

## MEMORANDUM

TO: Public Record for the 2008 Effluent Guidelines Program Plan  
EPA Docket Number EPA-HQ-OW-2006-0771 ([www.regulations.gov](http://www.regulations.gov))

FROM: Carey A. Johnston, P.E.  
USEPA/OW/OST  
ph: (202) 566 1014  
[johnston.carey@epa.gov](mailto:johnston.carey@epa.gov)

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SUBJECT: USGS Meeting Minutes (Reston, Virginia, 9 August 2007)

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The U.S. Environmental Protection Agency (EPA) met with representatives from the U.S. Geological Survey (USGS) to discuss data sources that may be of use to EPA's coalbed methane (CBM) study. Mr. Carey Johnston, EPA, provided a brief overview of the study. Table 1 lists the meeting participants.

EPA's Office of Water is conducting a study of CBM produced water to determine whether effluent limitations, guidelines, and standards (ELGs) are required for this industry. Currently, CBM discharges are not covered by the Oil and Gas Point Source Category. Because CBM extraction is relatively recent, EPA did not consider this activity during its development of the Oil and Gas Extraction ELG.

EPA is conducting site visits and stakeholder meetings in basins with active CBM development to obtain information about CBM production in each area. The basins included in the site visit program are:

- Black Warrior Basin (Alabama);
- Upper Appalachian (southwestern Pennsylvania, southeastern Ohio, and northern West Virginia);
- Lower Appalachian (southwestern Virginia and southern West Virginia);
- Powder River Basin (Wyoming and Montana);
- San Juan (Colorado and New Mexico); and
- Raton (Colorado and New Mexico).

EPA is meeting with industry representatives and local government agencies to assess publicly available sources of information relevant to the study and to solicit comments on the topics that will be covered in the CBM ICR (industry survey).

Mr. Johnston noted that EPA is aware that the economics and environmental impacts of CBM production are highly dependent on the location of the CBM development and the surrounding ecosystem. EPA will use a discounted cash flow model to evaluate the economic impact of any potential regulations. In addition, EPA can define specific standards by basin account for regional differences.

USGS personnel had concerns about the environmental impacts of CBM discharges. Mr. Jim Otton noted that CBM discharges in the Powder River Basin will have a much greater hydrologic impact than discharges in other areas. Ms. Brenda Pierce asked if soil chemistry issues could be included in the analysis and noted that produced water quality will change over the life of the well. Mr. Johnston stated that EPA would like to define parameters for proper use of produced water to minimize environmental impacts. Mr. Mark Engle asked if EPA was considering impacts on groundwater. Mr. Johnston replied that this study focuses on surface water discharges and their effects. Mr. Otton stated that in the Powder River Basin there are several thousand impoundments which can infiltrate into the ground. Mr. Johnston stated that EPA will evaluate some non-water quality impacts during the study which would include impacts to groundwater aquifers. Mr. Otton noted that studies have shown dramatic changes in total dissolved solids (TDS) in groundwater monitoring wells near CBM development. Mr. Otton will provide contact information for these studies.

Mr. Peter Warwick asked if EPA has coordinated with the fracturing work done in the Black Warrior Basin. Mr. Johnston stated that he has been in touch with the EPA office responsible for the hydraulic fracturing studies. Mr. Allan Kolker asked if CBM discharges would have to meet drinking water standards. Mr. Johnston stated that discharges do not have to meet these standards.

USGS personnel presented information from several of their on-going projects related to CBM produced water. The presentation slides used during the meeting are in Attachment 1. The remainder of this memorandum summarizes the information presented.

#### CBM Produced Water U.S. Gulf Coast Studies (Peter Warwick)

Mr. Warwick presented an overview of studies USGS is conducting in the Gulf Coast Region. There are approximately 50 CBM wells in northern Louisiana of which about 25 are producing. Southwest Energy is moving into the area so there may be an increase in drilling. The wells are drilled into the Wilcox coal formation to depths of 2,500 to 5,000 feet. The wells are drilled into areas that contain saline water which is believed to form through halite dissolution. All produced water from wells in this area is re-injected. USGS is trying to better understand water chemistry in this area. They are seeing a lot of microbial activity associated with methanogenesis in brinish waters and

are studying the water systems to determine how the different constituents contribute to methane formation.

#### CBM Produced Water Quantities and Major Chemistries (Jim Otton)

Mr. Otton described current CBM production in the U.S. and provided information on pH and TDS in the various basins. He suggested that EPA will need to consider the range of water quality in each basin for their study. Mr. Otton stated that water quality is typically 'fresher' near the recharge zone of an aquifer. Water quality may also vary within a particular basin. The San Juan Basin has highly variable water quality. In the Uinta, there are three major producing zones – each with different water quality.

#### CBM Produced Water and Human Health (William Orem)

Mr. Orem presented results from a USGS study of organic compounds in CBM produced water. The results of the study were recently published in Applied Geochemistry, "Organic Compounds in Produced Waters from Coalbed Natural Gas Wells in the Powder River Basin, Wyoming, USA" (DCN 05185). This work was part of a larger study of the effects of organic compounds from energy resources. USGS plans to begin studying trace inorganics in produced water next year.

