Oil & Gas
ENVIRONMENTAL
Research & Analysis Program

Promoting Cooperative Environmental and Regulatory Problem Solving

OIL AND GAS RD&D PROGRAMS

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Can the needs of a vital, growing U.S. economy be balanced with our Nation's commitment to a healthy environment? It is a question which, over the past 20 years, has prompted sharply polarized debate. Nowhere are the issues more pointed than in the domestic oil and gas industry.

To power our economy, the Nation depends on a mix of fuels. However, oil and gas still account for about 65 percent of all energy consumed in the U.S., and over 97 percent of energy in the transportation sector. Fuel is not the only contribution of the oil and gas industry to the economy. The industry employs over 1.9 million people directly, and its expenditures support as many as one million additional jobs throughout the economy. In 1997, oil and gas production activities contributed more than $125 billion to domestic economic activity.

Yet, the economic contributions of the domestic oil and gas industry are being challenged by rising environmental compliance costs. Higher costs could cause valuable oil and gas resources to become uneconomical to produce, potentially raising imports and increasing the trade deficit. Gas supply could be constrained, preventing natural gas from filling its role as the environmentally preferred fuel.

The Department of Energy is working closely with industry, States, and other Federal agencies to stem the rising costs of effective environmental protection and to enable oil and gas producers to operate more efficiently, contributing fuels, jobs, and economic value to the Nation. DOE, together with State officials and leaders from the gas and oil industry, are using the best information and science available to find new ways to address our Nation's environmental concerns. The results of their collaboration demonstrate that the needs of a strong economy and a healthy environment can indeed be fully compatible.

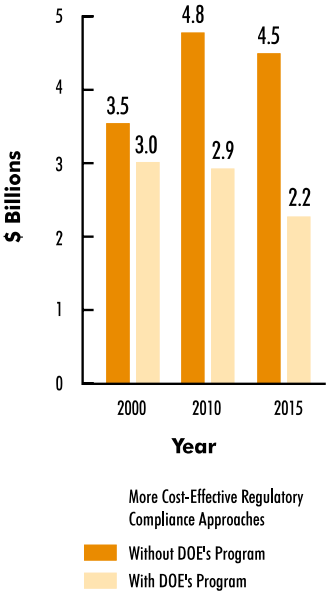
Oil & Gas Environmental Research & Analysis Program

DOE and industry are using the best information and science available to find new ways to address our Nation's environmental concerns.

In recent decades, environmental concerns led to numerous new Federal and State regulations being imposed on oil and gas operations in the United States. Although these regulations provided the framework for many environmental improvements by industry, compliance has become costly and increasingly complex. In 1996, the petroleum industry, including refining, spent as much on environmental protection as it spent searching for new domestic supplies: $8.2 billion or 9 cents for each gallon of gasoline Americans used.

As in other industries, the oil and gas industry has become subject to overlapping, duplicative, and sometimes unnecessary or outdated regulatory requirements. Although these regulations were well-intended, the time has come to focus on implementing regulations with greater flexibility and efficiency, and achieving optimal levels of environmental protection at the lowest possible cost.

Exploration & Production Environmental Compliance Costs are Likely to Rise



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Drilling rig surrounded by ponds and arctophila, North Slope, Alaska. Prudhoe Bay development covers only less than two percent of total surface acreage of the field.

Photo courtesy of BP Exploration (Alaska), Inc.

Government Role

The American public depends on the Federal Government to assure an acceptable level of environmental quality for its citizens. This is demonstrated by the large number of Federal laws and regulations that mandate environmental programs and compliance by industry, States, municipalities, and the populace. The Federal Government also must balance the goals of environmental protection and economic growth, while assuring an adequate supply of energy at affordable prices. Therefore, industry, States, and the public depend on the Federal Government to make environmental regulation cost-effective, and compliance feasible and reasonably economic.

Also, in its role as steward of the national oil and gas resource, the Federal Government has a responsibility to assure economic access to and recovery of that resource consistent with effective environmental protection, to obtain maximum value for the taxpayers. This role includes a responsibility to prevent premature abandonment of oil and gas resources due to environmental costs that do not result in commensurate benefits. Federal environmental, land management, and energy policies must be coordinated and consistent.

Placing Small Producers at Risk

The higher cost of meeting environmental regulations places a substantial economic burden on industry. The burden is magnified by the economically marginal conditions of a large percentage of domestic oil wells, and a growing share of domestic natural gas wells. Over two-thirds of domestic oil wells are classified as marginal, producing, on average, less than three barrels per day, making them highly sensitive to increasing costs. Yet, these wells produce 25 percent of onshore Lower-48 oil and 8 percent of onshore Lower-48 gas, contributing $13.4 billion to the U.S. economy in 1997. Every dollar of stripper well production creates 56 cents in additional economic activity.

Modest increases in environmental compliance costs can cause marginal wells to be plugged and abandoned, permanently cutting off access to oil and gas resources left in the ground. Premature abandonment of wells and forgone exploration and production threaten to increase our Nation's reliance on oil imports, and reduce the supply of natural gas, at a time when its use is being promoted as a key part of the solution to such environmental concerns as acid rain and global warming.

New Approaches to Addressing Environmental Concerns

There has been growing recognition in government and industry of the need for more cost-effective approaches to environmental protection. That realization was the genesis of ONGPT's Oil and Gas Environmental Research and Analysis Program. The National Petroleum Council, at the request of the Secretary of Energy, identified a number of ways that government and industry could work together to meet this need. Among the Council's recommendations were: development of a more flexible policy and regulatory framework; more efficient recovery technologies to reduce environmental impacts; cost-effective, risk-based regulations; and better science, dialogue, and education. These are the goals that define the program's mission.

The American Petroleum Institute (API) has underscored these concerns with a call for “common sense” regulatory development. Unlike approaches that mandate specific technologies or make it difficult to address cross-media impacts of pollutants, common sense approaches would give oil and gas producers more flexibility in determining how they can best meet standards, yielding the same environmental benefits at lower costs.

Common sense regulatory development benefits the environment and the economy.

