

Western Research

INSTITUTE

Coal Bed Methane Produced Water

—Solutions for disposal, treatment and management

www.westernresearch.org

Western Research Institute

Western Research Institute (WRI) is uniquely situated to provide high quality technical services to government and industry clients. Carrying the analytical and research capability of a university, WRI focuses on applied studies, technology development, and resolution of real world problems.

Issues Facing the CBM Industry

Extraction of coal bed methane (CBM) can create large volumes of produced water that is unfortunately discharged directly into drainage channels or used for irrigation. Produced water has the potential to cause serious problems with the salinity and sodicity of soils and decreased crop productivity. This is a major concern for all parties in the CBM industry, including producers, regulatory agencies, and land owners. Producers can be faced with significant liability for the long-term consequences this discharge may have on productive cropland.



Practical Strategies to Address CBM Produced Water

WRI approaches CBM water management from a multifaceted perspective. Our goal is to determine the best solution for a particular situation that balances producer, landowner, and environmental interests. For example, WRI analysis of water and soil chemistry and laboratory-scale tests of the interaction between the constituents enables stakeholders to choose the most suitable management strategy for land application and suitable treatments. In addition, our simulation studies in the lab under the controlled conditions can speed natural weathering processes and provide stakeholders with long-term data in months instead of years. Such information is critical for the industry to build a scientifically sound “defensive database” for the industry to be in compliance with regulatory policies of today and tomorrow.



What Liabilities Exist During and After Irrigation with CBM Water?

Ultimately, each contract between the industry and the landowner will end. The questions at that time will be whether there will be any negative impacts on the landowner's crop productivity in the future and what is the industry's potential long-term liability created by applying CBM produced water to the land for years.

Pretreatment Technologies

WRI has experience testing and evaluating innovative pretreatment processes for removal of organic constituents in produced water. We have found that techniques such as chemical oxidation and adsorption can significantly enhance the efficiency and reduce cost for contemporary CBM water treatment technologies, such as ion exchange and reverse osmosis.

Field and Laboratory Evaluations

Laboratory- and field-scale trials of water treatment strategies, such as mineral amendments, are not new to WRI. We have conducted soil core studies in the lab as well as field evaluations examining ion transport and accumulation through different soil horizons.



These tests include successful evaluations of the effects of CBM irrigation on soil integrity with various methods of mineral amendment application as well as comprehensive soil and water characterizations and field amendment trials. Additionally, WRI has conducted greenhouse studies and detailed analysis of hydraulic conductivity through soil using a flex-wall permeameter in our laboratory.



Contact:

Dr. Song Jin, CHMM
Environmental Remediation & Restoration Program
Western Research Institute
365 N. 9th St., Laramie, WY 82072
Tel: (307)721-2404
Fax: (307)721-2256
Email: sjin@uwyo.edu



How Can a Producer be Released From Liability by the Landowner?

Current Treatment Methods

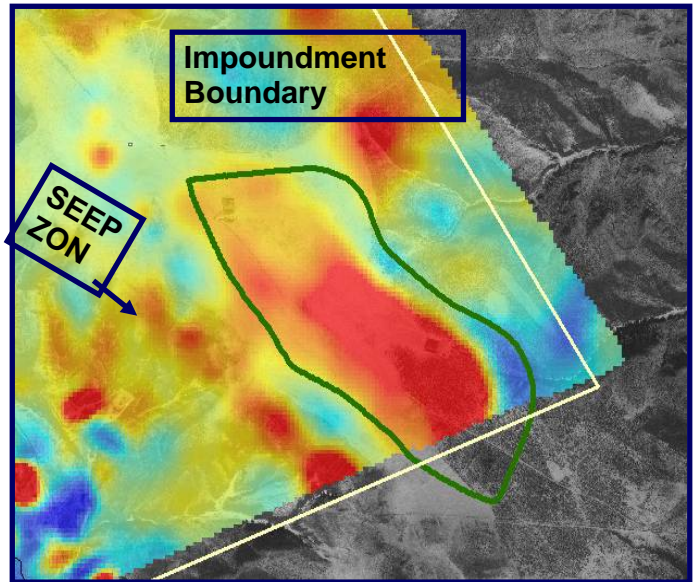
Industry does not have a low-cost method of verifying the movement of salts during and after application of CBM produced water to a landowner's property. The liability issue stated above could remain until such time that it can be demonstrated there are no potential future impacts. These impacts may be to property being irrigated or, potentially, to adjacent property if the salts migrate out of the application area either downward or laterally. The method currently available for verifying salt movement involves collecting numerous soil cores from varying depths at numerous locations throughout a site and characterizing them for important constituents such as Ca, Mg, and Na. The cost of this type of assessment can increase rapidly with multiple drill sites; and, the result is a non-cohesive map of a large area.

Alternative Methods

An alternative low-cost strategy that needs to be employed in treating CBM produced water is remote sensing, which can define conductivity with depth and identify lateral plume movement at a comparatively low cost. Remote sensing methods can measure conductivity profiles and surface chemistry on site using electromagnetic induction survey (EM) and field spectrophotometry technologies. A complete, cohesive assessment of an area is critical to the understanding of vertical and lateral sub-surface salt movement. Such an assessment is also needed for site closure and liability release. Rather than relying on interpolation between 10 to 20 random points from soil core analysis, remote sensing tools collect data continuously over transects on site and produce a cohesive map of the surface chemistry as well as conductivity profiles of an entire area. Therefore, remote sensing geophysical analysis may be the only technique capable of complete site assessment.

WRI Remote Sensing Experience

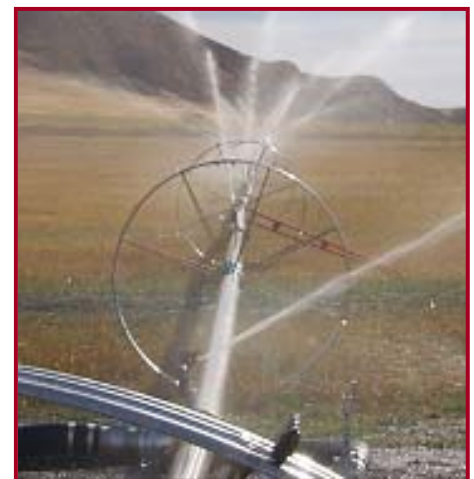
WRI has experience conducting EM surveys and characterizations of in situ soil chemistry using field spectrophotometry and interpreting its data. We believe ground based EM units can also be used to measure conductivity profiles in soil at 1- to 3-foot increments to track vertical salt movement well below the root zone during and after irrigation.



Electromagnetic image taken from an aerial survey demonstrating the ability of EM technology to identify high-conductivity, sub-surface plumes emanating from a CBM holding pond (Courtesy of Ackman et al. 2006 (NETL DOE), Symposium on Western Fuels, Denver, CO).

Technical and Financial Partnerships

Technically, WRI works closely with industry clients to tailor each project, address concerns, resolve problems, and provide maximum benefit. Industry partners can use portions of operating penalties imposed by the Wyoming DEQ (+50% cash) as set forth in the WYDEQ's Supplemental Environmental Projects program for this type of research. This effectively increases industry out-of-pocket contributions for CBM water treatment and management projects.



Let **WRI** help you manage your product water as a resource, not a liability.