The purpose of the study was to determine the potential human and environmental effects of organic compounds derived from coal by analyzing the concentrations and distributions of organic chemicals in produced water from Powder River Basin (PRB) wells. Studies have shown that there are higher rates of Balkan Endemic Nephropathy (BEN), a kidney disease, in communities that are drinking water from wells in coal seams. These communities also have high rates of renal/pelvic cancer. The higher disease rates seem to correlate to water supplies in low-rank coal seams which have a higher concentration of organic contaminants. Lower rank coals contain more contaminants since they contain more heteroatoms such as sulfide and nitrogen which make the toxic organic compounds more mobile. The Powder River Basin is a low rank coal seam.

Mr. Orem presented an overview of the results from this study. Produced water samples were collected from 18 wells in 2001, and 16 wells and one discharge pond in 2002. The samples were analyzed by gas chromatography/mass spectrometry (GC/MS) for organic compounds. Compounds of interest to the study included polycyclic aromatic hydrocarbons (PAHs), heterocyclic compounds, aromatic amines, phenols, and other aromatic and non-aromatic compounds. The compounds detected by USGS in PRB produced water were similar to organic compounds found in the Balkans and other areas with high BEN and cancer rates. Although organic compounds were detected, they were detected at low concentrations ( $\mu\text{g/l}$  and  $\text{ng/l}$ ) which likely preclude any acute effects. Chronic, low-level health effects are unknown.

EPA asked if there were any studies of PAH concentrations in surface waters. Mr. Orem said that because PAHs are hydrophobic, they will likely adsorb to particulate matter and settle in stream beds.

### Other USGS Projects

USGS personnel noted that they are involved in another project that is studying in-situ degradation of coal to produce methane. Water is required to keep the methanogenesis process working. Because surface water injection could introduce microbial and chemical contaminants to the underground environment, CBM produced water is the preferred water supply. Their study is looking at the effects of re-injecting CBM produced water into the well to stimulate methanogenesis and therefore increase the amount of methane produced in the coal seam. They have developed a bioassay to compare the degradation of different coals and hope to determine what part of the coal is being biodegraded to produce methane.

### USGS Data Sources

USGS has a produced water database, generated from Bureau of Mines data, that contains produced water quality data from conventional oil and gas wells. The database contains over 57,000 data points from the 1950s through 1970s. They are also working on developing a CBM data center to consolidate information on CBM.

### Additional Discussion Topics

1. EPA asked if USGS knows what information operators are using to determine if resources are technically recoverable. USGS said the major oil and gas companies will have geologists on staff that can use publicly-available data to understand formation geology and chemistry and then assess where CBM recovery would be economical. USGS conducts resource assessments to investigate technically recoverable resources but the resources may not be economically recoverable. USGS said they have state-based water science centers which may have CBM information. The USGS Web site has links to the state centers.
2. USGS recommended contacting state oil and gas boards to determine operators in each region. They noted that some states may not distinguish CBM wells from conventional oil and gas wells. USGS also recommended the Appalachia Petroleum Technology Transfer Council (PTTC) and West Virginia Geological and Economic Survey (WVGES) (<http://www.wvgs.wvnet.edu/>) as possible data sources.
3. EPA asked if USGS knew of any CBM production in Alaska. USGS stated that they did not think there is any production because of difficulty transporting gas from Alaska to users in the lower 48. Although resources in Cook Inlet have been investigated, there is no production.

Next Steps/Action Items:

1. Mr. Otton will provide contact information for studies that show changes in TDS in groundwater monitoring wells in the Powder River Basin.
2. Mr. Warwick will provide a copy of the Alaska CBM resource report.
3. EPA will review information on USGS's Web site on the state water science centers. The water science centers may have information on CBM produced water quality and receiving stream water quality. USGS will provide a contact for the Wyoming data.
4. EPA will review the Appalachia PTTC and WVGES Web sites.
5. Mr. Jim Coleman will act as the point of contact between USGS and EPA.

**Table 1. USGS Meeting Participants  
Thursday, 9 August 2007**

<b>First Name</b>	<b>Last Name</b>	<b>Organization</b>	<b>Phone Number</b>	<b>Email</b>
Carey	Johnston	EPA	202-566-1014	johnston.Carey@epa.gov
Don	Anderson	EPA	202-566-1021	anderson.donaldf@epa.gov
Brenda	Pierce	USGS	703-648-6421	bpierce@usgs.gov
Jim	Coleman	USGS	703-648-6400	jlcoleman@usgs.gov
Peter	Warwick	USGS	703-648-6469	pwarwick@usgs.gov
Jingle	Ruppert	USGS	703-648-6431	lruppert@usgs.gov
Bill	Orem	USGS	703-648-6273	borem@usgs.gov
Mark	Engle	USGS	703-648-6454	engle@usgs.gov
Allan	Kolker	USGS	703-648-6418	akolker@usgs.gov
Jim	Otton	USGS	303-236-8020	jkotton@usgs.gov
Betsy	Bicknell	ERG (contractor to EPA)	703-633-1612	betsy.bicknell@erg.com
Lori	Weiss	ERG (contractor to EPA)	703-633-1658	lori.weiss@erg.com