Such approaches would also apply risk assessment more broadly to determine whether the problems posing the greatest relative risks are being addressed, and to evaluate whether costs of proposed requirements are commensurate with associated benefits. In addition, finding ways of accomplishing public policy goals that are less bureaucratic than traditional methods is also more consistent with the Administration's philosophy of a re-energized, reinvented Federal government.

Industry Issues

- *Drilling waste management*
- *Low-impact operations in sensitive environments*
- *Public lands/leasing*
- *Produced water management*
- *Production waste management*
- *Spill prevention*
- *Remediation*
- *Air emissions*
- *Underground injection*
- *Data management/on-line systems*
- *Risk management planning*
- *Permitting/regulatory compliance advisories*
- *Toxics releases/community right-to-know*
- *Regulatory streamlining*

DOE: Balanced Between Industry and its Regulators

Working with industry, DOE is helping to ensure that environmental protection approaches make technical, environmental, and economic sense. DOE is well-positioned between industry and regulators to champion balanced, cost-effective approaches to environmental protection. DOE's environmental program pursues improvements to the regulatory process, supports development of new technologies, and exercises key responsibilities for energy policies that encourage efficient recovery and ensure adequate, secure energy supplies.

To support more informed regulatory decisionmaking, DOE facilitates dialogue among Federal officials, State regulators, industry personnel, and other stakeholders. Through its program activities, DOE can provide assessments of costs or risks, lending a credible and independent voice to the debate. DOE also characterizes problems and possible alternative solutions, catalyzing and contributing to the process of achieving common sense approaches.

Sharper Analyses, Better Tools

Many times, more cost-effective environmental approaches hinge on the development of new technologies. DOE supports such development, focusing on beneficial technology investments that could not be justified by a single company or small group of companies. Some of these technologies have longer-term payoffs or high risks; others may have widely diffused benefits that a single company cannot capture, but that will accrue to the Nation. For example, an improved, less costly water disposal technology may not save enough to justify the research investment for a single company. However, the nationwide cost savings and environmental benefits would be many times the cost of research and development.

DOE brings unique capabilities to its role, including the scientific capabilities of its National Laboratories and modeling/analysis tools developed specifically to address energy policy questions. A fundamental commitment to outreach and technology transfer – placing information and new techniques into the hands of those who can use them – enables DOE's efforts to generate maximum benefits for the Nation.

Credible Science, Incredible Results

By furthering risk-based, streamlined regulations based on credible scientific information, and by developing lower cost compliance technologies, by 2020 the program could ultimately:

- Decrease cumulative industry environmental compliance costs by over $36 billion;
- Increase oil production by 240,000 barrels per day;
- Increase gas production by 280 Bcf per year;
- Contribute $26 billion in tax revenues to Federal and State treasuries;
- Add as many as 22,000 jobs to the U.S. economy; and
- Increase Federal royalty revenues by almost $8 billion.

Oil and Gas Environmental Research and Analysis Program addresses wide-ranging issues, using a diverse set of strategies and tools.

Strategies and Tools

- *Policy analyses*
- *Legislative/regulatory analyses*
- *Risk assessment*
- *Technology development*
- *Technology transfer*
- *Dialogue, education, outreach, and training*

Transferring Results Nationwide

DOE is currently conducting over 80 environmental research and analysis projects. Some projects are national in scope and others are regional in nature, addressing specific technology needs or environmental constraints. Whether a project is initiated at a single site or in a handful of States, technology transfer is an integral part of the program approach. Once a project proves successful, the program focuses on transferring the results nationwide.

For example, a Risk-Based Data Management System (RBDMS), originally developed for six States, has proven so successful that 25 States have formed a users group to help each other implement the system. Over a dozen States have adopted the system and more are in the planning stage. The RBDMS is a PC-based program that allows States to easily manage their underground injection data and to make risk-based regulatory and operational decisions, such as where to assign inspectors for maximum effectiveness. The system enables States to generate reports quickly for the Environmental Protection Agency and the public.

DOE Role

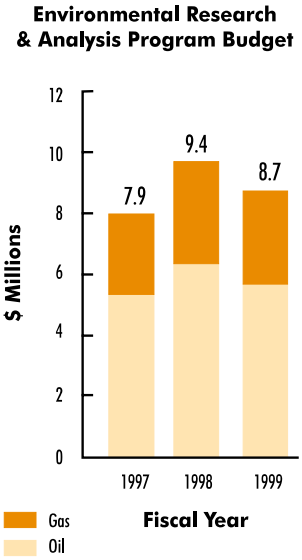
As the Federal Government's repository of oil and gas technology expertise, DOE's Office of Fossil Energy is uniquely situated to provide the information needed by lawmakers and regulators to make informed decisions based on sound science, to develop mechanisms to streamline and improve existing regulations, and to bring an energy policy perspective to oil and gas environmental issues. Fossil Energy also has a role in contributing to the development of lower cost environmental compliance technologies because it has unique technical capabilities and an ability to facilitate collaboration among companies, States, and other institutions.

The contributions Fossil Energy makes through this Federal role include providing unbiased scientific data to regulators and industry to help them make risk-based regulatory, enforcement, and compliance decisions. Both industry and the States, where the majority of oil and gas regulation resides, must spend their limited funds where the environmental risks are shown to be highest.

Data that show areas of high and low environmental risk – either geographically, by type of activity, by environmental setting, or by industry segment – enable regulators to tailor their requirements and enforcement, and industry to direct its compliance activities in ways that make the most effective use of scarce resources.

