

eye on environment



Photo credit: Kirk LaGory

DOE Research Partners

INTRODUCTION

The U. S. Department of Energy's (DOE) Office of Fossil Energy's oil and gas environmental program has agreements with several other federal, state, and non-profit agencies to respond to the environmental needs associated with domestic energy resources. The program develops work initiatives in the areas of water management and also in access to petroleum resources on Federal lands. The activities of our research partners are a part of that activity that will impact those work efforts. Currently, DOE has joint efforts with the Department of Interior's Bureau of Land Management (BLM), the Interstate Oil and Gas Compact Commission, (IOGCC), the Ground Water Protection Council (GWPC), and the Petroleum Environmental Research Forum (PERF).

SYNERGISTIC PARTNERSHIPS - DOE, BLM, IOGCC, GWPC, AND PERF

Environmental protection and economic development of public (Federal) lands in the United States is the responsibility of the DOE and the BLM. Mutual cooperation between these two stewards of national assets results in multiple perspectives, broader areas of consideration and beneficial solutions for the American public.

DOE partners with IOGCC, a 30-state member organization. IOGCC's primary goal is to promote conservation and efficient recovery of domestic oil and natural gas resources while protecting health, safety and the environment.

In conjunction with the GWPC's Research Foundation, DOE focuses on the protection and conservation of ground water. GWPC is a nonprofit organization whose members consist of state and federal ground water agencies, industry representatives, environmentalists and concerned citizens, all of whom come together within the GWPC organization to mutually work toward the protection of the nations ground water supplies. The purpose of the GWPC is to promote and ensure the use of best management practices and fair but effective laws regarding comprehensive ground water protection.

DOE's relationship with PERF is a natural partnership in providing a stimulus to and a forum for the collection, exchange, and analysis of research information relating to the development of technology for health, environment & safety, waste reduction and system security in the petroleum industry.

Research Partners Issue

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This edition of Eye on Environment highlights DOE research partnerships with other federal and state agencies, and non-profit organizations.



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The synergistic value of these partnerships should not be underestimated. Sharing resources (expertise, data, and scientific results/research) saves time, taxpayers dollars and produces excellent results/comprehensive solutions.

DOE's Oil Program Objectives

- To move our Nation toward a reliable, economic oil supply, enhance U.S. technological leadership and protect the environment.
- To promote the domestic oil resources to their fullest potential, contributing to the Nation's energy security, economic growth, environmental quality, and science and technological leadership. A key contributing factor in the success of the oil program is the customer-driven approach to public-private partnerships which contribute to the development of technologies, regulatory streamlining, and policies that support increased oil supplies.

BLM



BLM and DOE have had several cooperative agreements in recent years sharing the mutual goals of working to protect the environment while supporting the Presidents' goal of increasing domestic oil and gas production. Previous issues of the *Eye on Environment* (2002) were devoted to cooperative projects with BLM; air monitoring and wildlife habitat studies (Vol. 7 No. 1), and water handling (Vol. 7 No. 2). Currently joint projects are looking at air, water and habitat impacts in Alaska, Montana,

Wyoming and New Mexico. Two examples show the range of joint research.

Impact Study of Compressor Noise on Passerine Birds for the U. S. Bureau of Land Management

The effect of noise from gas well compressors on breeding bird populations was studied in the Rattlesnake Canyon Habitat Management Area in San Juan County, New Mexico. BLM administers 18,000 active gas wells in the San Juan Basin in an area of 1.5 million acres of land. Large gas-fired compressors (**Figure 1**) are used to increase the efficiency of gas extraction and pressurize gas pipelines on many of the wells in the basin. The noise produced by these compressors has prompted concern for its potential to affect wildlife populations in adjacent habitats.



Photo credit: Kirk LaGory

Figure 1. Large gas-fired compressor used in gas extraction.

The Rattlesnake Canyon study area is a piñon juniper habitat and home to a number of bird species during the breeding season. The survey area was laid out along 400 meter linear transects designed to pick up the range of compressor noise from low to moderate to the well pad site. Forty-six bird species were observed during the study (37 species on control sites and 42 on compressor sites). In general, the number of birds per species and the total number of birds observed tended to be higher on control sites than treatment sites. This frequency appeared to be significant only for one species, the spotted towhee (**Figure 2**). The number of birds per 50 meters of transect decreased with distance from the compressors and was consistent with the pat-

tern on the control sites, and only in the strongest noise zone immediate to the compressors were differences in bird populations observed. The spotted towhees were significantly lower (42% fewer) near the compressors and the numbers of house finches and juniper titmice were significantly higher (71% and 167% respectively) than in the same distance interval on control transects.



