



Water-Energy Sustainability
and the
RBDMS e-Commerce Initiative



2010-2011 Annual Report: **RBDMS.NET**

Regulators need sophisticated data sharing and analysis tools for informed decision-making about environmental risk factors. Industry needs safe technologies to develop oil and gas resources. RBDMS.NET is the GWPC's contribution to meeting both challenges.

RBDMS.NET e-Commerce projects are helping to shape the way agencies, industry, and the public think about and manage water and energy resources.

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Photo courtesy of the NYSDEC field inspection team.

HOW CAN YOU MAKE SURE YOUR AGENCY HAS THE BEST DATABASE TOOLS? WE CAN HELP.

The GWPC is a national association of state ground water and underground injection control agencies. Our 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. The GWPC provides a forum for stakeholder communication and research to improve governments' role in the protection and conservation of ground water.

The RBDMS.NET e-Commerce Initiative provides outreach to regulatory agencies and industry operators in data management strategies for understanding and mitigating the environmental risk factors inherent in the fossil-fuel and mineral extraction technologies, which are essential components of the nation's security and economic health.

--Mike Paque, GWPC Executive Director

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RBDMS: Overview

The Risk Based Data Management System (RBDMS) has evolved as a means to help stakeholders protect source waters while encouraging improvements in oil and gas recovery efficiency. RBDMS has been expanded to track work done in operationally complex settings such as deep and lower-permeability formations and mature gas fields.

RBDMS offers regulators the ability to focus attention on those wells that pose the greatest environmental risks. This evaluation of environmental risk gives both agencies and industry the opportunities to impose construction, testing, and inspection requirements that are commensurate with the assessed risk level.

The RBDMS.NET Web interfaces that are being rolled out nationwide are offering all stakeholders unprecedented access to well location, construction, production, injection, and geologic formation data. The two-way communication afforded by RBDMS.NET applications speeds the response times for technical planning purposes while improving data quality. The RBDMS applications are resulting in significant staff efficiencies and reducing the operating expenses associated with the environmental compliance tasks that both industry owners and regulators perform.

This Annual Report presents information about the program direction and current successes of RBDMS. The GWPC and the RBDMS Steering Committee welcome your feedback about and participation in this initiative.

1. THE FOCUS IN 2010-2011: RBDMS.NET PRIORITIES

Water and energy consumption rates are in a delicate balance with the hydrologic cycle. Environmental changes, population and economic pressures, and the consumptive uses of water (municipal, agricultural, and industrial) introduce stresses on the hydrologic cycle. However, choices made in energy production processes and the processes of converting energy to power depend upon the availability of water, often in large quantities. In turn, pumping, conveyance, treatment, and distribution systems for water and wastewater are dependent upon available, affordable energy.

The GWPC will devote significant project efforts in the next 2 years to helping state agencies deal with policy decisions and practices

associated with addressing ground water level declines and the continued demand for fossil fuels. Two areas in particular will receive this focus:

- The increased use of drilling and completion techniques that require large quantities of water.
- The nexus of climate change control strategies and enhanced oil recovery processes (EOR) and the potential effects on ground water.

CHALLENGE: Address concerns new technology poses for water-energy sustainability.

What is a Well?

A well can be defined as a system of tubular components and associated equipment that lines a borehole (the uncased drill hole) in such a way as to prevent caving in; to isolate and prevent migration of fluids; and to produce fluids as oil, gas, or water from or to inject such fluids into a permitted zone. These construction components are selected and installed in a way that is meant to be both efficient and environmentally safe.

A well can be vertical or, if intentionally drilled away from the vertical, can be said to be directional. Where departure from the vertical is greater than approximately 80 degrees, the well can be said to be *horizontal*. Because directional and horizontal wells typically penetrate a greater length of the target reservoir, these well types can offer significantly greater production than vertical wells (see Exhibit 1).

Casing used in wells can be of several different types of materials, such as steel, concrete, or polyvinyl chloride (PVC), depending on the well's purpose. The minimum grade and wall thickness for each type of material is subject to regulation. State oil and gas regulatory agencies evaluate the fluids in a wellbore and the pressures under which they operate. Well construction standards are enforced to prevent fluid migration between zones and to protect underground sources of drinking water (USDWs).

Although many construction techniques exist, the following few are widely used for various purposes around oil and gas well sites:

- **Rotary mud and/or air drilling:** In this method of drilling a well, a continuous circular motion of a bit is used to deepen the borehole.
- **Auger/reverse circulation rotary:** This method involves pumping wellbore fluids down the annulus and back up through the drill pipe, which connects the rig surface equipment with the bottom-hole assembly and the bit so that the drilling fluid can be pumped to the bit and to allow the bottom-hole assembly and bit to be raised, lowered, and rotated.
- **Cable tool/driven-casing hammer:** A drill bit is suspended in the well from a steel cable and is dropped repeatedly on the bottom of the hole to deepen it.
- **Jetting:** This method involves drilling soft, unconsolidated, and usually shallow formations by eroding the material below the bit solely by a high-velocity drilling stream.

Geological considerations play a major role in the design, drilling, and construction decisions made at the well site. For example, for wells that penetrate multiple aquifers, the relative thickness of the aquifers, the presence of confining layers, and possibility of hydraulic connection between the aquifers must be considered. When drilling in highly fractured zones, various logging techniques are used to measure the depths and determine the nature of the zones so that the well casing and cementing can be achieved properly.

As production levels decline in mature fields, industry turns to the use of other drilling techniques to tap production in areas such as tight shale formations. Understanding the geologic factors at play during oil and gas

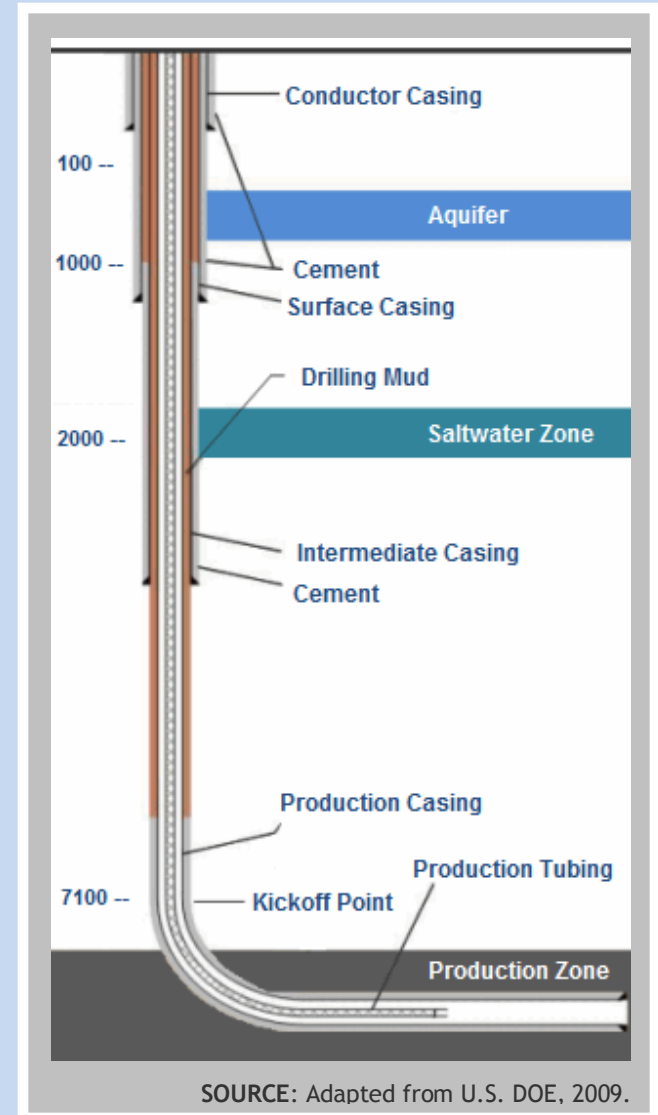


EXHIBIT 1. This generalized view of a gas well shows the cemented and cased intervals required for safe operation and water resource protection.

well drilling and stimulation is critically important to understanding the potential area-wide hydrologic effects of these activities.

Water Level Declines and Continued Demand for Fossil Fuels

Significant ground water level declines have been measured nationwide (Exhibit 2). Therefore, the interdependency of energy and water now threatens national energy production as a result of limited water supplies. Whether the United States will be able to provide sustainable sources of affordable energy and clean water depends greatly on resource management policy decisions and practices that take into account this water-energy nexus.

Juxtaposed with widespread declines in source water levels, the demand for energy derived from fossil-fuel sources is expected to remain high for the foreseeable future in the United States (see Exhibit 3). The demand for natural gas, which is in abundant supply in the United States, is increasing. Therefore, industry is turning to a variety of strategies to maintain production levels while managing associated costs. These strategies include using newer technologies to drill in shale formations and increasing the use of enhanced oil recovery (EOR) in mature fields where production is declining.

These drilling strategies frequently involve formation stimulation techniques that are receiving public scrutiny. Two of these processes are high-volume hydraulic fracturing (HF), which is now in demand for stimulating low-permeability (“tight”) formations, and the use of carbon dioxide (CO₂) for EOR.