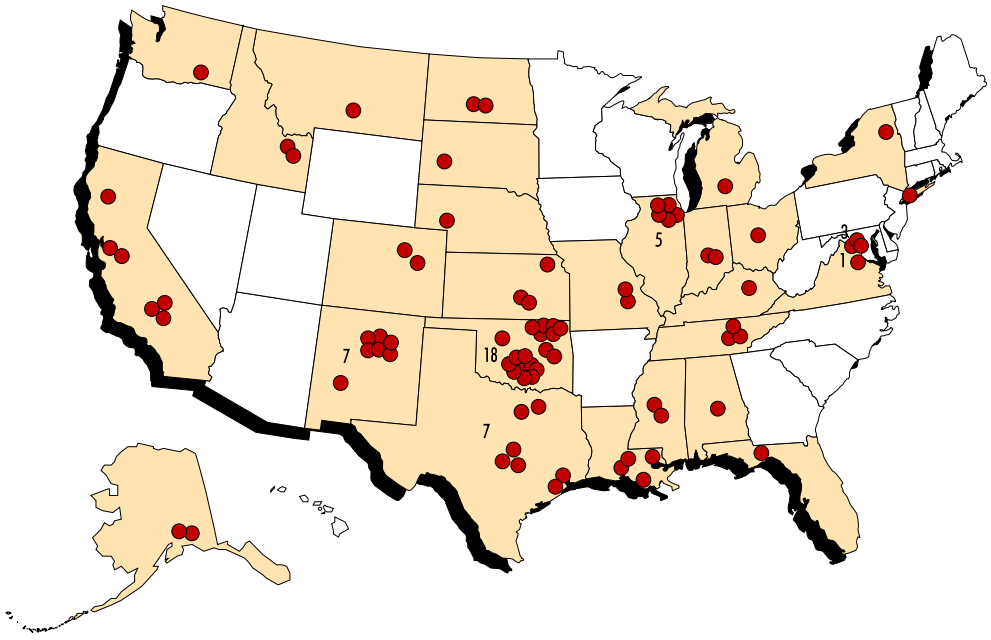
Fossil Energy fulfills this Federal role through a program of environmental risk assessment activities.

Fossil Energy is able to provide a credible, third party source of data and risk analysis because of its expertise in such analysis, and because of its status as an independent, non-regulatory Federal agency. This role is highly valued by Federal and State regulators who need reliable scientific information on which to base decisions, and by industry, whose own data and analysis are sometimes suspect because of their interest in the outcome of regulatory decisions.



Project Sites

More than 82 separate environmental RD&D projects are underway in 26 States.



Drivers

- Need for reliable domestic oil and natural gas supplies.
- Protection for the environment.
- Environmental regulations have raised the cost of exploration and production and have limited access to new resources.
- Future regulations will further increase costs.
- Economic damage resulting from the rising costs of environmental compliance and corresponding decline in U.S. oil and gas production.

Mission

- Maximize the recovery of U.S. oil and gas resources and environmental quality, by reducing the costs of effective environmental protection.

Goals

- Enable industry to reduce compliance costs and improve environmental performance.
- Help State and Federal government make sound regulatory decisions based on good science and common sense.
- Facilitate technology transfer among industry, government, and Tribes.
- Raise public awareness about the need to balance national energy, economic, and environmental objectives.

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Oil & Gas Environmental Research & Analysis Program

Strategies

- Promote dialogue, education, collaboration, and innovative problem solving.
- Work with States and Federal agencies to streamline regulations.
- Develop credible scientific and technical information to serve as the basis for risk-based regulation and compliance.
- Develop new lower cost, more effective environmental compliance technologies.
- Promote and support sound environmental practices by industry.
- Work cooperatively with States, Federal agencies, and industry to reduce the costs of effective environmental protection by 20 percent by 2010.

Measures of Success

- Adoption and implementation of program products.
- Reduction in environmental compliance costs.
- Changes in State and Federal regulations and policies to streamline requirements.
- Improvements in environmental performance of oil and gas exploration and production (E&P) operations.

Developing Lower Cost Environmental Compliance Technologies

FE's role is focused in areas where technology development is conducted to aid future regulatory development. FE provides information on performance and impacts for regulators where DOE can be a catalyst for cooperative efforts that would not otherwise have taken place, for reasons such as antitrust concerns, or because DOE's participation adds needed credibility, and where there is a unique technical capability at our National Laboratories or field centers. Much of this research would not otherwise be conducted because independent producers do not have the expertise or resources to invest in it, and would not individually reap sufficient benefits to cover the expense. However, the economic and environmental return to the Nation as a whole clearly outweighs the taxpayers' investment. In other cases, where the research supports regulatory decisions, the participation of a neutral Federal agency is crucial to the credibility of the effort.

In facilitating dialogue among Federal agencies, States, and industry to address regulatory and policy issues, FE is in a unique position to facilitate discussions and action because of DOE's energy policy role, which provides a balance among energy, economic, and environmental interests, and because DOE does not regulate oil and gas operations and can act as a neutral party.

In performing legislative and regulatory analysis, FE has unique capabilities, through its oil and gas modeling systems, to perform detailed engineering and economic analyses of proposed environmental laws and regulations. These analyses provide decisionmakers with information about the energy and economic impacts of the proposals. FE also brings DOE's unique energy policy perspective to the development of comments and recommendations to lawmakers and other agencies to encourage them to make informed, balanced decisions.

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The Prudhoe Bay region supports the central Arctic caribou herd, which spends most of the nine-month winter south of the oil fields near the Brooks Range.

Photo courtesy of BP Exploration (Alaska), Inc.