Photo credit: Kirk LaGory

Figure 2. Spotted Towhee.

The differences apparently reflect species-specific differences in habitat requirements and tolerance to noise. The results indicate that the effect of noise varies among bird species, but is measurable in areas exposed to relatively moderate levels of noise. The effects of compressor noise on bird populations could be reduced by using noise abatement measures to reduce the noise level.

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Evaluation of Phytoremediation of Coal Bed Methane Produced Water and Waters of Quality Similar to that Associated with Coal Bed Methane Reserves of the Powder River Basin, Montana and Wyoming

The Powder River basin in Wyoming and Montana has emerged as one of the most active areas for coal bed natural gas exploration and development. Coalbed natural gas extraction produces an excess of saline and sodium water as a byproduct. This produced water has the potential to elevate the

saline and sodium levels in the soil, which may decrease agricultural productivity.

The hypothesis of the project is that specific species of plants can function to uptake the excess salts and remediate the saline and sodium conditions (phytoremediation) associated with coal bed natural gas produced waters.

Certain plants, termed halophytes, are salt tolerant accumulators. These species can accumulate high concentrations of sodium and other salts in above ground tissues, and in some cases, excrete these salts through nodes or on leaf surfaces. The best phytoremediation plants are field crops which can be used in rotation or in combination with similar plant species grown in the area. Field crops used for phytoremediation remove the sodium and soda from the soil permanently as they are harvested annually. For the Powder River basin—barley, wheat, sorghum, cotton, and sugar beet are being tested for their use in phytoremediation of saline-sodic soils. The project is also looking at 12 other grasses and shrubs which are specific for sodium-sodic adsorption. These species may grow well in the ranching areas of the Powder River basin (**Figure 3**).



Photo credit: James Bauder

Figure 3. Laboratory tests at Montana State University facilities show plants growing in soils watered with coalbed natural gas-produced water.

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IOGCC



The Interstate Oil and Gas Compact Commission represents the governors of 30 states. These states produce all the domestic oil and natural gas in the United States.

The mission of IOGCC is to provide "an organization of states which promotes conservation and efficient recovery of domestic oil and natural gas resources while protecting health, safety and the environment."

"The governors of our member states have long stood for conservation and environmental protection in the area of domestic oil and natural gas," said IOGCC Executive Director Christine Hansen.

Strategic partnerships with organizations like the DOE are important tools for the IOGCC to accomplish its work, and are of obvious benefit to America's oil and natural gas industry.

"Every barrel of oil or MCF of natural gas, produced domestically meets the nation's growing demand for energy while helping to reduce the need for importing oil."

– Christine Hansen,
IOGCC Executive Director

The closely allied goals of IOGCC and DOE make their working together on environmental and regulatory topics vital. In a recent statement IOGCC Director, Christine Hansen, discussed the value of marginal wells, "Marginal oil wells make up 29% of our domestic oil production – and that's significant." The nation can not afford to plug and abandoned this resource. Speaking of oil and gas reserves on western public lands, Hansen reminded the press that, "Every barrel of oil or MCF of natural gas, produced domestically meets the nation's growing demand for energy while helping to reduce the need for importing oil."

IOGCC, working with DOE, has helped to develop and promote advances in technology that assists industry in extracting oil and natural gas while minimizing the impact on the environment. Speaking on the issue of access to public lands, Hansen said, "No one is arguing for ruining our environment and despoiling wilderness areas. But if we want to maintain our quality of life and make our nation more secure, we have to understand that access to oil and natural gas on public lands is very important."

Distributed Generation Electrical Power Units at Marginal Oil Well Sites

The IOGCC, working with the California Oil Producers' Electric Cooperative (COPE), will demonstrate and evaluate the economic feasibility of using modern Distributed Generation Power Units to create low-cost electricity for powering marginal oil well pumping units in southern California oil producing regions. This innovative distributed generation project will reduce the cost of oil production – thereby extending the economically productive life of critical domestic oil supplies. This project is a DOE PUMP III environmental award.

The primary goal of this project is to boost domestic oil production by 75,000 barrels per day (28 million barrels per year) within the next 10 years. How? By preventing the waste of these valuable domestic oil resources through premature plugging and abandonment, or shutting down of marginal oil wells due to economic and regulatory constraints.

Based on an analysis by COPE, 40 to 60 percent of today's cost of oil production and delivery is the cost of electricity. The objective of this project is to increase oil production by utilizing flare and shut-in gas from California's oil fields to generate valuable low-cost electricity, displacing high-cost grid power. A successful project will extend the productive life of marginal oil wells and thereby aid in reducing our country's reliance on uncertain foreign oil sources.