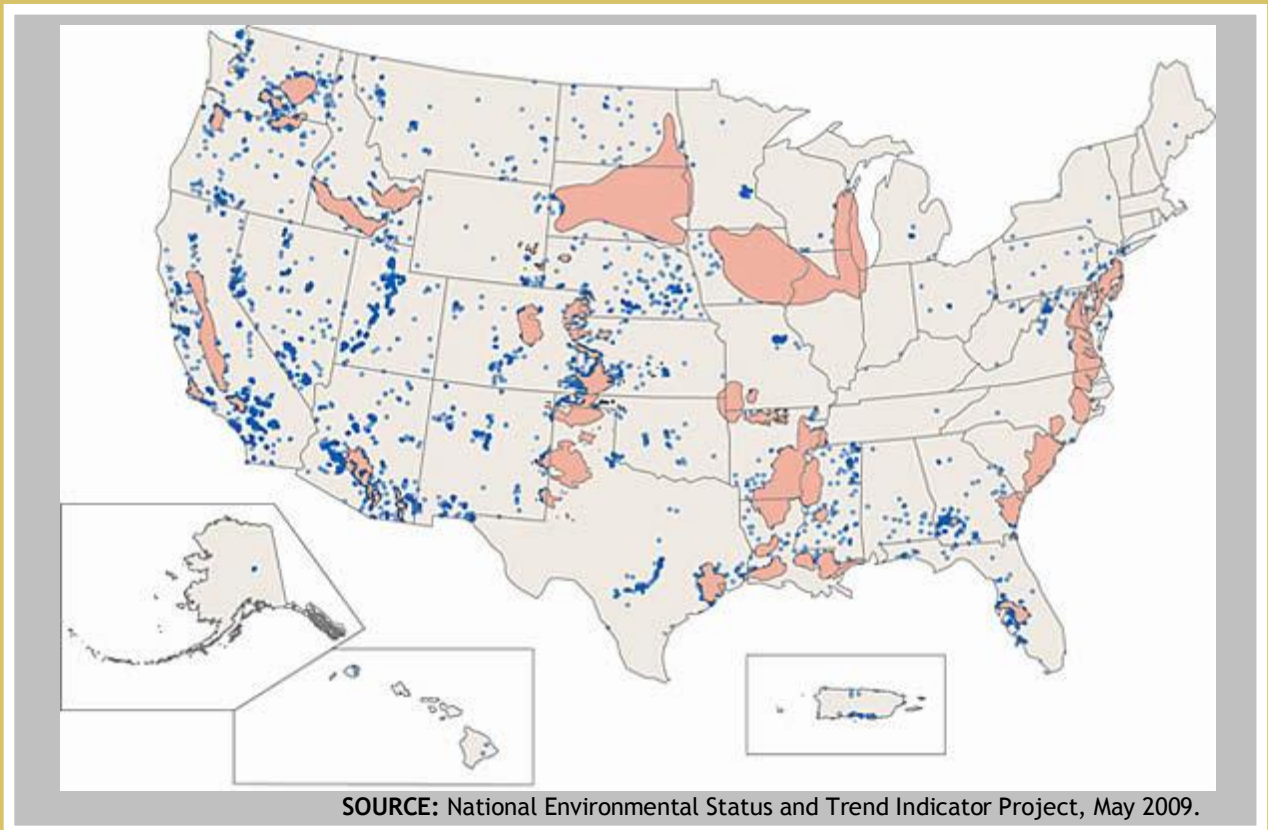


EXHIBIT 2. Water level declines nationwide threaten energy production.

- **Red regions:** areas > 500 square miles that have water level decline >40 feet in at least one confined aquifer or >25 feet of decline in unconfined aquifers since predevelopment.
- **Blue dots:** Wells in the USGS National Water Information System database where the measured water level difference over time is ≥ 40 feet.

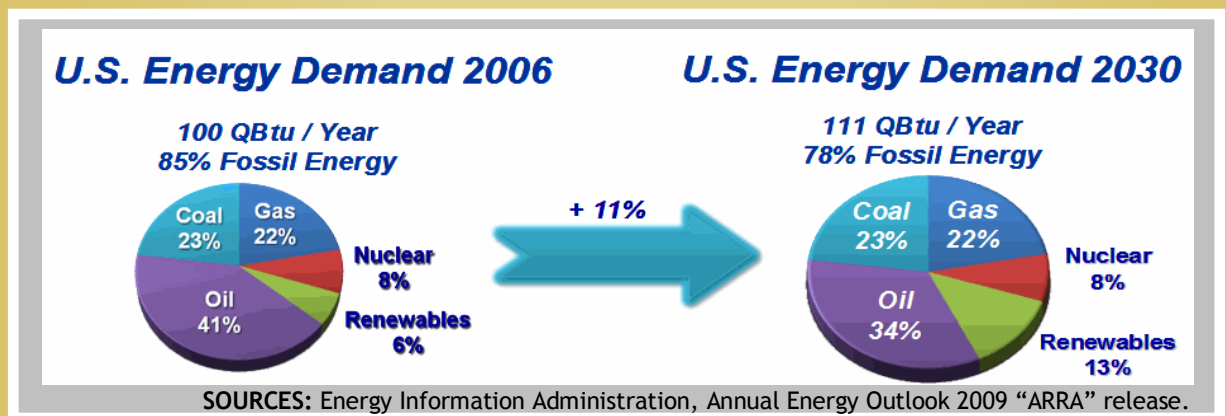


EXHIBIT 3. Demand for energy from fossil fuel will continue into the future.

Hydraulic Fracturing (HF) and High Water Usage

Hydraulic fracturing (HF) is often used to increase the flow of oil, gas, or coal bed methane from the producing formation or to increase the flow of injected fluid into a formation. A fracturing fluid is pumped through a perforated zone in the well casing at a rate that causes the down-hole pressure to fracture the formation, usually between 1000 and 3000 psi. The zone of interest is sealed by a packer assembly. Single or straddle packer assemblies can be used, although the single packer method is more common (NYSDEC, 2010). A proppant such as sand is mixed with the injected fluid to keep these fractures open, thus improving deliverability to the well bore.

The use of HF in formations such as the Marcellus, Fayetteville, and Woodford shales has greatly improved production (see Exhibit 4). While a properly conducted hydraulic fracturing operation poses minimal risks to water resources, the potential for water resource impacts is of concern to regulators, who may subsequently elect to capture additional data. Potential water resource impacts may be divided into several major categories: the quantity and quality of source water used, the quantity and quality of the water recovered and disposed, and the results of the fracturing process on the producing formation.

Fracturing horizontal shale formations requires large quantities of water. Several hundred thousand to millions of gallons of water can be required on a per-well basis. Regulatory concerns include the availability of water to support the HF process in light of other consumptive uses within the watershed

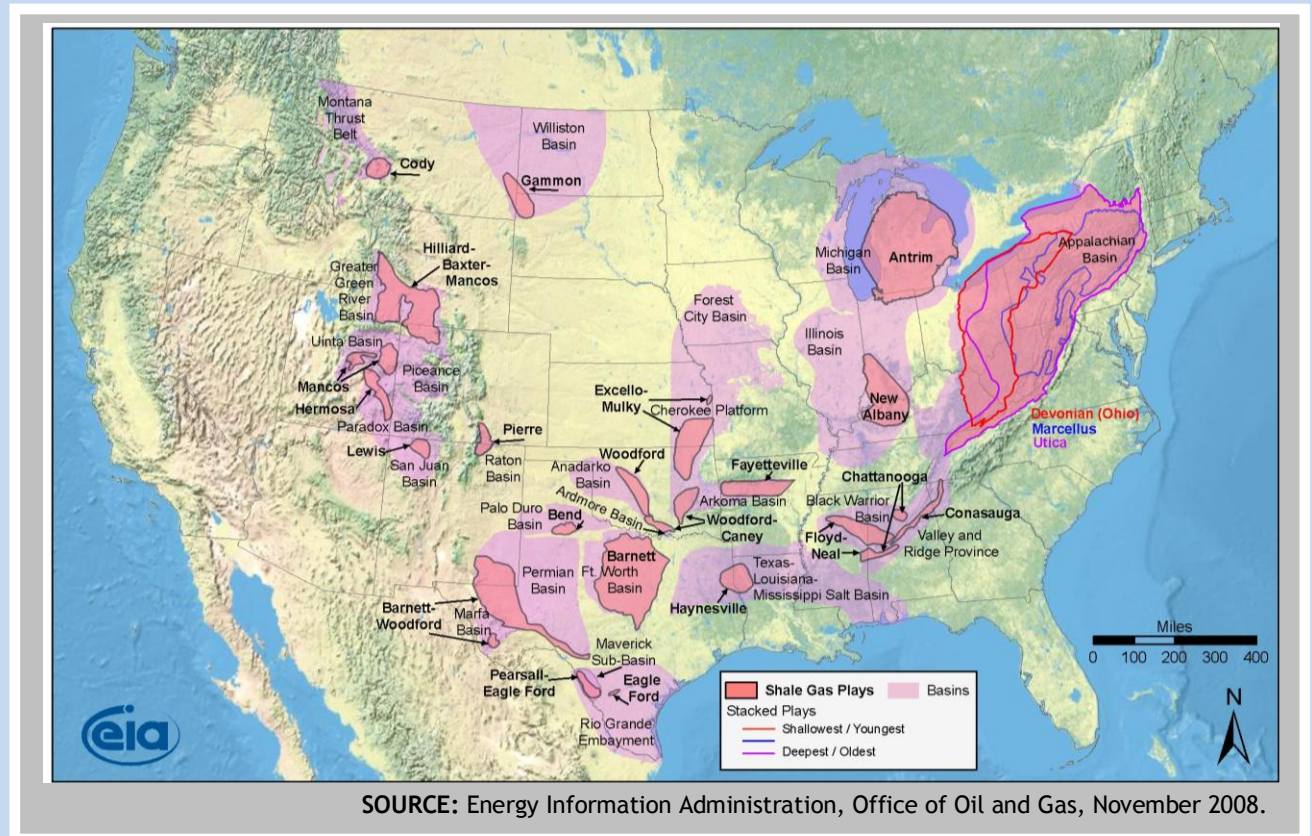


EXHIBIT 4. Many of the shale gas plays in the United States are located in RBDMS states.