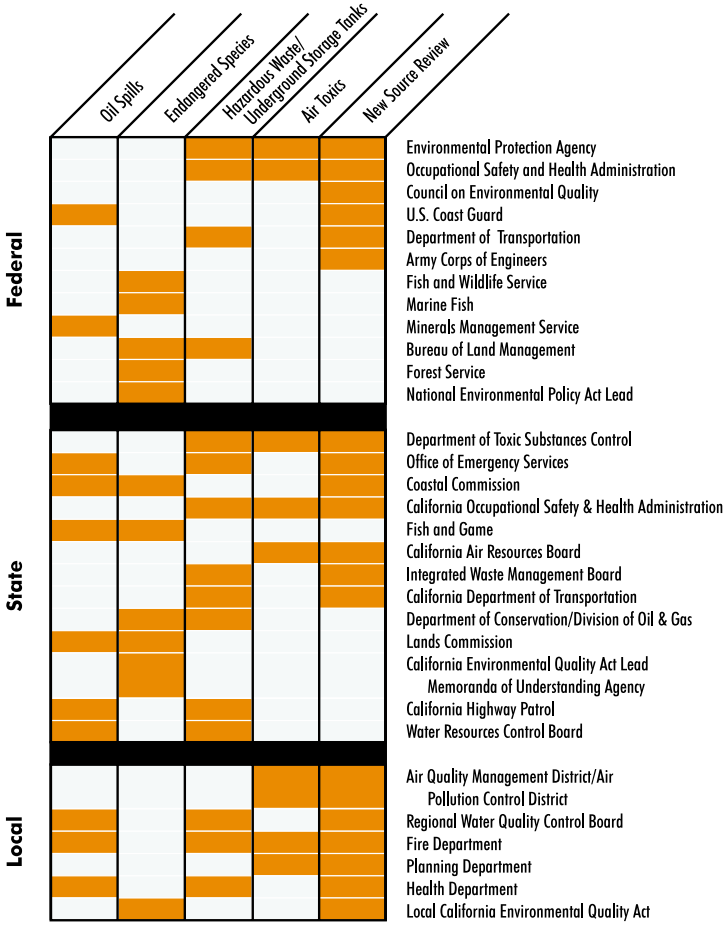
Relation to Other ONGPT Programs

While most of DOE's natural gas and petroleum technology programs are focused on increasing the Nation's fuel supply and enhancing its energy security, ONGPT's Oil and Gas Environmental Research and Analysis Program has been assigned a companion responsibility. It is the overriding goal of this program to ensure that the Nation's energy supply is developed in ways that respect the integrity of our environment and protect the quality of its air, soil, and drinking water.

Every facet of energy exploration, recovery, storage, processing, distribution, and use carries risks associated with environmental impacts. But these risks are often difficult to assess and costly to anticipate. By developing credible scientific and technical information to characterize those risks, and sharing that data with government regulators and industry operators, the program helps to achieve the Nation's energy supply goals, while containing the associated costs of environmental compliance.

In addition, by making use of information developed through its sister oil and gas programs as well as other credible sources, the program attempts to inform opinion leaders and interested citizens about energy-related environmental issues, and promotes collaborative problem solving among different stakeholder groups.

As a consequence, State and Federal regulations affecting the oil and gas industry are not only affording a high measure of environmental protection, but they are also becoming more streamlined and cost-effective.



Operators in California and other States are subject to potential regulatory overlap and duplication when multiple agencies have regulatory jurisdiction.

Success Story

Acting as a Catalyst for Discussion

A good example of a project that has led to increased understanding is a workshop for the development of educational tools for compliance under the Clean Water Act. This effort is led by the NPDES (National Pollutant Discharge Elimination System) Education/Communication/Training (ECT) Workgroup, an ad hoc government/industry group formed in the fall of 1996. The purpose of this Workgroup is to improve communication between NPDES regulators and the oil and gas industry in understanding objectives and methods of water discharge permit compliance. The Workgroup expects that, through its efforts, regulators and industry will gain a better understanding of each other's challenges and obstacles, and that NPDES permit compliance will improve.

The NPDES ECT Workgroup has focused on several areas, including pre-permit activities, permit compliance monitoring and reporting, enforcement activity and options, and treatment technology. Several educational products are being developed, including a list of NPDES education and training resources available to industry and government personnel, and plans are underway for an industry-sponsored Internet web site linked to helpful areas on the Environmental Protection Agency Internet home page. EPA is preparing an informational notebook for the oil and gas exploration and development industry sector, which will include NPDES compliance and monitoring information.

On September 23, 1998, the Workgroup held an NPDES Enforcement Workshop in Houston, Texas. The workshop, co-sponsored by the American Petroleum Institute, brought together industry and government representatives in an open and informative setting. Two EPA instructors presented NPDES inspection and enforcement materials and provided time for questions from workshop participants. Feedback on the workshop was so positive that the NPDES ECT Workgroup is considering another session in 1999.

Trans Alaska Pipeline

Main Program Areas

ONGPT's Oil and Gas Environmental Research and Analysis Program focuses on four elements:

- Building consensus around environmental and energy challenges;
- Regulatory streamlining;
- Risk-based decision-making; and
- Lower cost environmental compliance technologies.

The discussion of the four program elements on the following pages highlights specific program accomplishments and summarizes the range and variety of program activities.

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Building Consensus Around Environmental and Energy Challenges

A core component of all ONGPT Oil and Gas Environmental Research and Analysis Program activities is the collaborative process – the building of trust through sharing of ideas and information, and the hard work of creating consensus, identifying needs, and finding solutions.

Assessing Environmental Trends and Setting Priorities

Policy analysis, technical research, and strategic planning are at the heart of the ONGPT program. Through these activities, environmental issues and technology constraints are characterized to help determine future program directions. Energy and economic impacts of potential legislative, regulatory, and policy initiatives are carefully analyzed. Their findings are provided to government offices and interagency task forces to help inform their decisionmakers. ONGPT also conducts education and outreach activities addressing the industry and the program, and evaluates program benefits and possible alternative program directions.

ONGPT strives to ensure that its program is responsive to the needs of stakeholders. In evaluating potential projects and allocating resources within the program, ONGPT uses key criteria, such as potential compliance cost impact or savings, extent of oil and gas resources affected, environmental benefits, ability to positively influence key industry and government decisions, and geographic balance. To accelerate progress toward reducing the costs of effective environmental protection, ONGPT works cooperatively with States, other Federal agencies, and industry to identify high priority environmental issues and leverage efforts.

Information and Analysis: Raising the Level of Discourse

ONGPT conducts some projects with the express purpose of increasing public, industry, and government understanding of the national situation with respect to energy and environmental issues. Three such projects have been undertaken in collaboration with the Interstate Oil and Gas Compact Commission, an organization representing the governors of the 29 States that produce virtually all our Nation's oil and gas resources.

Simplifying compliance and improving environmental performance involves teamwork.

Success Story

Eliminating Unnecessary Compliance Costs

To protect underground drinking water sources from contamination by subsurface injection, current Safe Drinking Water Act regulations require oil and gas producers to conduct a quarter-mile radius Area of Review (AOR) analysis of disposal and injection wells. Under certain conditions, however, AOR variances can be granted.

With support from ONGPT, the University of Missouri-Rolla developed a methodology that could be used by regulators to validate AOR variance requests. A pilot study of the variance methodology, sponsored by ONGPT and the American Petroleum Institute, was conducted in an East Texas oil field where the oil reservoir lies 3,000 feet below the base of the region's principal fresh water aquifer. The study, which made use of DOE's extensive geological, epidemiological, emissions, and regeneration-related databases, was able to demonstrate that there is little risk of aquifer contamination from underground injection in that particular field. Its finding led the Texas Railroad Commission to approve an AOR variance.