Project goals include:

- Reduce our foreign trade deficit, and depend-

ence on foreign oil

- Lower unemployment
- Reduce greenhouse gases and NOx emissions
- Generate additional revenues for local, state and federal governments.

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Building Partnerships with Results: Interstate Oil and Gas Compact Commission Multi-State Funding

The objective of this project is to expand a number of ongoing environmental projects in the oil and gas producing states. Projects include technical and training assistance, regulatory streamlining, data management standardization and discussions of regional oil and gas issues. Specific tasks in the project involve:

- Database standardization - improve uniformity of state oil and gas data management systems
- Training - conduct environmental compliance workshops
- Appalachian - Illinois Basin; regulatory efficiency through partnering with agency directors
- Regulatory streamlining - including the identification and elimination of unnecessary duplication of effort between state and federal programs on public lands.
- North American Coastal Alliance - involves the states, and the provinces of Canada that have offshore petroleum in a shared regulatory alliance to identify areas of concern and standard practices for offshore environmental and regulatory compliance.
- Environmental and Technical Assistance - promote development and implementation of risk-based environmental regulation by the states.
- Toxics Release Inventory - coordinate with the Environmental Protection Agency (EPA) to ensure adequate information is available to the public.
- Public Education and Outreach - demonstrate leadership in educating the public about oil and gas exploration and production methods, and the economic value of domestic petroleum, conservation efforts and the benefits to the American public.

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GWPC



"The Ground Water Protection Council is a national association of state ground water and underground injection control agencies whose mission is to promote the protection and conservation of ground water resources for all beneficial uses, recognizing ground water as a critical component of the ecosystem." GWPC provides a forum for communication and research in order to improve the role state and federal government plays in the protection and conservation of ground water. Ground water provides 55% of the population's drinking water, is used to supply the needs of industry and agriculture, and may directly influence the quality of surface water.

GWPC policy elements:

- Prevent ground water contamination
- Promote safe and responsible use of underground injection for waste disposal
- Promote ground water as a resource requiring protection for current and future use
- Promote participation in GWPC by local, state, federal governments and industry
- Utilize academia, industry and government for technical, educational, financial and research support to achieve these policies.

Advancing Technology and Methodology to Streamline Environmental Compliance is a 3 year project conducted by GWPC. This represents a project in which DOE has funded GWPC to provide assistance to State agencies and the oil and gas industry with data management and regulatory streamlining. The development of a Risk-Based Data Management System (RBDMS) is designed for use on personal computers to allow improved data management.

Part of the original funding was for the development of Cost-Effective Regulatory Approach projects. Three main tasks are involved (1) install the

RBDMS in all state oil and gas agencies that want to use the system and provide customized assistance in its use, (2) continue to advance the capabilities of RBDMS, and (3) use peer reviews and a National Forum on Water Re-Use issues to improve regulatory streamlining. A new effort will begin the collection of environmental data on hydraulic fracturing of coal beds.

As of 2002, 18 state agencies were using the RBDMS software to handle a significant amount of all or their data management needs. In addition several states have requested assistance to upgrade the RBDMS utility or to train personnel. Part of the tasks under this project will be to develop a user and administrative manual which will allow agencies to train new personnel and document procedures. New customized updates available include on-line permitting, generic field mapping, inspections and pressure tests, scheduling inspections, improving inspectors time management and data recording, evaluation for taxation purposes, and electronic reporting requirements.

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Cost-Effective Approaches to Enhance Domestic Oil and Gas Production and Ensure the Protection of the Environment provides assistance to oil and gas agencies and producers in individual states to develop environmental risk management practices and to assist in direct implementation. Area of Review (AOR) variance programs will also be established and both large and small producing companies will be assisted in meeting Class II injection well AOR requirements.

Two detailed RBDMS pilots were conducted in the Williston Basin (in parts of Montana, North Dakota and South Dakota), and in the Dorr field waterflood in Kansas. The pilots included a nationwide survey and needs assessment survey, which revealed that 24 states were interested in the RBDMS project and requested assistance. Many states also expressed interest in expansion of the

RBDMS capabilities. This DOE award will allow GWPC to provide assistance and revise the RBDMS format to accommodate the response from the states. States which will be assisted under the award include; Kansas, Oklahoma, Ohio, California, Colorado, Alabama, Texas, New York, Louisiana and New Mexico.

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PERF



“The Petroleum Environmental Research Forum is a research and development joint venture whose members are corporations engaged in the petroleum industry that recognize the importance of a clean, healthy environment and are committed to supporting cooperative research and development”.

PERF provides a forum for members to collect, exchange, and analyze research information relating to practical approaches to science and technology, and the environment in the petroleum industry.

