Session F6: Monitoring for Impacts of Fracking, Session 1

Room C120-122
1:30 – 3:00 pm

0188
F6-1

Unconventional Hydrocarbon Development and the Use of Hydraulic Fracturing – Monitoring for Water Quality Impact

William Kappel

US Geological Survey, Ithaca, N.Y., USA

The development of High Volume Hydraulic Fracturing (HVHF) to release hydrocarbons (gas and oil) from tight bedrock formations along horizontal well bores has grown exponentially in the United States over past several decades. Nearly all the hydrocarbon "Plays" in the United States where the HVHF technique has been used has raised the public's awareness of the process and their level of concern about potential contamination of drinking- water aquifers, streams, and ecologic and human health. To understand potential effects, existing water quality (baseline) must first be documented. Changes in water quality may then be monitored as HVHF is implemented and as the energy resource is produced.

The parameters to be monitored vary by the formation in which the hydrocarbons reside, as well as the formations through which the well bore is drilled. The simplest fluid parameter tests include specific conductivity, total dissolved solids (TDS), chloride, bromide, sodium, and potassium, which can be determined by field meters and colorometric analysis. More complex (and costly) tests include dissolved gases (such as methane) and radiometric measurement of gross alpha and beta emission, if applicable. Additional tests may include trace-element analyses, organic-chemistry chromatography, and isotopic assessment of the produced hydrocarbon(s). The ability of an individual or organization to perform such tests vary by the Play and availability of funding.

In the long run, establishing and disseminating baseline water-quality data along with an understanding of the parameters that best define the chemical, radiologic, and natural hydrocarbon fingerprint of the producing formation can be used to understand the degree of impact of HVHF on the water resources in that region.

0198
F6-2

Continuous Remote Water Quality Monitoring of Headwater Streams within the Marcellus Shale Region of the Susquehanna River Basin

Dawn Hintz

Susquehanna River Basin Commission, Harrisburg, Pa., USA

Approximately 85 percent of the Susquehanna River Basin is underlain by natural gas shales, which includes the Marcellus Shale formation. Only recently has it been economically feasible for natural gas within these shales to be extracted, using large volumes of water through a process known as hydraulic fracturing. Since 2008, more than 1480 well pads (one well pad can have 10-12 wells) have been approved within the Susquehanna River Basin and SRBC has approved over 160 surface and groundwater sources for use in gas extraction. As hydraulic fracturing began in the Susquehanna River Basin, SRBC became keenly aware of the importance of establishing measures to protect the quantity and quality of the water in the basin as it pertains to gas industry activities. Some of the efforts to that end include low flow protection requirements, environmental screening, aquatic resource surveys, and continuous remote water quality monitoring stations.

The Remote Water Quality Monitoring Network (RWQMN) is comprised of 51 remote stations on headwater streams in the Marcellus shale region of the basin; stations are located in a variety of areas including state forests, gamelands, private property, and municipal property. Each station includes a data sonde, data platform, and a solar panel or another power source, and continuously monitors the following parameters: pH, temperature, conductance, dissolved oxygen, turbidity, and relative water depth. These data are collected as frequently as five-minute intervals and are uploaded to a public web site at predetermined intervals via cell or satellite transmission.

Since the RWQMN project was initiated in January 2010, SRBC has been collecting baseline water quality conditions on headwater streams where data have typically been scarce to non-existent. These data are assisting with characterizing and protecting the water resources in the Susquehanna River Basin, and will be an important tool in evaluating the impact of the Marcellus Shale gas industry over the next 5-10 years.

0438
F6-3

Monitoring for Natural Gas Development in the Delaware River Basin: Establishing Baseline Ambient Conditions and Assessing Water Quality Impacts

Thomas Fikslin, John Yagecic, Erik Silldorff, Ronald MacGillivray and Robert Limbeck

Delaware River Basin Commision, West Trenton, N.J., USA

Monitoring and assessment of expected natural gas development activities in the high quality headwaters of the Delaware River Basin are necessary to balance energy extraction activities and water quality protection. Development and adoption of regulations by the Delaware River Basin Commission prior to extensive development activities provided a window for the collection of baseline monitoring data in late 2010 and 2011. The baseline monitoring included continuous conductivity and temperature data, and macroinvertebrate sampling at approximately 100 sites in PA and NY.

For the long-term assessment of these activities, the proposed regulations require monitoring associated with the construction and hydrofracing of well pads including pre-construction, pre- and post-hydrofracing of each well on the pad, and annual monitoring thereafter. Surface water monitoring would be required in nearby tributaries upgradient and downgradient of the pad, and include continuous conductivity/temperature measurements, chemical analyses and macroinvertebrate sampling. Groundwater monitoring is required at a representative number of existing wells and monitoring wells installed prior to construction of the well pad and annually thereafter. Chemical analysis of a representative sample of flowback/production water resulting from each hydrofracing event is also required. The Commission is planning a 150 site regional ambient monitoring network with each site sampled every two years. Macroinvertebrate sampling would occur during the respective index period for each state. Samples for chemical analyses would occur at about ½ of the sites. The current parameter list includes ions, metals, nutrients, radionucleides, methane and selected organic compounds. Other initiatives include the reanalysis of ambient samples collected at Delaware River mainstem and tributaries in 2009 and 2010 as part of the Commission's antidegradation Special Protection Waters program for selected ions characteristic of wastewater resulting from natural gas activities. A study to evaluate the response of standard toxicity testing species in the soft waters characteristic of the headwaters and the potential to use mayfly species more representative of these headwaters in toxicity tests of flowback/production waters is also planned.

This combined monitoring strategy will enable the Commission to evaluate the impact of activities related to natural gas development on the high water quality of these Basin waters.

0453
F6-4

Monongahela River QUEST: A Collaborative Approach to Monitoring Water Quality in the Monongahela River Basin

Melissa O'Neal, David Saville and Paul Ziemkiewicz

West Virginia Water Research Institute, Morgantown, W. Va., USA

The Mon River QUEST is a collaborative water quality monitoring and reporting project for the Monongahela River Basin (MRB), led by the West Virginia Water Research Institute (WVWRI). The program serves to display and manage water quality data collected internally by the WVWRI and through QUEST Volunteer Organizations throughout the Basin.

The Monongahela River originates in north-central West Virginia and flows northward through south-western Pennsylvania to Pittsburgh where it meets the Allegheny River to form the Ohio River. It is 128 miles long and has a drainage basin of 7,340 square miles. Current and historical coal mining within the MRB has impacted the river and caused the levels and concentrations of Total Dissolved Solids (TDS) to rise to near maximum acceptable levels and some tributaries regularly exceed these levels.

Recent exploration and extraction of gas from the Marcellus Shale and soon to be exploited Utica Shale within the Basin put a new and additional stress on an already strained ecosystem. Over 3,000 wells have already been permitted in West Virginia alone. Each of these wells can use several million gallons of water to drill and fracture. The flowback water from these operations can be extremely high in dissolved solids which are very difficult to filter out before disposal.

These new and increasing threats to the water quality in the MRB have led many local watershed organizations to either discuss sampling programs, organizing volunteers, or are already currently collecting conductivity data to measure TDS levels. The Mon River QUEST program provides assistance to volunteers and volunteer-based organizations that need training, equipment, and/or guidance. It also serves as an online GIS-based platform for dissemination of water quality information concerning the MRB. This

publicly available GIS data display provides the public, industry, agencies, and organizations with an easy to understand visualization of the health (in terms of conductivity) of the MRB over a period of time. As gas exploration increases throughout the watershed, water quality changes can be monitored and responses to water quality disruptors can be timely addressed.