and the effects of the drawdown where water supply is already stressed or in areas under drought conditions. Transportation of the water and equipment to the jobsite is expensive and can impact rural roads and associated infrastructure. In addition, small local watersheds are placed at risk by new sediment loads. The types of permits issued and the agencies with jurisdiction vary by state. Best management practices to keep the pace of shale gas drilling and production activities consonant with sustainable water use are either under discussion in places affected by the Marcellus Shale play or have been implemented in various areas, such as in the Barnett Shale in Texas (Soeder and Kappel, 2009).

The process wastewater, referred to as *flowback*, must be collected at the job site for recycling or transport and disposal, a process that is also subject to various permitting requirements. For the most part, flowback is disposed at underground injection control (UIC) facilities. In some cases, other disposal methods can be used, such as National Pollutant Discharge Elimination System (NPDES) or publicly owned treatment works (POTWs), although the states are increasingly discouraging the latter option. In some states, agencies are required to monitor the quality of the flowback and track its chemical constituents. In addition, the hydrogeological effects of fracturing of the formation must be

understood, including the potential fate and transport of the fluid fraction left in formation. Other data of interest may include fracturing dates and well stimulation history; the type of stimulation performed; the volumes of fluid and pressures used; the perforated intervals by stage; the volumes of flowback recovered, and the well operator and service company contact information.

The Energy Policy Act of 2005 included language about the status of HF (EPA, 2005). In the Act, Congress clarified the issue of Safe Drinking Water Act (SDWA) jurisdiction over HF by stating that HF was not an activity intended to be regulated by the SDWA. Regardless, public questions about the practice have been raised as the use of HF has grown in scale and expanded into some geographic areas that had not previously experienced oil and gas exploration and production. As a consequence, many states are reviewing HF as it is currently practiced in the shale gas regions and, as needed, modifying their regulatory programs to insure that it continues to be conducted in a safe and environmentally responsible manner.

To assist agencies in providing oversight of HF technology, the GWPC is expanding its RBDMS program initiative to provide regulators with enhanced methods of monitoring the effects of these formation stimulation techniques on USDWs. The RBDMS Stimulations module is being developed to assist agencies in administering protective measures for source water.

Stimulation data will be collected and imported electronically into RBDMS. In combination with other analytical tools, such

as RBDMS Data Mining and RBDMS for Water (RBDMSW), the well locations will be hyperlinked to well construction and inspection data and overlain on area of review and source water protection area maps. The locations also will be linked to monitoring data from public water supply wells, and integrated with data from regulatory agencies' laboratory information management systems.

The GWPC also will update its RBDMS well schematic diagramming utility to generate drawings of well construction details that include notations of stratigraphy and of the stimulation zone location. Data sets that conform to state requirements will be queryable via the Web. Depending on state requirements, the following data may be tracked for HF stimulations:

- The quantities and quality of water used to support extraction methods and the sentinel indicators of effects on watersheds.
- The methods and locations used to dispose of flowback water from the wells.
- The physical properties of the fracturing fluids (e.g., volumes and pressures).
- The chemical components of fracturing fluids or trade names or both (where required by states).
- Selected down-hole pressures within wells and formations.
- The mechanical integrity of stimulated wells.
- Other pertinent information such as operator, location, and injection volumes.

RBDMS Stimulations will help regulators to assess the fate and potential transport of stimulation fluids, to assess the risk to drinking water aquifers and to regulate the ultimate disposition of flowback fluids. RBDMS Stimulations also will provide the means to assess the variables of geology, well and formation pressures, the water quality of overlying aquifers, and watershed monitoring program results. With this data at hand, agencies will be able to make permitting processes more transparent and will be better able to respond to public questions and concerns.

As a part of its work on the Stimulations module, the GWPC will update both its Area of Review (AOR) utility for Class II oil and gas wells and its RBDMSW program, which is now in use to assess acid mine drainage abatement procedures. UIC managers and oil and gas regulators nationwide have used the RBDMS AOR module since the early 1990s to assess the potential risk to water resources from oil and gas and injection activities.

These updated utilities will be linked with GIS thematic mapping, and the chemical parameters now tracked in RBDMSW will be expanded to include the constituents of various fracturing fluids and proppants in use. The resulting application, which will help regulators to monitor and to analyze the effects of industry's use of HF, will then be pilot tested and rolled out. Agencies in Pennsylvania, New York, Arkansas, and Colorado may participate in parts of these projects.

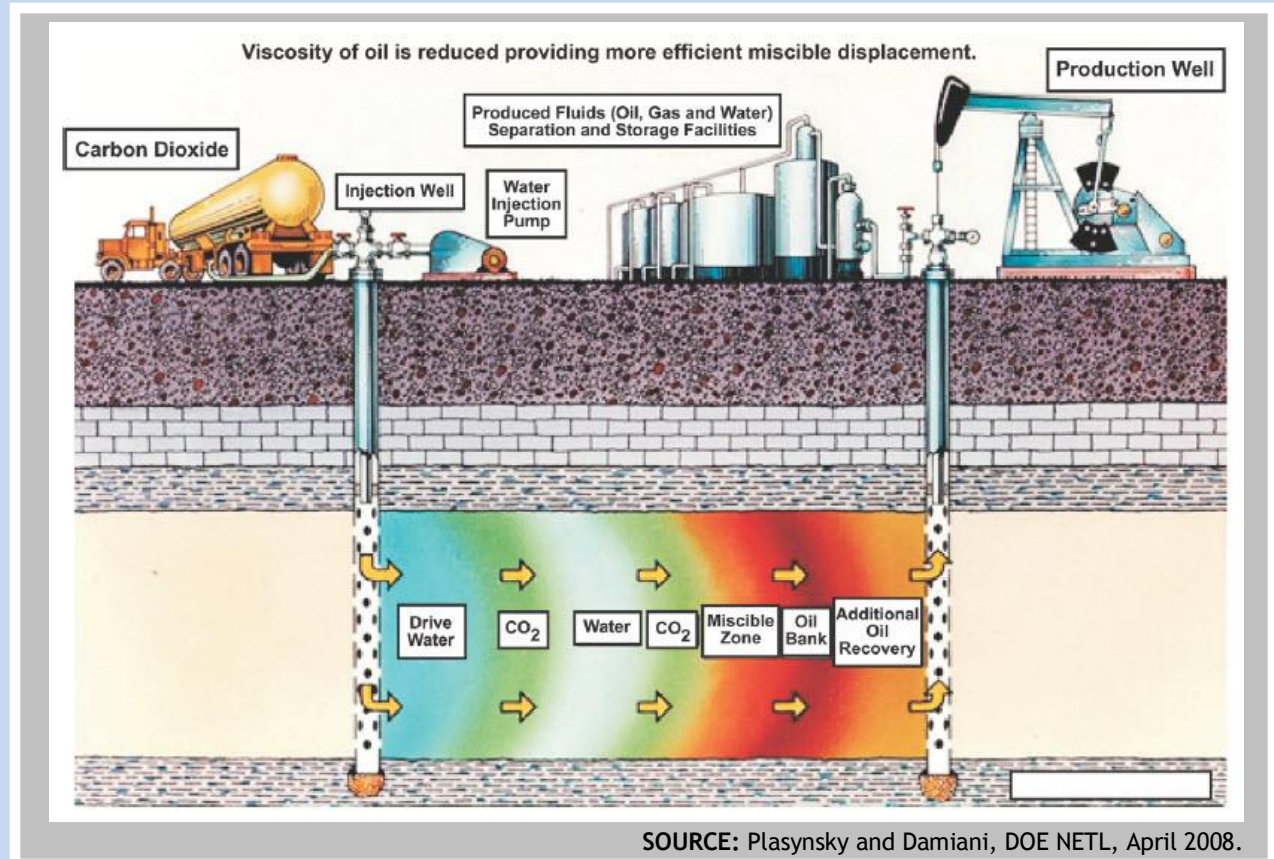
The RBDMS Stimulations module will allow agency staff and members of the public to click locations of HF operations near drinking water supplies on a GIS map to see selected parameters.

