis in Geology at the University of Delaware and earned his Professional Geologist's license in 2004.

**Pete Penoyer, Water Quality Team Lead, Aquatic Resources Branch, National Park Service**

Pete Penoyer is a Hydrogeologist serving as Water Quality Team Lead in the Aquatic Resources Branch at the National Park Service Program Center in Fort Collins, Colorado. He has been with the Park Service 12 years providing technical assistance to parks on surface water and groundwater monitoring and contaminant issues (Comprehensive Environmental Response, Compensation, and Liability Act; Resource Conservation and Recovery Act; Leaking Underground Storage Tank Programs) throughout the United States. Prior to that he worked seven years for the US Army Corps of Engineers Omaha District conducting site investigations, overseeing contractor studies and groundwater remediation projects and representing the Department of Defense on Responsible Party technical committees at current and formerly used defense sites (FUDs). His current work at the Park Service includes participation on interdisciplinary teams in the evaluation of threats to Park resources posed by mining activities and unconventional oil and gas resource development. One of his focus areas the last four years has been on evaluating subsurface risks to water resources and drinking water supplies from the deep underground process of hydraulic fracturing versus stray methane gas migration

(pathways) that have always been a potential threat with conventional oil and gas development. He has presented on this and related topics at the 2012 National Water Quality Monitoring Conference, the 2012 GWPC Stray Gas Migration Forum and the 2011 Marcellus Summit (poster) and has reviewed several high profile case histories through discussions with State Regulators (PA, TX, CO, WY), available published information and conference attendance. Penoyer has an Associate of Science Degree in Hazardous Materials Technology, BS and MS degrees in Geology (Western Kentucky University and Oregon State University) and a Professional Degree in Hydrogeology from the Colorado School of Mines.

### **Peter Pope, Assistant Director of the Site Remediation Section, Oil and Gas Division, Railroad Commission of Texas**

Peter Pope is the Assistant Director of the Site Remediation Section, Oil and Gas Division, Railroad Commission of Texas. Pope has over 20 years of experience practicing hydrogeology and performing risk-based environmental assessments for private industry and public sector clients. Pope 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.

### **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 SRBC has primary responsibility for regulating water acquisition 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, Richenderfer 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 groundwater resources. Richenderfer specialized in the investigation of groundwater and surface water problems associated with petro-chemical manufacturing, materials storage, mining and mineral extraction, municipal and industrial waste disposal and agricultural operations. Richenderfer's academic training includes BS degrees in Forestry (Paul Smith's College), Natural Resource Management (SUNY College of Environmental Science and Forestry) and Geology (Dickinson College). He also holds MS and PhD degrees in Hydrology (Penn State University).

### **John Robinson, Senior Hydrogeologist and Project Manager, Dewberry Engineers, Inc.**

John Robinson is a Senior Hydrogeologist and Project Manager at Dewberry Engineers in Parsippany, New Jersey. He is a geologist/hydrogeologist and Geographic Information System Professional with expertise in fracture flow in bedrock systems and fate, transport and remediation of anthropogenic contaminants in groundwater. He has over 30 years of research and professional experience as a geologist/hydrogeologist. He has worked on subsurface evaluations and remediation of both unconsolidated and bedrock aquifers that have been impacted by petroleum compounds and other industrial activities. After completing his BA in Geology, he worked in the Texas Gulf Coast Onshore Exploration Group for the Louisiana Land and Exploration Company in Houston, and engineering and design support for the Alaska Northwest Natural Gas Transportation Company for Michael Baker Jr. Engineers in Fairbanks. After completing his MS in Geology, he worked as a hydrogeologist for Eckenfelder Brown and Caldwell focusing on fracture flow in bedrock aquifers using borehole geophysics at municipal landfills and large Superfund sites in the northeastern United States. He has co-authored several papers on hydrogeology topics, including the characterization of fracture flow in bedrock and well head protection. In the area of hydraulic fracturing and drinking water, his article "Reducing Environmental Risk Associated with Marcellus Shale Gas Fracturing" was recently published in *Oil & Gas Journal*. He has a BA in Geology from Hartwick College in Oneonta, New York and a MS in Geology from the University of Texas at El Paso.

