

## **Session G6: Monitoring for Impacts of Fracking, Session 2**

Room C120-122

3:30 – 5:00 pm

**0033**

**G6-1**

### **Monitoring Potential Surface-Water Effects from Shale Gas Exploration and Extraction Activities in the Fayetteville Shale of North-Central Arkansas**

Jaysson Funkhouser and Timothy Kresse

*US Geological Survey, Little Rock, Ark., USA*

The US Geological Survey (USGS) Arkansas Water Science Center is collaborating with numerous partners, government and private, to monitor and understand the effects that shale gas exploration and extraction in the Fayetteville Shale have on the water resources in north-central Arkansas. The hydraulic fracturing of one natural gas well in Arkansas can use as much as 6 million gallons of water. Because this area of the State does not have an aquifer that produces a high yield of groundwater, the companies developing the gas use surface water as their main source of water supply for hydraulic fracturing. To “produce” this water, impoundments are built to capture a part of the runoff that occurs during rainfall events. The terrain where these shale gas exploration and extraction activities are taking place in Arkansas is fairly rugged and very sparsely populated. Little infrastructure is available to move equipment from site to site, and no infrastructure is in place to transfer the developed gas to users. As such, the companies have had to build numerous gravel roads to access the job sites and pipelines to transfer the gas to users. These infrastructure projects, coupled with preparing the site with a 5 - 10 acre pad to hold the drilling equipment, have the potential to mobilize large amounts of sediment to nearby streams during rainfall events.

Currently, the USGS Arkansas Water Science Center has installed streamflow gaging stations and continuous water- quality monitors and is sampling streams in the area for suspended sediment to examine the potential sediment runoff and water-use effects on streams. Data from these monitoring activities are also being used by the USGS to compile a watershed model to simulate the possible effects on a major public water-supply stream that is located in the middle of the shale gas exploration and extraction activities. The results of this model will be used by numerous agencies, including the USGS, to assess the cumulative effects of construction of well pads, gravel roads, and impoundments on surface water in north-central Arkansas.

**0096**

**G6-2**

### **Pennsylvania Department of Protection (PA-DEP) Water Quality Monitoring Section, Continuous Instream Monitoring, In Response to Ever Increasing “Deep Well” Shale Gas Drilling Activity**

Dustin Shull and Tony Shaw

*Pennsylvania Dept. of Environmental Protection, Water Quality Monitoring Section, Harrisburg, Pa., USA*

In response to ever increasing “deep well” shale gas drilling activity, Water Quality Monitoring Section staff under the Water Quality Standards Division of Pennsylvania Department of Environmental Protection took lead on establishing 10 portable continuous instream monitoring sites throughout the state, and expanded the existing fixed station Water Quality Network (WQN) to include 10 continuous instream monitors. Both the fixed station and portable monitoring approaches currently seek to establish background stream data where surface impacts from deep well drilling are unknown. However, WQN monitors operated by USGS were placed in larger systems with the intent to gather data over an extended period of time, whereas the portable monitors operated by PA-DEP Monitoring Section staff were configured for smaller systems with the intent gather data for approximately one year. As a result, a self-sufficient and highly mobile monitor configuration along with efficient data management and reporting processes were established. After almost two full years of data collection, reporting, and protocol development, the Monitoring Section staff reports current findings and lessons learned.

**0240**

**G6-3**

### **Assessing Potential Water-Quality Effects on Shallow Groundwater from Unconventional Gas Production in the Fayetteville Shale in Arkansas**

Tim Kresse, Jaysson Funkhouser and Phil Hays

The Fayetteville Shale of late Mississippian age is an active source of unconventional natural gas production in north-central Arkansas. The drilling footprint for this gas production occupies a surface area of approximately 3,000 square miles, and over 3,500 gas wells have been drilled to date in the Fayetteville Shale. The gas-producing zone resides in the lower section of the Fayetteville Shale and ranges in thickness from 50 to 300 feet. Production wells can range in depth across the footprint from 1,500 to 6,500 feet, with average depths ranging from 2,500 to 3,500 feet. News articles and non-reviewed publications have documented known and potential environmental problems related to degradation of surface and groundwater quality. Documented environmental problems normally are found at the surface and include inadequate sediment-control practices, leaking water pipes, and overflowing holding ponds.

Shallow groundwater in this area of the State occurs in fractured bedrock of Pennsylvanian-aged sandstone and shale formations. Numerous households in the area rely on shallow groundwater as a source of domestic supply; for some areas, no other water source is available. Depths of domestic wells range from approximately 50 to 300 feet, with an average of approximately 100 feet. Concerns have been raised by local residents in the Fayetteville Shale production area about the potential threat of hydraulic fracturing to the quality and quantity of domestic well-water supplies, and claims have been made related to problems with production, turbidity, taste, and overall degradation of the quality of water from individual domestic water wells. The USGS has been working in cooperation with counties, State and Federal agencies, private entities, and Duke University to assess shallow groundwater quality in more than 150 wells in the Fayetteville Shale production area. Analyses include major ion and trace metal chemistry, oxygen, hydrogen, and strontium isotopes, and methane gas. All analyses to date are within the range of concentrations listed for historic samples taken previous to 1983 in the area, and methane concentrations were less than 4 mg/L with isotopic analysis suggesting a shallow biogenic source, as opposed to a deeper thermogenic source of methane.

**0300**

**G6-4**

### **Groundwater Quality Assessment in the Central Arkansas Area Overlaying the Fayetteville Shale Gas Play**

Anna Nottmeier<sup>1</sup>, Ralph Davis<sup>1</sup>, Phillip Hays<sup>2,1</sup> and Doug Melton<sup>3</sup>

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Due to a paucity of data and information on domestic water well quality in central Arkansas, an up-to-date spatial groundwater-quality analysis was conducted through the extent of the Fayetteville Shale Gas Play (FSGP). Water samples from approximately 100 wells were collected across six counties. Wells in this area withdraw water from freshwater aquifers that are plagued with extreme variable yields and poor water quality are often impacted by elevated Iron (Fe), Manganese (Mn), total dissolved solids (TDS), Sulfate (SO<sub>4</sub>) and are associated with the local geology.

The aquifers in this region lie within relatively shallow geologic units (generally 0-300 ft) that are not laterally extensive. The aquifers are comprised of fractured sandstones, siltstones, limestones, shales, karstic limestone, and dolomite aquifers. Comparison of geology and water-quality data collected shows a distinct relation between groundwater-quality and the geology of the region. Wells located in sandstone formations have extremely low TDS, but because of Fe being a dominant cation and very reactive there is an issue with Fe precipitating when oxidized. The shale formations show high concentrations of Fe, Mn, and TDS.

The purpose of this study is to establish a spatially distributed data set for domestic water wells throughout the FSGP in central Arkansas, defining background groundwater-quality across this geologically heterogeneous area. Residents in central Arkansas have expressed concerns about the potential impact the extensive development and extraction of natural gas may play on their well water quality. Complaints over the FSGP, from many water well owners, allege that their wells water quality has already been negatively impacted. The data collected will help to address concerns by providing a water quality basis to which complaints can be compared and resolved.