New and Current Uses: CO₂ Geological Sequestration

Capturing carbon from fossil-fueled power plants for permanent below-ground storage is a new approach to managing global climate change. The feasibility and efficiency of the technology is similar to the oil and gas EOR process. The United States is the world leader in EOR technology, using about 32 million tons of CO₂ per year for this purpose (U.S.DOE, September 2009). In fact, the revenues from recovered oil and gas lower the net cost to sequester carbon. Many power plants and other large emitters of CO₂ are located near geologic formations that are amenable to CO₂ storage. These formations include oil and gas reservoirs, unmineable coal seams, and deep saline reservoirs.

CO₂ EOR has been used by the oil and gas industry for over 40 years, but only recently has its potential as a carbon sequestration method been realized and investigated. A schematic of the CO₂ EOR process is shown in Exhibit 5. Currently, CO₂ EOR comprises approximately 37 percent of all EOR being performed in the United States (Plasynsky and Damiani, April 2008). The GWPC toured one such facility recently (Exhibit 6).

However, as with other UIC technologies used for EOR, the potential risk to USDWs must be assessed and monitored. Specifically, regulators must be able to assess the variables of geology, current use of the formation, and stoichiometric calculations derived from computer models of the in-situ water quality to predict chemical interactions that may pose risk to USDWs. The success of the technology also depends on the makeup of the receiving formation. The geochemistry, porosity, and permeability of the receiving formation must



SOURCE: Plasynsky and Damiani, DOE NETL, April 2008.

EXHIBIT 5. Agencies that monitor EOR activity use RBDMS to track well mechanical integrity and geologic zone data also must be able to track the potential for plume migration and geochemical changes in the receiving formation.

be evaluated to determine if CO₂ will change the chemistry in the formation and any trace elements that may be mobilized. The geology of the receiving formation also must be understood to determine the vertical and horizontal migration potential of the CO₂ plume.

To monitor the effects of CO₂ geo-sequestration, the GWPC will develop the RBDMS CO₂ module. The software will include

components of the RBDMS for Water application and the RBDMS Geology module. The CO₂ module will store data such as miscibility effects and reservoir characteristics for evaluating the CO₂ flooding potential of oil fields. The CO₂ storage capability of oil fields will be calculated from the analysis of the geochemistry and the geology of the receiving formation.

The integrity of the injection well is a primary factor for successful CO₂ geo-sequestration. The types of casing and cement used for well construction and the performance of those materials over time and exposure to CO₂ will be tracked in RBDMS. Compliance records, mechanical integrity testing, and inspection results will be tracked for these wells in RBDMS.

The RBDMS CO₂ module also will record the results of sampling from monitoring wells in both the receiving formation and in overlying USDWs. The following data may be tracked for CO₂ geo-sequestration and its use for EOR:

- Miscibility effects and reservoir characteristics for evaluating the CO₂ flooding potential of oil fields.
- Calculations of the CO₂ storage capability of oil fields.
- Sampling results from monitoring wells in both the receiving formation and in overlying drinking water aquifers.
- Geology including faults, penetrations, plugged drill holes, and the condition of the overlying impermeable layers.
- Other pertinent information such as operator, location, and injection volumes.

The GWPC also plans to use the updated AOR capabilities within RBDMS to track monitoring data associated with the geologic sequestration of CO₂ and its use for EOR.

RBDMS for Water was originally developed to automate the transfer of sampling data from laboratories to environmental databases through multiple tiers of quality control. The data structure being used for RBDMS for Water has been proven to provide flexible handling of diverse sampling and analysis techniques for soil, water, and air matrixes on many environmental projects, including NASA's Kennedy Space Center, the U.S. Air Force, Chevron, and Miami International Airport. Please see the RBDMS for Water Fact Sheet included with this document.

The RBDMS Geology module is an integral component of all RBDMS installations, tracking formation tops, bottoms, perforated intervals, stimulations, and reservoir characteristics. The information is accessible to the RBDMS Inspection module.



Photo Courtesy of Anadarko Petroleum

EXHIBIT 6. The GWPC recently toured Anadarko Petroleum Corporation's Salt Creek, Wyoming, EOR operations. The company is stimulating oil production from a 100-year-old field by injecting CO₂ into the ground, thus preventing a greenhouse gas from being emitted into the atmosphere.

The RBDMS CO₂ module will track the results of sampling from monitoring wells in both the receiving formation and in overlying USDWs to assess the effects of geo-sequestration. The CO₂ storage capability of oil fields will be calculated from the analysis of the geochemistry and the geology of the receiving formation.



2. WHAT WE DO: RBDMS.NET EFFECTIVENESS

Since the program's inception and gradual rollout to agencies nationwide, the overarching goals of the GWPC's RBDMS eCommerce initiative have been threefold:

- To help protect water resources by sharing data in multiple ways:
 - ✓ Across state boundaries.
 - ✓ Across jurisdictional boundaries.
 - ✓ With the public.
 - ✓ With industry operators and their third-party laboratories.
- To help agencies reduce their operating expenses while increasing staff efficiency.
- To conserve domestic oil and gas resources through data access for online exploration and efficient regulatory permit and other form processing.

This chapter presents the hard evidence in support of the RBDMS claim to continued success in each of the three program goal areas. The following examples tell the story of why supporting the GWPC's RBDMS initiative will help give environmental managers working in both regulatory agencies and industry clear guidance for confident decisions to protect the country's source waters. Fact sheets for each of the RBDMS.NET products are included with this document.

CHALLENGE MET: Protect Water Resources by Sharing Data across State Lines

Watershed boundaries do not stop at the state line. Sharing data across state lines helps to target regulatory activity in wellhead protection areas that may be threatened by activities in adjoining states. The Nebraska Oil and Gas Conservation Commission (NOGCC) took this lesson to heart when it re-vamped its well inspection program to target wells located in source water protection areas for quarterly inspections.

The NOGCC has been working cooperatively with the Nebraska Department of Environmental Quality to collect coverages of the source water protection areas delineated in the State and to identify the oil, gas, and UIC wells located within those areas from the RBDMS database. The resulting maps yield spatial representations of high-risk, environmentally sensitive areas with respect to those wells. In addition, the NOGCC staff imported information from databases in the neighboring states of Colorado, Wyoming, South Dakota, and Kansas to develop contiguous coverages of well location information (see Exhibit 7).

With the aid of the powerful spatial analysis and data organization and retrieval capabilities of RBDMS.NET, the NOGCC has re-prioritized its field inspection activities to focus more pro-actively on those areas where risk is greatest.

Proof: Increase in the Knowledge Base at Reduced Operational Cost

The revised structure and focus of the well inspection program has saved the NOGCC approximately \$40,000 per year measured in terms of reduced vehicle mileage and inspector labor. In addition, the agency has improved its overall strategy for managing its environmental compliance program.

The NOGCC RBDMS Data Mining Web site is available at <http://nogcc.ne.gov/nogcconlinegis/>.

The Mississippi State Oil and Gas Board (MSOGB) version of RBDMS Data Mining Web application is available at <http://gis.ogb.state.ms.us/MSOGBOnline>.

The Ohio Department of Natural Resources (ODNR) makes its oil and gas data open to the public at <http://ohiodnr.com/mineral/databas/e/tabid/17730/Default.aspx>.