### **David Russell, Director of Completions, QEP Resources**

David Russell is the Director of Completions at QEP Resources with over 25 years of industry experience including ten years with Dowell Schlumberger and nine years with QEP Resources. He has experience in vertical and horizontal well completions in several tight gas sand and shale areas in the US including: Haynesville, Bakken/Three Forks, Mesa Verde/Lance, Cana Woodford, Granite Wash, Baxter, Mancos and Niobrara. He has a BS in Petroleum Engineering from the University of Missouri-Rolla and a ME in Petroleum Engineering from the Colorado School of Mines.

### **Steve Shost, Research Scientist, New York State Department of Health**

Steve Shost is a Research Scientist at the New York State Department of Health in Albany, New York. For six years he was his Department's technical lead investigating groundwater, surface water, sediment, soil and/or air contamination at several dozen sites including active manufacturing facilities, inactive hazardous waste disposal sites, sanitary landfills, manufactured gas plants and a former petroleum refinery. For the past 12 years he has conducted environmental research projects and health risk assessments with an emphasis on exposure modeling, contaminant transport and source apportionment. He has served on a number of internal and external working groups, including groups to establish Brownfield soil clean-up values, natural resource damage claims, soil sampling protocols, health-based comparison values and cancer incidence maps. Since 2011, he has focused on evaluating the potential for high-volume hydraulic fracturing and related activities to contaminate groundwater, surface water and outdoor air, supporting reviews of New York's Draft

Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program. He earned a MPH with a dual focus in Toxicology and Epidemiology and a PhD in Environmental Health from the University at Albany School of Public Health.

### **Ron Sloto, Hydrologist, U.S. Geological Survey**

Ron Sloto is a Hydrologist with the U.S. Geological Survey in Exton, Pennsylvania. He has worked on a wide variety of water-resource issues in Pennsylvania and the surrounding states. His experience includes groundwater and surface-water modeling, characterization of contaminant transport at Superfund sites, application of borehole geophysics to hydrogeologic investigations, radionuclides in groundwater and development of computer programs for hydrologic analysis. He is the project chief of the Washington County, Pennsylvania, Marcellus Shale study that is part of the US EPA Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources. He has also worked at Marcellus Shale sites in Blair, Cambria, Fayette, Lycoming, Monroe, Pike, Somerset, Sullivan, Tioga and Wayne Counties in Pennsylvania. Ron has published over 80 reports, papers, abstracts and journal articles on water resources, geophysics, geology and mineralogy. He is a graduate of West Chester University.

### **Bert Smith, Senior Hydrogeology Specialist, Regulatory Affairs Group, Chesapeake Energy Corporation**

Bert Smith is a Senior Hydrogeology Specialist in the Regulatory Affairs Group of Chesapeake Energy Corporation. His areas of expertise are groundwater hydrogeology, geochemistry and evaluation of oil/gas impacts to the environment. Smith previously worked for Science Applications International Corporation (SAIC) (or prior affiliated companies) for approximately 25 years, all in the environmental profession and mostly on issues related to oil and gas development and production. His last position with SAIC was as Technical Director of the Shale Gas Group. Prior to SAIC and upon obtaining his graduate degree, Smith worked approximately eight years for Kerr-McGee Corporation in a number of environmental areas (nuclear, chemical, coal, oil/gas), with his last title being Division Geotechnical Coordinator. At Chesapeake and SAIC, he has been actively involved in the geochemical review of over 20,000 pre-drill baseline groundwater samples (culminating in presentations at conferences, with technical papers under preparation). Smith managed the technical aspects of pre-drill baseline sampling conducted by SAIC for oil/gas industry members in several states, and was a technical lead on a comprehensive investigation of a surface release of hydraulic fracturing fluid in NE Pennsylvania. His current research activities include a year-long study of 12 private water wells to determine the variability of methane occurrence in groundwater, and factors that control that variability such as groundwater chemistry, climate, or pumping of wells by landowners. In addition, Smith is a Chesapeake Energy Corporation technical lead on the US EPA's prospective hydraulic fracturing study being proposed at a site in northwest Oklahoma. He is also very involved and a technical lead in reviewing the US EPA retrospective sampling program and associate results. Smith is also active in a number of other technical areas involving evaluation of hydraulic fracturing activities. He recently served on a Oklahoma Water Resources Board

