

## **Coalbed Methane Research**

### **DE-AP26-06NT02045**

#### **Goal**

The project encompasses several tasks related to coalbed natural gas (CBNG) and produced water. The objectives of the first task are 1) improving the efficiency and reducing the cost of managing produced water from CBNG production for beneficial use and 2) conducting technology transfer to industry and regulatory agencies.

The objective of the second task is to develop a total maximum daily load (TMDL) model for the allocation of discharges based on environmental standards and measures in California.

A third goal is to conduct a technology exchange workshop in China that summarizes the technical and applied aspects of selected current technologies used in U.S. coal basins for the exploration, drilling, and development of CBNG and coal mine methane (CMM) resources.

#### **Performer**

Arthur Langhus Layne LLC, Tulsa, OK

#### **Results**

Work continues on all tasks, and the work is being reviewed by several interested parties. Major deliverables will be completed this year.

#### **Benefits**

Cost reductions will be achieved by enhancing the infiltration option for CBNG operators to evaluate. If the use of unlined infiltration ponds is a widespread option available across the Powder River basin (PRB), CBNG operators will be able to evaluate and utilize this option and not be limited to costly options such as deep injection and water treatment. The research will document current usage of infiltration ponds. The hydrogeological conditions at selected ponds will be characterized and numerical modeling performed to document the water budget of the ponds at various locations throughout the PRB. Geochemical modeling will also be used to forecast the future functioning of the ponds, given their current character. Fate and transport models will be run to forecast the changes in bedrock and percolating water as infiltration proceeds. Modeling results will be compared with published hydrogeological data and geographic information systems (GIS)-derived spatial relationships of natural parameters to forecast the potential magnitude of CBNG infiltration pond development. Modeling results will be collated to suggest risk-based regulatory limits for pond placement, construction, and reduction of potential impacts to soil and water resources.

The development of a TMDL model for allocation of discharge will be very useful to the industry and regulatory agencies in California in their efforts to maintain oil and gas production but effectively minimize environmental impacts. The development of an allocation model for TMDLs will address the diverse concerns of stakeholders: health, environment, industry, land use, regulatory, interest groups, local economy, and cost issues.

The workshop in China will allow the Chinese government and industry to apply the best technology to the development of their resources.

#### **Background**

The PRB CBNG play is one of the most rapidly expanding gas plays in the United States. Since the late 1990s, more than 12,000 CBNG wells have been installed that produce in excess of 25 billion cubic feet of gas per month. Associated with the production of natural gas from PRB CBNG wells is the production of large volumes of variable-quality produced water that must be managed appropriately. The CBNG industry has struggled to find economic means of managing the produced water in an evolving regulatory environment. The rapid expansion of the PRB CBNG industry has led to a reactionary environment where produced-water management regulations and

monitoring guidance are being developed as a result of limited monitoring data and limited investigation into the duration and extent of these changes.

Infiltration systems and impoundments are being used across the more heavily developed Wyoming portion of the PRB as means to economically manage produced water. These systems typically comprise unlined on-channel dams or off-channel pits that retain produced water and allow it to infiltrate into the subsurface. Infiltration systems in their simplest form (unlined pits or dammed drainage ways) are an inexpensive means to prevent water from directly discharging into surface waters, allowing the water to evaporate or infiltrate into the subsurface. Regulators and citizens groups have expressed concerns as to the fate of infiltrating produced water.

### **Summary**

The contractor will finalize a guide document on the topic of CBNG impoundments—the technologies, impacts, and alternatives. To date, ten impoundments have been investigated in the field by the research team through the use of geotechnical borings, monitoring wells, subsurface and airborne geophysics. Additional impoundments have been analyzed based on monitoring reports submitted to regulatory agencies. The subsurface investigations have yielded signs of water infiltrating beneath the impoundment resulting in changes to the chemistry of the water within the groundwater aquifers. There has been little evidence to indicate the changes would result in violations of state water quality standards. The impoundments which were classified as in-channel features showed impacts to the alluvial aquifer and changes in water quality that resulted in improved water quality. However; based on data analyzed under this project and collected by other CBNG operators, as time goes on, water quality for both in and off-channel impoundments is expected to be returned to pre-existing conditions. Documentation is being assembled on these impoundments to documenting the research to date on fate and transport of infiltrating CBNG water.

The TMDL work continues as interviews with the industry proceed and information is added to the model research.

A technology exchange workshop that summarizes the technical and applied aspects of selected current technologies used in the U.S. coal basins for the exploration, drilling, and development of CBNG and CMM resources will be held in Shanxi, China, in April-May 2007. Materials are being translated for the workshop.

### **Current Status (July 2007)**

The project is in the fourth quarter of its project period and progressing normally.

### **Funding**

This project is a sole-source contract as a follow-up to DE-AD26-03NT30489 and was awarded under a MOBIS contract.

**Project Start:** March 30, 2006

**Project End:** December 31, 2007

**Anticipated DOE Contribution:** \$245,000

**Performer Contribution:** none required

### **Contact Information**

NETL – Rhonda Jacobs ([rhonda.jacobs@netl.doe.gov](mailto:rhonda.jacobs@netl.doe.gov) or 918-699-2037)

ALL Consulting – Dan Arthur ([darthur@all-llc.com](mailto:darthur@all-llc.com) or 918-382-7582)