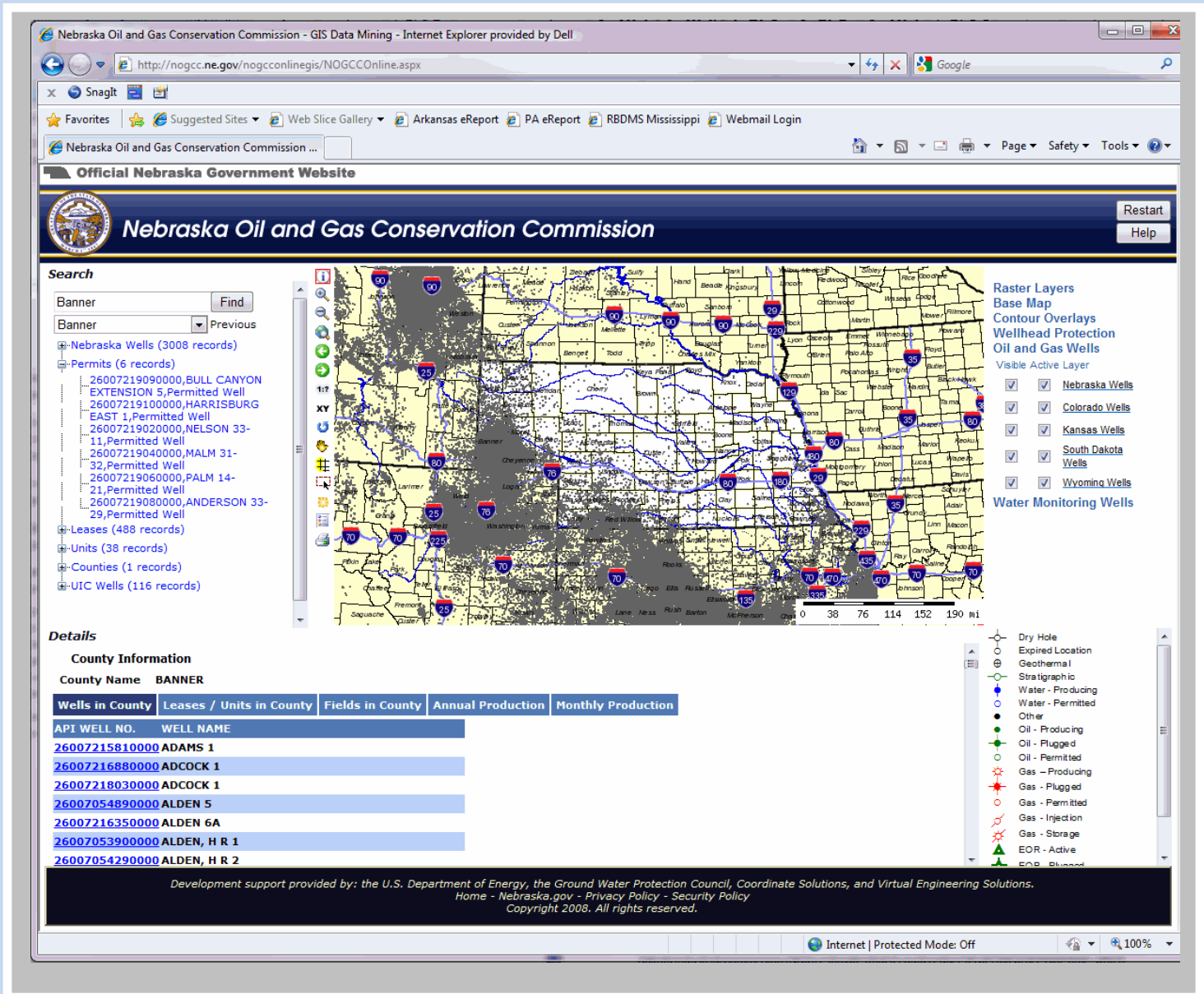


EXHIBIT 7. Contiguous point location coverages combined with well head protection area polygon coverages help protect water resources by targeting high-risk wells for more frequent inspections wherever they are located.

CHALLENGE MET: Protect Water Resources by Sharing Data across Jurisdictions

Notwithstanding the challenges of time and money, managing irreplaceable water resources demands easy access to multiple caches of stored data. This data access is needed for trend analyses and interpretation of the environmental effects of fossil fuel and mineral extraction operations on water quantity and quality. Even in agencies that do manage large amounts of data through client-server database applications, the wide variability in the development tools used to create these systems and the differences in their form and function have created many technical obstacles to sharing data with sister agencies. Overcoming the barriers created by early software programming and hardware choices has been difficult, with the result that large quantities of data have historically been accessible by relatively few people.

The RBDMS eForm Web application illustrates how the GWPC is helping to make inroads in lessening such obstacles to sharing data. When the passage of new rules in Colorado imposed greater protections on water resources in April 2009, the Colorado Oil and Gas Conservation Commission (COGCC) and the GWPC had already partnered to develop and launch eForm, which has since been embraced by multiple states. RBDMS eForm helps states to serve regulatory forms (permit applications, site location impact assessment forms, completion reports, and sundry notices) on the Web for industry use while accommodating statutory differences.

The design specifications called for developing one application to gather the data required by multiple agencies and then to allow

industry operators to provide that information only once. eForm is configured so that two sister agencies within state government (the Department of Wildlife and the Colorado Department of Public Health and Environment) and various local government designees can review the submitted permits and location documentation and then recommend conditions of approval. This elimination of duplicative data entry and storage greatly improved the efficiency of the permitting process.

With funding help from the US DOE and the GWPC, the COGCC was able to accomplish better

communication between the other agencies at a lower overall cost. Exhibit 8 shows the workflow processing interface for the internal agency navigation page of eForm. More information is available in the fact sheet included with this document. The COGCC's eForm application is available at <https://cogcc.state.co.us/eform/>.

The GWPC is scheduled to roll out eForm in 2010 in Nebraska, Alabama, and Mississippi and, in 2011, in Pennsylvania.

The screenshot displays the Colorado eForm web application interface. At the top, there is a search form for an 'Existing Application' with fields for Operator (0), Doc # (1759298), Start Date (6/30/2009), End Date (10/2/2009), and Status (In Process). Below the search form is a table of tasks for the application.

Doc ID	Form	Status	Opr Num	Company Name	Created Date	Status Date	Tasks	Attachments	Comment	View
1759298	O2A	IN PROCESS	100185	ENCANA OIL & GAS (USA) INC	9/18/2009	9/27/2009	0	...	Comment	View
	Task			Due Date	Assigned To	Reviewer	Status	Status Date		
	CDPHE				KUSTER, KENT		Pass	9/27/2009		
	Completeness				AHLSTRAND, DENNIS	COLER, LARRY	Pass	9/27/2009		
	DOW				GREENMAN, CELIA		Pass	9/27/2009		
	Final Approval			12/11/2009	NESLIN, DAVID		Active	9/27/2009		
	LGD			10/17/2009	BARKER, BRUCE T.		Active	9/27/2009		
	OGLA			12/11/2009	Halstead, Mary		Active	9/27/2009		
	Operator					JEVIN CROTEAU	Pass	9/27/2009		
	Permit			12/11/2009	FISCHER, ALEX		Active	9/27/2009		
	Public			10/17/2009	FINE, MARC		Active	9/27/2009		
	RCOA			12/11/2009	KERR, THOM		Active	9/27/2009		

EXHIBIT 8. RBDMS eForm makes online filing of permit application, completion reports, and sundry notices easy and quick for industry operators. eForm centralizes the data multiple agencies need for permit review and approval including attachments, recommended conditions, and other notifications.

More Proof of Interagency Data Sharing...

Another example of interagency data sharing through RBDMS can be found in New Mexico. The New Mexico Oil Conservation Division's (OCD's) RBDMS installation provides data access to other state agencies for their review upon potential issuance of a permit. In addition, the New Mexico Bureau of Land Management (BLM) provides data to the OCD through an RBDMS download. As BLM field personnel inspect well sites and enter their data into RBDMS, it is then available for download to the RBDMS server, thus allowing for seamless transfer of data to the OCD for review and tracking.

CHALLENGE MET: Protect Water Resources by Sharing Data with the Public

In addition to interagency review, public opinion and comment are becoming a major component of environmental decision-making. Incident reporting and public complaint adjudication are other agency response areas in which the RBDMS.NET approach to data access provides real-time and just-in-time analysis. An Ohio regulator noted to the GWPC that, as a program administrator, he could use RBDMS.NET to filter for the location of a complaint; zoom to it in the GIS pane, select it and evaluate the location with respect to other nearby facilities; review the sampling history and results; and generate a report to address that public inquiry about incidents or possible enforcement actions—all while still on the phone with the citizen-caller.

COeForm also demonstrates how public comment is becoming an integrated feature of regulatory dialogue through its public comment forum. Members of the public can now directly query the agency's Web database to view and to comment on permit applications that are under active review. After passing through moderation, the comments are displayed on the Web site with the permit in a manner similar to blog entry discussions. Oil and gas operators as well as the public can track the status of permit applications and discussion through the public pages of eForm.

CHALLENGE MET: Protect Water Resources by Sharing Data with Industry and Their Laboratories

Within the last few years, the GWPC extended the RBDMS software into water quality, laboratory information management, produced water management, and water quantity assessment. Earlier versions of the RBDMS for Water application were used in Nebraska, Mississippi, and Nevada UIC programs. Since 2006, the upgraded .NET application has been in use in Ohio to manage surface water, ground water, and waste stream quality (e.g., oil field brine, associated waste and acid mine drainage) and data associated with mining operations to evaluate permit applications and application revisions. It is now used to store and analyze the laboratory data provided by coal operators to comply with requirements for pre-mining characterization of background hydrologic conditions, quarterly monitoring reporting (QMR), and NPDES reporting.

Phase 2 of the Ohio RBDMS for Water project, scheduled for completion in 2010, will allow oil and gas and mine owners and their laboratory consultants to refer to the database through a Silverlight Web application to track compliance with water information reporting requirements. The electronic data deliverable is being developed for compatibility with the EPA's schema for water quality, as appropriate for data exchange with laboratories and other state and federal agencies. The standard is at <http://www.epa.gov/storet/wqx/index.html>.

Field inspectors and watershed volunteers will use the RBDMS for Water Web site to report data from the field in four program areas:

- The Abandoned Mine Lands group tracks samples for Acid Mine Drainage Abatement and Treatment plans and watershed restoration projects.
- The Coal Regulatory group tracks sampling for baseline and quarterly monitoring, hydrologic inventory, NPDES discharges, and complaint investigations.
- The Industrial Minerals group tracks sampling results from site inspections for permit compliance, complaint investigations, and enforcement efforts.
- The Oil and Gas group tracks sampling results associated with complaint investigations, permit requirements, UIC facilities, and brine analysis inventories.

The eForm Notification module is being used in the RBDMS for Water Web project in Ohio as an integral part of the process for generating alerts and notifications for criteria exceedances (parameters and holding times) between agencies and laboratories (see Exhibit 9).

RBDMS for Water gives users the ability to overlay sampling locations with laboratory results within the boundaries of a well location, UIC facility, mine permit, watershed project area, or source water protection area on GIS maps in the office and in the field.

This capability is helping all stakeholders to protect water resources. Field inspection programs that are focused in this way make the best use of public funding and afford greater protection of water resources.

One Agency's Results

Q

How is RBDMS for Water making a critical difference to the ODNR's Division of Mineral Resources Management (DMRM) programs?