committee to promulgate rules regarding water issues related to mining activities. He holds a BS in Geology and a MS in Engineering from Washington State University.

### **Daniel Soeder, Research Scientist, US Department of Energy National Energy Technology Laboratory**

Daniel Soeder is a research group leader, laboratory manager and scientist with the US Department of Energy at the National Energy Technology Laboratory in Morgantown, WV. His research includes assessment, characterization and environmental studies related to the production of unconventional fossil energy resources such as shale gas, shale oil and tight gas sands, assessments of water resource risks and impacts from hydraulic fracturing, the application of petrophysical data, pore geometry and imaging to oil and gas recovery in low permeability reservoirs and the geological storage of CO<sub>2</sub>. His previous experience includes 18 years as a hydrologist with the United States Geological Survey (USGS) in Delaware-Maryland-DC and on the Yucca Mountain Project in Nevada. His research included groundwater contamination studies, source water protection assessments, streamflow and surface water supply studies and management of a basic hydrologic data collection program. He served three years as chair of the Science and Technical Advisory Committee for the Delaware Estuary Program, which included interactions with representatives of state and local governments, academia and other Federal agencies such as the US EPA, Corps of Engineers, National Park Service and US Fish and Wildlife Service. His recent collaborations with the US EPA and the USGS have focused on preparing cooperative environmental risk assessment plans for unconventional oil and gas at the national level, and specifically focused on the Marcellus shale in the Appalachian Basin. He received his BS in Geology from Cleveland State University and his MS in Geology/Marine Geology from Bowling Green State University.

### **Daniel Stephens, Hydrogeologist, Daniel B. Stephens and Associates, Inc.**

Daniel Stephens is a hydrogeologist with over 33 years of professional experience, including ten years on the faculty at New Mexico Tech where he also was geoscience department chair. Stephens founded Daniel B. Stephens and Associates, an environmental and water resources consulting firm which has over 110 employees with offices in Texas, California and New Mexico. He has significant relevant experience in hydrogeologic systems at the local and basin scale. He has served on numerous peer review panels such as at Los Alamos National Lab, Hanford, Fernald and Yucca Mountain. He recently chaired a team of scientists to evaluate the Department of Energy's Advanced Simulation Capabilities for Environmental Management program. Stephens is the chair of the Scientists and Engineers Division of the National Groundwater Association (NGWA) and is on the board of directors of that association. Stephens provided input to the position paper on hydraulic fracturing developed by the NGWA and he has given lectures on hydraulic fracturing and its applications to water resources to environmental lawyers this past year. He holds a PhD in Hydrology from the University of Arizona, a MS in Hydrology from Stanford University and a BS in Geological Science from Pennsylvania State University.

**Mindy Vanderford, Environmental Scientist, GSI Environmental, Inc.**

Mindy Vanderford is an Environmental Scientist at GSI Environmental, Inc., in Houston, TX. She has technical experience in the environmental risk assessment, statistical analysis and remedy performance monitoring and compliance. Her project experience includes environmental site investigation, human and ecological risk assessment, monitored natural attenuation evaluation and the application of geographic information system tools. She is principal investigator for the MAROS software for GSI and has extensive experience using decision matrices to analyze and optimize groundwater remediation projects. She has developed and conducted classes in Long-Term Monitoring Optimization and statistical analysis for the US EPA, Department of Defense and several state environmental agencies. Vanderford received a PhD in Environmental Sciences and Engineering from the University of North Carolina Chapel Hill and MS and undergraduate degrees from Rice University.