PERF started in 1986 as a multidisciplinary group of scientists, engineers and managers with interests in petroleum and the environment. The PERF members are all volunteers from member companies. An eight member Board of Directors assists in coordination between research and development projects in industry and government agencies. PERF meetings are held quarterly, and representatives from other trade associations and such government agencies as DOE and the National Laboratories are invited to participate. Projects typically have from two to six or ten participants and the actual research work may be performed by a university, National lab, independent contractor or by a PERF member company.

PERF Objectives

- To provide a stimulus for cooperative research and development of technology for the environment, health, safety, waste reduction and system integrity for the petroleum industry.

- To provide a forum to discuss and develop proposals for cooperatively funded projects relating to these areas.

Highlights of several current DOE/PERF projects indicate the range of overlapping interest and cooperation.

Evaluation of Slurry Fracture Injection Technology conducted by Argonne National Laboratory with the participation of ChevronTexaco, ExxonMobil, ConocoPhillips and Unocal. The objective of the research is to evaluate various injection technologies used for disposal of solid oil field wastes. Emphasis is on slurry fracture injection techniques. The project team began with a complete review of the literature on slurry fracture injection and then contacted state officials for information on injection activities and to learn about each state's injection permit practices. **Figure 4** illustrates mixing equipment and an injection well as part of slurry technology designed by Terralog Technologies under a DOE contract.

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Physiologically-Based Extraction Protocol to Determine Bioavailability and Health Hazards of Petroleum Products from Soils to Humans performed by Lawrence Berkeley National Laboratory is designed to investigate the exposure pathway from hydrocarbons in soils to absorption by humans. Exposure to hydrocarbon residues at petroleum-contaminated sites poses a risk to human health by skin absorption and accidental windblown soil ingestion. Exposure may affect long term and expensive cleanup goals at these sites. The research focuses on *in vitro* gastrointestinal protocol in order to quantitatively determine the valid indicators of human exposure to residual petroleum hydrocarbons in soils. *In vitro* work has shown that only a fraction of the hydrocarbons in ingested soils would cross the intestinal membranes and enter the systemic circulation.

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Photo credit: Michael Bruno



Photo credit: Michael Bruno

Figure 4. Injection well (above) and mixing and pumping equipment.

An Ecological Framework to Evaluate Impacts of E&P Releases performed by Lawrence Livermore National Laboratory (LLNL). The goal of the project is to develop and improve methods for ecological risk evaluation and assessments on an ecosystem or ecoregion scale, and to reduce the protocol required at small, remote sites. The specific pur-

pose is to investigate the role of size and spatial distribution of small contaminated sites, and assess their impact on the larger ecosystem.

State and federal agencies frequently require ecological risk assessments (ERA's) to estimate such impacts. The petroleum industry has thousands of sites which may be impacted by the release of petroleum-related products and brines to various degrees, and the ERA's are very complex and time consuming to file, particularly for small independent producers. Many of these sites will be abandoned and, if in remote locations, will not be a risk to human health. The effort of the ERA's may not be necessary at all sites, and such ecotoxicologically based ERA's at each isolated, impacted area may provide a misleading estimate of the impact on populations and communities at larger, more ecologically meaningful scales.



Photo credit: Harvey Payne

Figure 5. Tall Grass Prairie Preserve, OK.

The Tall Grass Prairie Preserve in northern Oklahoma (**Figure 5**) was selected as a representative E&P facility or ecosystem. The protocol will develop the use of GIS for data assessment for E&P sites and greatly facilitate cost-effective means for evaluating ecological impacts within ecosystems.

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EoE features oil- and gas-related projects implemented through DOE's oil and gas environmental research program.

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Upcoming Events/Meetings

May 18-21, 2003, Interstate Oil and Gas Compact Commission (IOGCC), Midyear Meeting, State Leadership in a Global Environment, Williamsburg, VA, www.iogcc.state.ok.us

June 2-4, 2003, Petroleum Environmental Research Forum (PERF), 62nd Quarterly Meeting, Paris, France, www.perf.org

June 5-6, 2003, Powder River Basin Organization, CBM Information Fair, Gillette, WY, www.powderriverbasin.org

September 13-17, 2003, Ground Water Protection Council (GWPC), Annual Forum, Niagara Falls, NY, www.gwpc.org

October 19-21, 2003, Interstate Oil and Gas Compact Commission (IOGCC), The Challenge of Energy Policy, Annual Meeting, Reno, NV, www.iogcc.state.ok.us

November 11-15, 2003, International Petroleum Environmental Conference (IPEC), Houston, TX, www.ipec.ens.utulsa.edu