A

Users can define sites by grouping or re-grouping point and polygon locations on the fly and to analyze water quality data across boundaries, yielding greater freedom to assess regional trends and impacts to ground water, and, by extension, to monitor enforcement actions.

Multiple levels of built-in quality control have been programmed so that QMR and laboratory data that fail data checks will be returned to the third-party lab or industry operator that submitted it, making those parties responsible for the quality of the data submitted. In addition to format requirements for the data, the application checks for invalid sample IDs and inappropriate ranges (dissolved > total).

Users can specify their preferences for grouping locations, analysis parameters, and observation results, which further increases the accessibility of water resource data. Role-based security is integrated into the application, so database administrators can set create, read, update, and delete privileges by user group for each form, sub-form, or report in the application.

The express purpose of this project is to make the collected data in the DMRM's database highly accessible to the public in a number of formats. RBDMSW allows Web site users and agency staff to create and display varied types of reports (trend, box-whisker, tabular, and other statistical formats) on the fly with as few as two or three mouse clicks.

From: eFormNotify [mailto:mail@dnr.state.oh.us]
Sent: Tuesday, January 26, 2010 5:27 PM
To: Gregg Miller
Subject: Ohio RBDMS for Water Alerts

Ohio DNR Alerts for 1/26/2010

Alerts					
Criteria Exceedance	Location: MC00060	Sample Date: 12/21/2009 12:00:00 AM	Analysis: Total Dissolved Solids	Result: 1,030	Criteria Range: NA to 1000
Criteria Exceedance	Location: MC00300	Sample Date: 11/10/2009 12:00:00 AM	Analysis: pH	Result: 7.2	Criteria Range: to 7
Criteria Exceedance	Location: Temporary Location for Lab Sample	Sample Date: 10/23/2009 12:00:00 AM	Analysis: Aluminum	Result: 0.290	Criteria Range: NA to 0.25
Criteria Exceedance	Location: Temporary Location for Lab Sample	Sample Date: 10/23/2009 12:00:00 AM	Analysis: Hardness	Result: 1,240	Criteria Range: NA to 1000

EXHIBIT 9. RBDMS for Water generates automated e-mail alerts for criteria exceedances (shown here), regulatory deadlines, and data validation exceptions for cation/anion balance, dissolved vs. total analyses, and sample holding times for subscribed users.

CHALLENGE MET: Help Agencies Reduce Operating Expenses

Nationwide, only a small percentage of environmental compliance monitoring data is available in electronic format. Even in agencies where automated data systems exist, vast filing systems of wholly paper-bound archives provide the only access to important legacy background data. Obstacles to converting these archives to electronic databases include lack of funding and overstretched personnel resources. The RBDMS Initiative is addressing this issue while introducing numerous cost efficiencies within agency business processes.

Industry operators have been quick to embrace online permitting, which has spurred continued efficiencies (see Exhibit 10). For example, in Colorado, by the time the RBDMS eForm Web application had been deployed for 6 months, industry operators were using eForm to submit applications for permission to drill (APD) and oil and gas location assessment forms at a rate that accounted for 75 percent of such forms received by the agency. Every eForm submitted saves the COGCC an average of 20 minutes of preparation, data entry, and scanning time alone. The COGCC also estimates that Web-based submittal of permit applications has reduced review and processing time for APDs by 3 days. The agency is now acting on plans to use RBDMS eForm to accept completion reports and sundry notices over the Web.

Likewise, the North Dakota Industrial Commission (NDIC) estimates it could reduce its permit processing time, which averages one week, by about 50 percent through a Web-based permit application such as eForm.

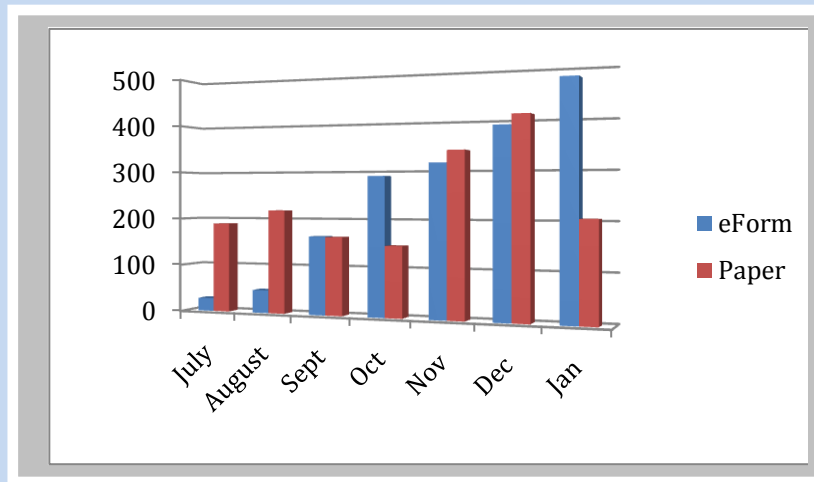


EXHIBIT 10. APD permit application activity over the first 7 months of RBDMS eForm operation demonstrates the rapid acceptance of the technology by the Colorado oil and gas industry.

SOURCE: COGCC Monthly Staff Report, February 2010.

The Pennsylvania Department of Environmental Protection (PA DEP) is now completing a needs assessment as a prelude to customizing RBDMS.NET for the agency's internal use on the desktop. The results of the agency's analysis indicate significant cost benefits of RBDMS in terms of agency operational expense reduction and environmental impact avoidance. In addition, the Bureau of Oil and Gas Management (BOGM) within DEP has estimated that centralizing oil and gas oversight activities through RBDMS will save 32,844 labor hours by streamlining the processes associated with permitting processes within the agency, for a total annual cost avoidance of \$927,780 and higher staff efficiency in technical review tasks (see Exhibit 11).

In terms of environmental impact avoidance, the BOGM cites the reduction of paper copies that RBDMS makes possible for saving trees and energy. One ton of 30-percent post-consumer content copier paper saves 7.2 trees, assuming a mixture of softwoods and hardwoods 40 feet tall and 6-8 inches in diameter (Social and Environmental Entrepreneurs, 2009). The monetary benefit of a single tree has been pegged at \$57,151. This assumes that a single tree provides \$73 worth of air conditioning, \$75 worth of erosion control, \$75 worth of wildlife

shelter, and \$50 worth of air pollution reduction, with this total of \$273 compounded at 5 percent interest for 50 years (American Forestry Association, 1992). The BOGM estimates that in-agency use of RBDMS will avoid the useless printing of 1,319 pounds (0.66 tons) worth of copier paper per year on the basis of 2007-2008 permitting activity. Assuming 100 pages per pound, the BOGM estimates that RBDMS will save 4.75 trees per year, for an additional total impact avoidance valued at \$271,454.

The evidence indicates that the cost-effectiveness of RBDMS software is so great that agencies recover the costs they incur for RBDMS installation and customization projects within only months of deployment. For example, the NOGCC recovered its cost for the initial deployment of the RBDMS Data Mining application within the first year of use as a result of cost-savings measures the application made possible in the agency's field inspection program.

Agencies recover the costs incurred for RBDMS installation and customization projects within only months of deployment.

The efficiencies derived from RBDMS and the GWPC's peer user support network also can be measured by state agencies' consistent matching of Federal support for continued program

development. In 2009 alone, state agencies contributed \$1.5 million in direct match and in-kind support for RBDMS.

Employee	Pay Scale/ Level	Hourly Salary	Benefit	Time Saving/ Applica- tion by Hour	Total No. of Permit Applications	Time Saved by Hours	Total Savings
Clerical - Administrative Review, open the mail, checking for completeness, date/time stamp	3/10	\$14.85	39%	0.25	7,441	1,860	\$38,398
Clerical - Application Process, key data into eFACTS.	3/10	\$14.85	39%	0.75	7,441	5,581	\$115,195
Geologists for Oil & Gas - Technical review w/ plat, well data, quad sheets, measure & scaling encroachment evaluations	7/10	\$24.84	39%	0.75	3,895	2,921	\$100,864
*Geologists for Coal (SWRO-Pittsburgh) - Technical review w/ plat, coal maps, other database (7441 total applications minus the 3895 oil & gas applications)	7/10	\$24.84	39%	4.25	3,546	15,071	\$520,348
Clerical - notification, tracking, permit issuance, printing and mailing 6 copies	3/10	\$14.85	39%	1.00	7,411	7,411	\$152,974
TOTAL (Annual Savings)						32,844	\$927,780

EXHIBIT 11. The PA DEP estimates that using RBDMS.NET will save the agency nearly \$1 million per year in staff time for routine permit review tasks.

SOURCE: PA DEP Bureau of Oil and Gas Management, 2009.

CHALLENGE MET: Conserve Oil and Gas Resources Through Data Access

RBDMS Data Mining's GIS interface opens agency data stores for Internet prospecting. Through the RBDMS.NET eForm application, operators can increase their compliance with permit conditions so drilling programs can be managed with efficiency and environmental safety. Routine permits can be processed with greater efficiency, while new permit applications can be subjected to appropriate levels of technical review and oversight.

The PA DEP BOGM estimates that, by using the RBDMS.NET, eForm, and eReport.NET applications, 50 percent of routine oil and gas permits issued, such as sundry notices, can be processed within 1 to 2 days, as opposed to the current 28 days. Automating monthly regulatory reports through RBDMS eReport.NET also frees agency staff for other work.