Industry cost savings related to this single AOR variance are estimated at $86 million. Exemption from aquifer protection in Oklahoma's Osage Tribal reserve, where groundwater has never been used because of its poor quality and considerable depth, will allow the Osage to increase their revenue from oil production by more than $2 million a year. Cost savings for industry-wide AOR exemptions in low risk areas are projected to exceed $300 million.

ONGPT has completed work in Texas, Oklahoma, Kansas, and California on developing and implementing systems and data to support the granting of AOR variances or equivalent waivers. At the close of these projects, ONGPT sponsored a workshop for all oil and gas producing States. At the workshop, representatives from all four States explained their projects and provided information and advice to other States on implementing an AOR Variance Program. A written summary of the workshop will be prepared and distributed to all oil and gas States.

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These projects are:

- A study of oil and gas exploration and production waste management in 17 States, conducted in 1993;
- An annual report on the energy and economic importance of the Nation's marginal oil and gas wells; and
- Nationwide studies of idle and orphaned wells, including State and Federal strategies for reducing environmental risk and ensuring more efficient resource recovery, conducted in 1992 and 1996.

As part of the ONGPT planning process, the oil and gas environmental program searches for relevant environmental technologies that may be developed for other industries but can have useful applications in the oil and gas industry. ONGPT even searches other DOE programs for such technologies, particularly those programs that are cleaning up DOE sites where environmental damage has occurred. As part of this effort, ONGPT is working with DOE's Albuquerque Operations Office and Applied Sciences Laboratory, Inc., to evaluate DOE-developed technologies from other programs that can meet oil and gas industry needs.

Virtual Regulation: Using Modeling Systems to Project the Energy and Economic Impacts of Proposed Laws and Regulations

ONGPT has unique capabilities, through its databases and modeling systems, to perform detailed engineering and economic analyses of potential legislative, regulatory, and policy initiatives, including proposed regulations under the Resource Conservation and Recovery Act, Clean Water Act, Safe Drinking Water Act, and mineral leasing statutes. DOE can help States and other Federal agencies to understand the potential consequences of alternative regulatory scenarios, and to ultimately make more cost-effective regulatory decisions. The program also uses its analysis of these impacts to help set priorities for funding and staff activities.

Regulatory Streamlining

Cooperative streamlining efforts focus on: simplifying regulations without compromising environmental protection, and eliminating duplicative, unnecessary, or overlapping regulation. These activities support industry and government priorities of cutting red tape and achieving common sense regulations, as well as congressional efforts to promote regulatory reform. DOE fosters interagency cooperation and facilitates dialogue and partnerships among industry, State and Federal agencies, Tribes, the public, and other affected parties. Regulatory streamlining is a win-win proposition – it reduces costs to oil and gas operators and to regulatory agencies, and promotes a healthy respect for the environment.

DOE works collaboratively with States and other Federal agencies to enhance the efficiency and effectiveness of regulatory programs. DOE has been a longstanding supporter of and participant in IOGCC efforts to improve State programs for regulating the management of oil and gas wastes. These efforts are funded by EPA and involve industry and environmental groups.

A key to more effective regulatory programs is ensuring that industry understands its compliance responsibilities. To improve environmental performance, ONGPT is working with States and industry on:

- Modern, on-line permitting and environmental compliance advisory systems *(www.npto.doe.gov/ecas/main.html);*
- Environmental guidance manuals and compliance handbooks for North Dakota, South Dakota, and Montana, adding to manuals that have been funded in five other States;
- Guidance and workshops for small operators facing new requirements; and
- Workshops that provide a forum for industry/EPA dialogue on compliance issues.

Pre-empting Regulation: Voluntary Safety and Environmental Management Planning

Demonstrating the feasibility of Safety and Environmental Management Planning (SEMP), as an alternative to traditional command-and-control regulation, is the focus of a joint project involving the Department of the Interior, industry, and ONGPT. The American Petroleum Institute and the Offshore Operators Committee developed this innovative planning concept to improve worker safety and environmental protection on offshore platforms. Using SEMP's risk management approach, industry is responsible for identifying potential hazards in the design, construction, and operation of offshore platforms, and for developing specific processes to improve safety and environmental protection. An ONGPT-funded project involving Taylor Energy has evaluated the cost and effort required to implement SEMP by small- to medium-sized operators, who may not have had the extensive environmental and safety expertise of major oil companies. The project has served as a model for other independent operators. This model has become well accepted among these companies, and is estimated to reduce compliance costs by five percent.

State-Based Alternatives to Federal Programs

EPA is considering whether to include the oil and gas exploration and production industry in its Toxics Release Inventory (TRI) program. Doing so would be fraught with difficulties and would be costly to industry. TRI reporting from this industry would yield confusing, inconsistent, and misleading data and would not meet the goals of the TRI program. This is primarily because there are reporting thresholds that many independent oil and gas operators would not meet, or would meet only periodically. As a result, although all operators would have to go to the effort and expense of determining whether they meet the reporting thresholds, only a minority would report each year – independents who had a total of ten full time equivalent employees on site.

In addition, the nature and risks of "releases" from oil and gas operations under TRI can be confusing to the public.

ONGPT, in cooperation with the American Petroleum Institute, is funding a pilot of a State-based alternative approach that the States could adopt instead of TRI. This approach uses software, such as the Risk-Based Data Management System, to take information already reported to the State by operators, and convert it to TRI-style data. All producers who report production to the State are represented; therefore there is a consistent data set from year to year. This data is then placed on the Internet using DOE-funded software, in a user-friendly format, including clickable maps. Also, the web site includes additional information that TRI does not provide, such as descriptions of oil and gas operations and terms, the risks associated with different releases, and State agency contacts for more information. Therefore, it meets the TRI goals of providing easily accessible information to the local community.

Streamlining in Cyberspace: Online Permitting and Reporting

DOE has been working with States to develop on-line systems that would allow producers to look up environmental regulations and requirements, apply for permits and receive approvals electronically, and file required environmental reports via the Internet.