**Avner Vengosh, Professor of Geochemistry and Water Quality, Duke University**

Avner Vengosh 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. He has worked on natural systems as well those that have been impacted by industrial activities, especially mountaintop mining, coal ash disposal and conventional and unconventional oil and gas exploration and development. He has developed new methodologies for monitoring water quality degradation and evaluated environmental conditions at many such sites in the United States, the Middle East (Israel, Jordan, Palestine), Eastern (Ethiopia) and Northern (Morocco) Africa and Southeastern Asia (Vietnam). After completing his PhD at the Australian National University, he was a Research Geochemist in the Israel Hydrological Service, followed by an Associate Professor position at Ben Gurion University in Israel. In 2005 he moved to Duke University where he is a Professor of Geochemistry and Water Quality. His research includes development and utilization of stable and radioactive isotopes (carbon and hydrogen in methane, oxygen, hydrogen, boron, strontium, carbon in dissolved inorganic carbon, radium isotopes) for delineating the magnitude and mechanisms of groundwater and surface water contamination. In the area of hydraulic fracturing and drinking water, he is especially interested in baseline water quality monitoring, the direct impact of shale gas exploration and hydraulic fracturing on water quality, stray gas contamination, produced and flowback water quality and their direct impact on the environment and the potential transport of chemicals used in hydraulic fracturing to groundwater and surface water resources. He has a BS in Geology and a MS in Isotope Geology from Hebrew University in Jerusalem and PhD in Environmental Geochemistry from the Australian National University.

**Norman Warpinski, Technology Fellow, Pinnacle - A Halliburton Service**

Norman Warpinski has worked for 36 years on hydraulic fracturing, in situ stress, geomechanics, natural fracturing, formation evaluation, hydraulic fracturing diagnostics and many other related petroleum engineering and geosciences areas and applications. The first 28 of those years was at Sandia National Laboratories where he performed lab, field, theoretical and numerical studies for the Department of Energy and the Gas Research Institute (now

Institute of Gas Technology); the last eight years have been with Pinnacle Technologies, which was acquired by Halliburton and is now Pinnacle - A Halliburton Service. Pinnacle specializes in hydraulic fracture diagnostics such as microseismic, tiltmeter and fiber optic services, as well as fracture analysis and modeling. Warpinski oversaw and partially developed much of the work flow and software for microseismic monitoring, was a lead investigator in two of the primary research projects on fracturing (the DOE Multiwell experiment and the GRI/DOE M-Site experiment) and has been exposed to the monitoring results of over 15,000 fracture treatments. He has worked in several other consortia, such as the Mounds Drill Cuttings Injection project and the Cotton Valley Hydraulic Fracturing projects. He holds a PhD and MS in Mechanical Engineering from the University of Illinois, Urbana and a BS in Mechanical Engineering from the Illinois Institute of Technology.

### **Ming Zhu, Senior Site Program Manager, US Department of Energy**

Ming Zhu recently served as Senior Advisor to the Director of Homeland Security Advanced Research Projects Agency within the Department of Homeland Security on strategic planning of R&D activities. Since 2010 he has served as the Department of Energy (DOE) headquarters Senior Site Program Manager/Site Liaison for Richland Operations, for the DOE Office of Environmental Management. Prior to that, he established and served as the founding DOE Program Manager for the Advanced Simulation Capability for Environmental Management; managed natural systems testing and modeling work of Sandia National Laboratories and engineering firms in support of the licensing and construction of the Yucca Mountain repository for high level radioactive waste and nuclear spent fuel in Nevada; and led large-scale modeling efforts on a number of Comprehensive Environmental Response, Compensation, and Liability Act and Resource Conservation and Recovery Act sites in the US and similarly overseas for URS Dames and Moore. A licensed civil engineer, he was elected Fellow by the American Society of Civil Engineers in 2009. In 2012, he received the DOE Secretary's Achievement Award. He received a PhD in Mineral Engineering from the University of California, Berkeley.