In addition to shorter permit application response times, RBDMS Data Mining and other Web interfaces are providing the necessary data to help industry manage existing assets. Shut-in and idle wells that cannot be technologically or economically worked in various market scenarios and that pose a low risk of USDW contamination can be preserved as possible candidates for EOR projects. Through agency tracking and evaluation of mechanical integrity, static fluid levels, and idle well reports, those wells can be kept in a beneficial state and environmentally sound manner.

State agencies also have documented that the RBDMS data exchange tools are helping to maximize the recovery of oil and gas from

marginal wells. Nationwide, many marginal wells are being reworked and brought back online at a significant cost savings through new technology, re-drilling, or horizontal drilling. The cost savings to drill a well horizontally from an existing well rather than a grass-roots well is estimated to be at least \$300,000. For example, in North Dakota, more than 250 wells over the last 5 years have been re-entered and drilled horizontally. Before agencies' well information was readily available, many of these wells would have been plugged or shut in.

Improved industry access to oil and gas agency data over the Web also gives exploration geologists the ability to develop prospects and to drill and operate their leases more efficiently. Production trends and risk can be assessed across lease, state, federal, and other boundaries to produce more domestic oil and gas. The RBDMS Data Mining application is a clear example of a public-facing Web application that is unlocking vast amounts of stored data for dual purposes: (1) trend analyses and exploration data for industry and (2) interpretation of the environmental effects of fossil fuel and mineral extraction operations for water resources managers (see Exhibit 12).

Mississippi State Oil and Gas Board

Reporting [Restart Help](#)

This Web application is in development, and the information represented in it was derived from a variety of sources. Therefore, the Oil & Gas Board makes no warranties as to the completeness, accuracy, reliability, or sustainability of the data, and site visitors assume full responsibility for any conclusions derived through the use of this Web application.

Search

Switch to Advanced Filter

McComb Field Unit

McComb Field Unit Previous

- Wells (89 records)
- Permits (117 records)
- GIS Selection
 - Wells
 - MCCOMB UNIT 9-13 1 2311300363

Map

Details

Well Information

Name	MCCOMB UNIT 9-13 1	API Well #	23113003630001	Type	Oil - Production	Status	Producing				
General	Location	Construction	Dates	Injection	Production	Permit	History	MIT			
SideTrack	Completion	No Completion	Type	Diameter	Weight	Grade	Casing Top	Casing Bottom	New Pipe	Inside Casing?	Cement
00	01	Oil - Production	13.325	48	Grade J-55	Casing/Tubing 0	33	Yes	No	0	
00	01	Oil - Production	9.625	36	Grade J-55	Casing/Tubing 0	1621	Yes	No	0	
00	01	Oil - Production	9.625	36	Grade J-55	Casing/Tubing 0	1621	Yes	Yes	0	

EXHIBIT 12. RBDMS Data Mining applications provide online production trend data and well location maps from agency databases that can be factored into prospecting analyses.

SOURCE: MSOGB, 2010.

3. HOW WE DO IT: **RBDMS.NET** PROGRAM DIRECTION

Since the program's inception in 1992, RBDMS development has been underwritten through grant funding from the DOE and administered by the GWPC. Matching funding has been provided by state agencies in the forms of both donated, in-kind services and direct funding.

The GWPC's RBDMS program is now an integral tool in 22 agencies for managing oil and gas activity and evaluating the risk to source water posed by fossil fuel and mineral extraction operations (see Exhibit 13). Many of the components of the RBDMS software are common throughout the many installations across the United States, from Kentucky to Alaska, New York to New Mexico. Therefore, interaction with other RBDMS member-states and stakeholders has produced a whole community of user-based support. RBDMS users set up two committees

under the aegis of the GWPC early in the program initiative: the RBDMS Steering Committee and the RBDMS Technical Advisory Committee. Ongoing RBDMS development, legacy data conversion and migration, and system setup efforts in multiple states are among the efforts directed by these groups.

RBDMS's original design in Access version 1.1 was updated through Access 2003/SQL Server 2000 format. With the increasing need to publish datasets to the Web and to exchange information in .xml formats, the GWPC undertook a comprehensive update of the RBDMS applications. This recent update reflects a significant improvement in data access and retrieval.

Managing Change: Facets of the RBDMS Initiative

RBDMS development has historically been and continues to be directed by the 22 RBDMS states that use it. Members of the RBDMS Steering and Technical Committees volunteer their talents and time to pull the following program components into a cohesive focus for ongoing software development for environmental and regulatory compliance monitoring:



Analytical Insight



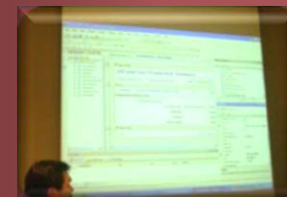
Process Understanding



Issue Communication



Data Assimilation



Training



Peer Support



EXHIBIT 13. RBDMS e-Commerce Initiative partners include agencies in 21 states and the Osage Nation.

Comprehensive User Support

In addition to telephone and remote [Terminal Services and/or Virtual Private Network (VPN)] help desk support, GWPC provides user support, code sharing, and development updates through peer networking, bi-annual training meetings, open-attendance monthly conference calls, and when absolutely necessary, onsite consulting support. A Microsoft SharePoint Services Web site for registered users to use for online discussions and change tracking is at <https://www.rbdmsonline.org/Projects>. A document library available to public users also has been established at <http://www.rbdmsonline.org>.

A New, Holistic Approach to Data Availability

Unlike earlier data crunching tools and earlier versions of RBDMS, the GWPC's new RBDMS.NET application is based on a holistic approach to data management that does not limit the data view to the capability of a single underlying development tool such as Access. The updated user interface for RBDMS.NET applications is in no small part the reason for its effectiveness.

The user interface includes key word, full-text, and advanced Find features. In addition, the RBDMS.NET and Data Mining applications pair a data view with a GIS window so that the user's focus is always on using information as opposed to searching for it. The search capability minimizes the need for general users to compose queries.

When a keyword is entered, the Find results are categorized in a tree control embedded in the Search pane, with the list elements hyperlinked for either a Details display or zoom-to-location operation in the map window. Including the ability to jump from a keyword search directly into a map or from a map into a report with one or two mouse clicks, these features make browsing data fast and easy for both casual and power users. This user interface pattern has been carried through the RBDMS.NET and RBDMSW client-server applications and the RBDMS Data Mining Web application.

With the combination of full-text searching, GIS, automated notifications, and highly granular security, the RBDMS.NET application is suitable for use within agency offices as well as for field inspection. The result is an application that

provides immediate access to data for a wide variety of regulatory purposes.

The ability to map and mine other databases for water quality and quantity monitoring data also has improved greatly over the last 5 years, and this technology has allowed the GWPC to harvest water quality information from USGS, STORET, and other sources where it exists electronically. Then by adding this data to RBDMS.NET, these point locations can be shown on a map and the data searched, overlain with other types of data, buffered, filtered, and reported in ways limited only by the data administrator's and user's imaginations.

Server-Neutral GIS Brings Full Data Access to Field Inspectors and Managers

State agencies are increasingly asked to provide the same high level of environmental compliance programs under stagnant or reduced funding and escalating real costs. The conundrum, however, is that onsite inspection is the most expensive component of any regulatory oversight program and the one that agencies can least afford to compromise to meet the mission-critical goal of water resource protection. Further complicating the technical requirements for data collection is the fact that such inspection programs are often run by people of widely varying computer skills. The people who run these programs include managers who need summary information on demand; technical and laboratory staff who require sophisticated analysis tools; and field inspectors and grassroots citizen volunteers who perform extensive routine watershed data collection.

Arguably one of the most effective means of displaying complex data relating to water and waste stream parameters and other site-specific data is through a GIS format, which RBDMS.NET provides (see Exhibit 14). MapServer is now used as the mapping component of RBDMS.NET (<http://mapserver.gis.umn.edu/>). Using this royalty-free product means that agencies incur per-seat license fees of \$0. The integration of the mapping component also means that field inspectors will see the same information that internal agency staff see and can use the same application on their laptops. Data replication can be set up so that inspectors need only download the raster data (topographic and aerial maps) for their assigned territories. The RBDMS GIS module can support a wide variety of GIS server products.

The granular security of RBDMS.NET allows field inspectors who use it to replicate the relevant data for their territory via the Internet. The inspectors can then use the same application that in-house agency staff members use to input and evaluate the data. Such a configuration puts critical information in the hands of those on the front line of environmental compliance monitoring while cutting implementation costs, response times, and learning curves (see Exhibit 15).