With ONGPT funding, IOGCC developed a prototype web site using New Mexico as a model. The Indiana Division of Oil and Gas has taken that model and developed their own site through which operators can get a range of regulatory information and contacts. Indiana is working on adding an interactive permitting capability, and is offering their software to any State that is interested in adopting it. This software can be adapted to the needs of additional States with a minimum of effort.

Photo courtesy of BP Exploration (Alaska), Inc.

Drilling Pad in Alaska North Slope

Advances in drilling and improved waste management techniques have significantly reduced the land area needed for oil field development. For example 65-acre drill sites of the 1970s have been reduced to 5-acre drill sites today.

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Risk-Based Decisionmaking

There is a new paradigm in thinking about environmental decisions, and DOE is actively promoting it. In the past, both regulators and industry operators based environmental decisions on the technologies available at the time, and what it cost to use them. It was a one-size-fits-all approach to environmental protection, which failed to account for the unique constellation of risks faced by each production facility and often resulted in misapplied resources.

As a remedy, DOE supports risk-based regulatory, enforcement, and compliance decisions. This approach assesses the environmental risks associated with oil and gas exploration and production. It then develops data and tools that foster better, more sharply targeted decisionmaking. As a source of credible scientific data to support risk-based regulation, DOE already has been successful in influencing development of new regulations based on environmental risk, cost, and energy impacts, which have resulted in considerable savings for industry.

Improved Data Management Systems for States and Industry

Through its Underground Injection Practices Research Foundation, the Ground Water Protection Council, with funding from ONGPT, has developed the Risk-Based Data Management System to help State oil and gas agencies and industry with risk-based data management. RBDMS is the only comprehensive, fully relational PC-based oil and gas regulatory data management system in the Nation.

Due to overwhelming acceptance by States and industry, the system – originally designed to manage oil and gas underground injection data – has been modified to also manage production data. In addition, some States are pursuing RBDMS modifications that will include data management for hazardous materials identified through inventories of toxic releases, as well as industrial injection wells. More than a dozen States plus two EPA regions are now using RBDMS to help manage their oil and gas programs. In addition, a “generic version” of the system is being developed that can be fully installed and customized for as little as $20,000. This compares to over half a million dollars spent by each of the first States that implemented RBDMS. In addition, an Internet capability is being added to the system.

Advanced data management techniques help States make better regulatory decisions, improve their use of scarce resources, and gain widespread acceptance. In a related project, ONGPT supports efforts of the IOGCC Data Standardization Committee to inventory State data management capabilities and to identify data requirements for effective State regulation. The same data is also being used to satisfy community right-to-know requirements.

To further the use of advanced data management techniques by the States, ONGPT has sponsored training on geographic information systems (GIS) for State regulatory officials. GIS software is increasingly being used by States to provide easier access to oil and gas data for both State personnel, such as oil and gas inspectors, and the general public. Feedback from the 15 States that attended this training, which was organized by the IOGCC Training Committee, has been extremely positive. Attendees intend to implement or improve GIS systems in their States as a direct result of the training. DOE intends to repeat the training in 1999.

Salting it Away: Analyzing the Use of Salt Caverns for Oil Field Waste Disposal

A key program strategy is to increase the availability of more cost-effective environmental compliance technologies, including environmentally sound waste management methods. DOE commissioned Argonne National Laboratory, in consultation with Sandia National Laboratories, the Texas Bureau of Economic Geology, the Solution Mining Research Institute, and the Ground Water Protection Council, to conduct a study on the potential use of salt caverns for disposal of non-hazardous oil field waste.

Preliminary analysis suggests that salt caverns, which are currently used for storage of crude oil, natural gas, and hydrocarbon products, offer a lower risk alternative to landfill and surface pit disposal of oil field wastes. In examining the proposal's feasibility, the partnership developed computer models to analyze its economic and technical features. That analysis also involved several risk scenarios, including the use of salt caverns for hazardous waste storage, for permanent disposal of naturally occurring radioactive materials, and for associated technical spin-offs.

In response to demand for the practice, a regulatory structure to support cavern disposal is being developed. The Texas Railroad Commission, which regulates the State's gas and oil production, is in the process of developing regulations for cavern disposal. Information from the DOE study will aid in the development of these new regulations. Ten other States, with both oil production interests and suitable salt formations, are following Texas's experience with interest.

Removing Barriers to New Technology Deployment: Synthetic Drilling Fluids

In the early 1990s, synthetic drilling fluids were developed in response to prohibitions on discharge of conventional oil-based fluids and increasing restrictions on discharge of mineral oil-based fluids. Although these fluids may increase drilling efficiency and offer significant environmental and safety advantages, existing regulations are so narrowly constructed that they preclude use of this advanced technology. In 1994, DOE initiated a dialogue involving industry, the EPA, and the Minerals Management Service to evaluate synthetic drilling fluids and to eliminate any unnecessary regulatory barriers to their use and discharge. Use of such fluids could save the industry over $50 million annually.

As a result of these efforts, regulations promulgated by EPA in October 1996 endorsed the use of this innovative waste minimization technology that is crucial for deepwater drilling.

Currently, EPA is taking further steps toward removing unnecessary regulatory barriers to using synthetic drilling fluids. The EPA Office of Water is engaged in an innovative "presumptive" rulemaking, involving the full spectrum of offshore production, service, and equipment companies, as well as DOE and the Minerals Management Service. This expedited rulemaking process to write synthetics into the regulations will cut considerable time from the normal schedule. In addition, ONGPT is working with the Offshore Operators Committee to fund research into the marine impacts and risks of using synthetics, to support the implementation of these regulations with sound science.

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Six gathering centers and flow stations in the Prudhoe Bay field separate oil from produced water and gas. Approximately 84 percent of produced water is reinjected into the reservoir to improve oil recovery.

Photo courtesy of BP Exploration (Alaska), Inc.

Scientific Data for Improved Regulatory Decisions: Assessing Impacts of Discharges from Gulf of Mexico Operations

As part of a four-year study, ONGPT has worked with Continental Shelf Associates and the Brookhaven and Lawrence Livermore National Laboratories to assess environmental and human health risks associated with produced water discharges from offshore and coastal oil and gas operations in the Gulf of Mexico.

The project's goal was to increase scientific knowledge about:

- Characteristics of produced water and sand;
- Environmental effects of organic materials, trace metals, and naturally occurring radioactive material (NORM) in water, sediment, and biota;
- Impacts on commercially and recreationally important fish and shellfish species in coastal and offshore waters;
- Seafood catch and consumption in the Gulf region;
- Ability of wetlands and open bays to recover from prior oil and gas development activity; and
- Impact of existing and anticipated Federal and State offshore and coastal discharge regulations on energy supply and the economy.

The last risk assessments to be conducted as part of this research are now being published.

Risk-Based Regulations: Heavy Oil Storage Tanks

Current regulations require that oil storage tanks be fitted with costly scrubbers to prevent the emission of volatiles. These regulations were originally designed for tanks that store light oil, and may not be appropriate for the large number of tanks in California that store heavy oil with less volatile material.

ONGPT is funding the Lawrence Berkeley National Laboratory to lead a working group that includes the Western States Petroleum Association, the California Air Resources Board, the Environmental Protection Agency, and Air Quality Districts in two counties. This effort will lead to test methods for properly estimating the amount and type of reactive gases emitted from heavy oil tanks, and to less stringent regulatory requirements based on scientific data. As an additional benefit, the project has already resulted in the development of a simple sampling device that can be constructed for less than $20 from parts bought at a local hardware store. Previously, a device costing $500 was used for this type of sampling.

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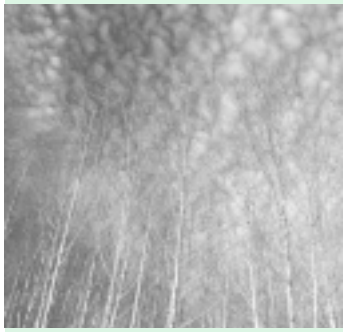

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How Clean is Clean? Soil Remediation

Gas Research Institute has been conducting a research program into the question of "How clean is clean?" That is, to what extent do contaminated soils have to be remediated before the contaminants are no longer able to move into the surrounding environment? DOE is contributing to this effort by sponsoring research at Pacific Northwest Laboratory on the leachability and bioavailability of aged hydrocarbons in soils. It is hoped this research will lead to more risk-based remediation requirements.

Other remediation activities include:

- Research on cleanup of salt contamination in the Tall Grass Prairie of Oklahoma;
- Funding of the Oklahoma Energy Resources Board to develop improved site remediation strategies and transfer their success to other States; and
- Working with the Bureau of Land Management to develop remediation alternatives for salt contaminated sites on Tribal land.

There's Something in the Air: Air Quality Research

Air quality impacts have increasingly become a potential "show stopper" for oil and gas development, especially in the Western States. New requirements and concerns involving ozone, particulate matter, acid deposition, and regional haze have all focused attention on the air emissions resulting from oil and gas exploration and production activities. Some of these standards are health-based, some are aesthetic, but they all raise scientific questions about the types and rates of emissions, the contribution of different sources of emissions, man-made versus biogenic sources, atmospheric chemistry, and the influence of terrain and meteorology. ONGPT is working with industry, States, and other Federal agencies to address these questions in a number of areas:

- Addressing air quality modeling issues, emissions inventories, emissions trends, and alternative analytic strategies for assessing visibility impacts in Wyoming;
- Conducting feasibility studies for the use of innovative air tracers to determine the sources of air pollutants in the Gulf of Mexico and California;

- Working with the Bureau of Land Management, Wyoming State Office to monitor air pollutants at key sites around the State and to integrate that monitoring with the data needs of air quality modeling in the region; and
- Conducting research on the indoor concentrations of fine particulate matter ($PM_{2.5}$). The average person spends over 85 percent of his/her time indoors. Therefore, indoor concentrations and comparisons with outdoor concentrations should have a significant impact on health and health-based standards. ONGPT's upstream and downstream research programs are jointly funding this effort, with cost-sharing from industry.

Stewardship of Federal Lands

Twenty-four percent of domestic oil production and 37 percent of gas production come from Federal lands. As much as half of our undiscovered oil and gas resources may be under Federal lands. Therefore, access to these lands for oil and gas production has a significant impact on national energy policy. If future natural gas production is to be significantly increased to meet the needs of climate change goals and electric power restructuring, ways must be found to get to the gas that underlies Federal lands with an acceptable level of environmental impacts.

Success Story

Methane Leaks

A new methane detection technology could cut losses for the industry and reduce emissions of methane, a powerful greenhouse gas. Sandia National Laboratories (SNL) are applying expertise to the development of a video camera to detect methane leaks. The camera will use specialized computer chips and advanced portable lasers to provide images of methane at very low flow rates from a distance of 130 feet. Also under development is a more powerful laser that could boost the range to 330 feet. In 1999, SNL will conduct a test of a shoulder-mounted unit to detect gas leaks in a refinery. This effort is being conducted in cooperation with EPA's Common Sense Initiative. It is hoped that this technology will enable EPA to revise its leak detection and repair requirements in a way that will reduce costs for refiners, while decreasing methane emissions.

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DOE and the Department of the Interior (DOI) have formed a Federal Lands Technology Partnership to address this issue and provide technical support to Federal land managers. Fiscal Year 1998 was the first year of DOE funding under this partnership. The two agencies solicited projects from BLM field offices and worked together to prioritize the proposals. As a result, four projects were initiated:

- Air quality monitoring in Wyoming;
- A predictive GIS model for archaeological resources in Nevada. This model is designed to allow Federal and State agencies to identify areas with high and low probability of containing "cultural resources," allowing them to open areas of low probability to leasing for oil and gas;
- Strategies for remediating salt-contaminated sites on Tribal land in Oklahoma; and
- Research into the issue of "micro-annulus" formation between well casing and cement that could lead to aquifer contamination.

This partnership will be continued and hopefully expanded with additional projects in Fiscal Year 1999.

Naturally Occurring Radioactive Material

Treatment and disposal of naturally occurring radioactive material is a high priority issue for both regulators and operators. Several States are developing regulations for NORM treatment and disposal, and EPA is considering development of national regulations. At the same time, some companies that have conducted or proposed NORM disposal projects have run into considerable public opposition.

DOE is funding a series of assessment projects to provide scientific data needed for risk-based regulatory development. Argonne National Laboratory (ANL) is conducting analyses of exposure risks that would result from the disposal of oil field NORM waste in a variety of settings, including injection wells, salt caverns, Resource Conservation and Recovery Act (RCRA) landfills, and landspreading. ANL is also assessing the costs of disposal alternatives. Brookhaven National Laboratory has investigated the risks associated with discharging NORM wastes from offshore platforms. Meanwhile, ONGPT is supporting an effort by the IOGCC to develop scientifically defensible, risk-based model NORM regulations for States. Future work will include consolidation of the risk assessment work in a form easily accessible by State regulators, and research into the risks associated with melting down NORM contaminated equipment.

Lower Cost Environmental Compliance Technologies

DOE supports development of more cost-effective environmental compliance technologies by:

- Providing access to the technical resources of National Laboratories and research centers;
- Developing information on technology performance and potential environmental impacts for use in regulatory and industry decisionmaking;
- Performing bench-scale and pilot projects to demonstrate the technical feasibility of more advanced, cost-effective environmental compliance technologies; and
- Removing technical and regulatory barriers to using advanced, innovative technologies that can reduce environmental compliance costs and improve industry's environmental performance.

DOE's technology development projects address:

- Drilling and production waste management;
- Air emissions detection and control;
- Produced water treatment and disposal;
- Management of naturally occurring radioactive material;
- Remediation of contaminated sites; and
- Protection of wetlands and other sensitive environments.

Wetlands Protection and Restoration

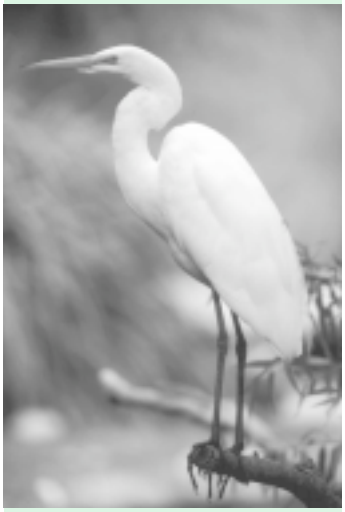
A significant portion of the Nation's oil and gas resources are under or adjacent to wetland areas. ONGPT projects have included efforts to assess the environmental constraints of expanding oil and gas reserves in Louisiana wetlands, to examine the feasibility of wetlands mitigation banking, and to evaluate the use of innovative transport methods to support drilling and production of oil and gas in wetlands. One effort by Southeastern Louisiana University employs unique temperature-controlled laboratory facilities to simulate hydrologic conditions found in wetlands, and to evaluate the beneficial use of drill cuttings in creating or restoring wetlands.

Water Treatment and Disposal Technologies

Produced water is the largest waste stream generated from oil and gas exploration and production. Efforts sponsored by ONGPT to address treatment and disposal of water produced as a byproduct of oil and gas recovery include:

- Evaluating alternative technologies for treating produced water prior to discharge in the offshore environment;

Protection of wetlands and other sensitive environments is a focus of a number of DOE's technology development projects.



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Downhole separation and disposal technology has the potential to reduce the volume of produced water by as much as 90 percent and increase oil production by as much as 50 percent.

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- Developing lower cost methods for treatment and disposal in specific regions. Technologies involved range from advanced technology membranes to low-cost, low-volume systems that small operators can construct with inexpensive, readily available materials;
- Using microbes to reduce the sulfide content of produced water; and
- Developing and evaluating technologies for downhole separation of oil and water, as described in the following section.

Downhole Separation of Oil and Water

Treatment and disposal of produced water represent significant costs for operators. A relatively new technology, downhole oil/water separator (DOWS), has been developed to reduce the cost of handling produced water. DOWS separates oil and gas from produced water at the bottom of the well, and re-injects some of the produced water into another formation, or another horizon within the same formation, while the oil and gas are pumped to the surface. Because much of the produced water is not pumped to the surface, treated, and pumped from the surface back into a deep formation, the cost of handling produced water is greatly reduced. When DOWS is used, additional oil may be recovered as well.

In cases where surface capacity for processing or disposing of produced water is a limiting factor for further production within a field, the use of DOWS to dispose of some of the produced water can allow additional production in that field. Simultaneous injection using DOWS has the added benefit of minimizing the opportunity for contamination of underground sources of drinking water through leaks in tubing and casing during the injection process, or for spills during surface handling of the water.

In its efforts to transfer innovative technologies with environmental and economic benefits to the industry, FE has funded a feasibility evaluation of DOWS technology by Argonne National Laboratory, CH2M-Hill, and the Nebraska Oil and Gas Conservation Commission. The evaluation describes the types of DOWS currently available and their suppliers, economic information on DOWS, data on 37 DOWS installations in North America, and DOWS regulatory information. FE also has provided funding to Oak Ridge National Laboratory to investigate development of a new type of DOWS through modifications to an existing centrifuge device.

DOWS has a great potential to save money and reduce the environmental impacts of managing produced water at the surface, but the technology is not yet fully developed. Some trials have been very successful and have repaid costs in a few months. Other trials have failed. The cost of installing DOWS equipment, including the well workover, is substantial and operators have been hesitant to invest in DOWS due to low oil prices in 1998.

The Natural Gas and Oil Technology Partnership for the Environment

Many advanced technologies have been developed by the National Laboratories, often under the sponsorship of other DOE and Federal programs, which have applications for oil and gas exploration and production. The drilling, diagnostics, and production portions of ONGPT's oil and gas program have conducted a Partnership with the National Laboratories and industry for several years to transfer these technologies to the oil and gas industry. In Fiscal Year 1997, the environmental program initiated a new element of this Partnership to focus on environmental technologies. ONGPT is funding five cooperative laboratory/industry projects under the Partnership, which involve:

- Using microbes to reduce the sulfide content of produced water;
- Developing an improved technology for downhole separation of oil and water;
- Reducing the amount and toxicity of chemicals used to treat produced water through continuous monitoring of water content;
- Continuous monitoring of particulates in air emissions from oil field generators and boilers as an aid to controlling emissions; and
- Air emissions control using plasma assisted catalysts.

ONGPT plans to continue and expand this Partnership in 1999.

Natural gas development wells in Anshutz Ranch East field, Utah-Wyoming border.