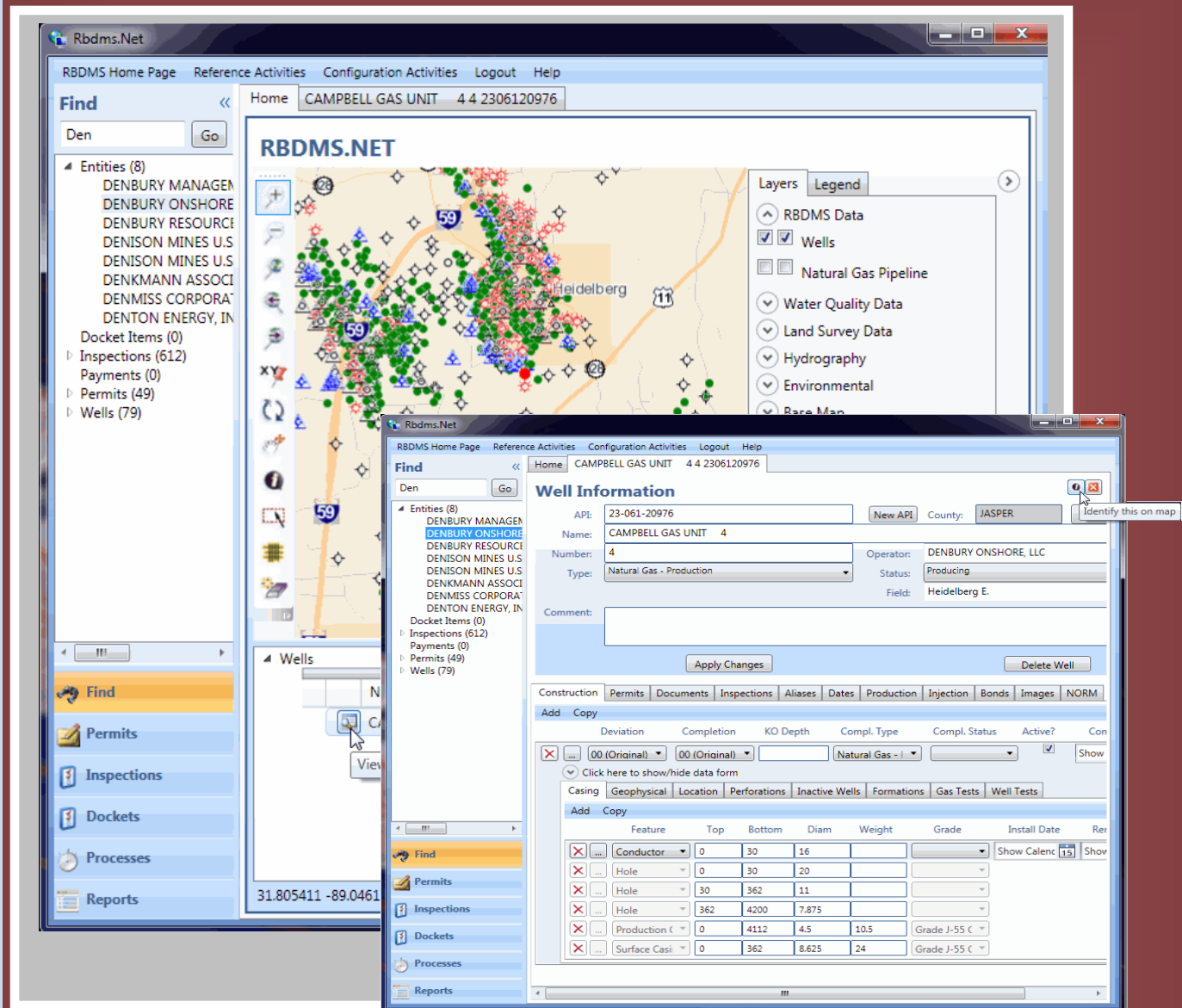


EXHIBIT 14. The RBDMS.NET user interface organizes data in an easy-to-navigate point-and-click environment.

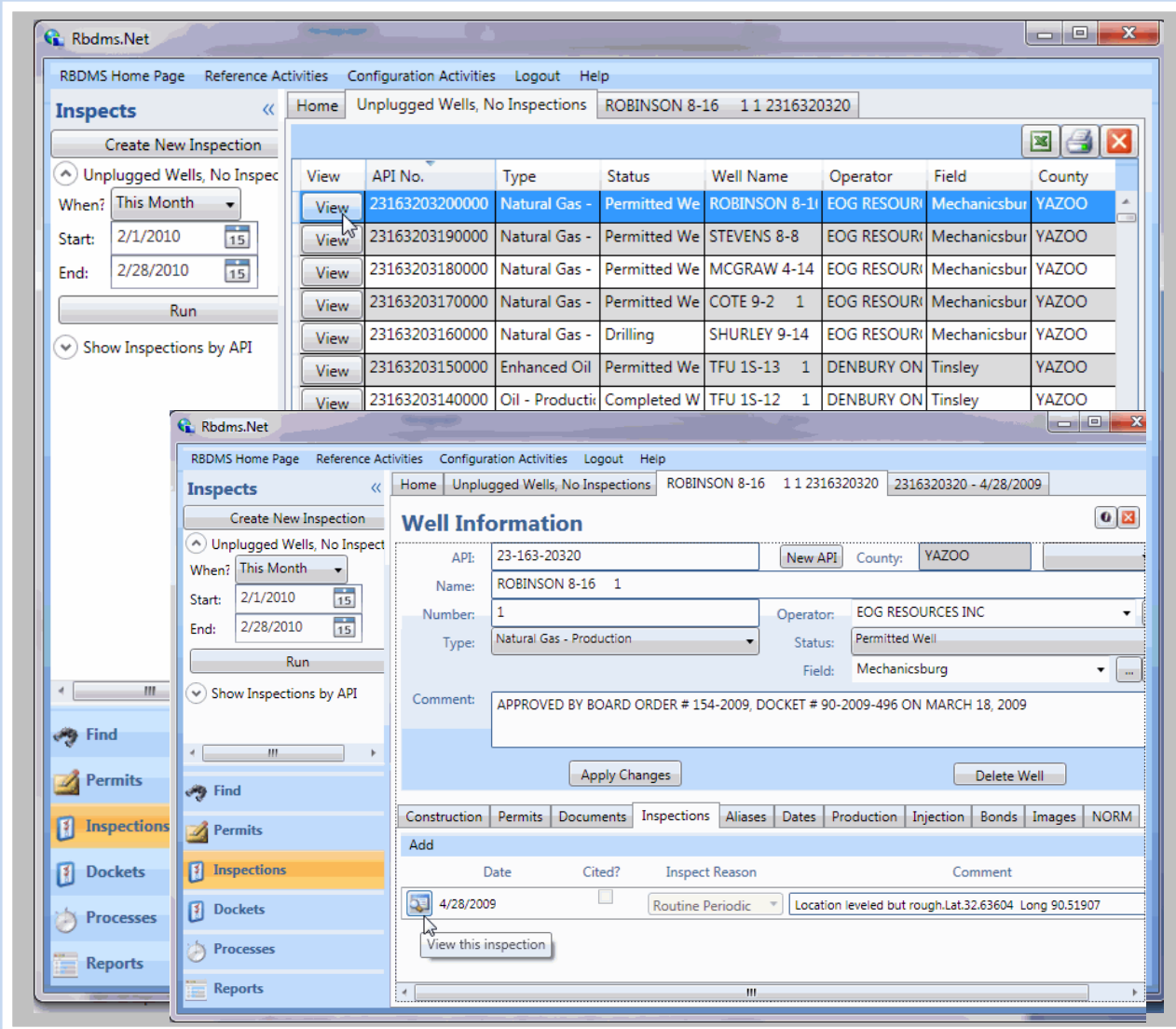


EXHIBIT 15. RBDMS.NET gives field inspectors access to the same full set of data accessible to office staff. Merge replication keeps the updates in synchronization.

RBDMS.NET Specifications

The client-server RBDMS.NET application is now being released as a multi-tiered application with a .NET Framework 3.5.1 Windows Presentation Foundation user interface, a SQL

Server 2005-2008 database, an integrated GIS, and a LINQ-to-XML data access layer. The application uses separate business logic and data access tiers to handle state-specific regulatory processes.

RBDMS.NET eForm is a Silverlight Web client, a Windows Communication Foundation (WCF) middle tier, and a SQL Server 2008 intermediary database in a DMZ that is replicated to the production database behind a firewall. Notable features include a roles-based notifications and workflow processing system to track regulatory tasks and a public comment forum.

RBDMS Data Mining is an ASP.NET Web that includes the RBDMS GIS module. The RBDMS GIS module is incorporated within the user interface for internal (RBDMS.NET) users and Web site (Data Mining) visitors. The module abstracts the RBDMS.NET application from underlying GIS servers such as ESRI ArcIMS (via the ArcIMS ActiveX Connector) or MapServer (via the MapScript C# API), which are both currently supported. The module can be extended to use other data sources and servers. Internally, the RBDMS GIS module uses the MapServer MapScript C# API for a number of common operations such as coordinate projection.

The RBDMS eReport.NET application is a ClickOnce smart client WinForm application developed expressly to assist oil and gas operators with monthly production and disposition reports. eReport.NET includes a WCF layer that manages report upload and processing to the agency's server through a series of automated data quality control checks. The underlying data transfer format is based on the GWPC's eReport schema (http://www.rbdmsonline.org/xml/ver3_6Doc/eReport3_6About.html).

Spring and Fall Training Sessions

The RBDMS Spring and Fall Training sessions focus on the administration and maintenance requirements for state-specific RBDMS products. Representative recent topics have included data translation and migration with SQL Server Integration Services, developing RBDMS report templates and filters, customizing RBDMS Data Mining and GIS, and serving permitting and completion forms with eForm.

4. RECENT RBDMS DEVELOPMENT: REPORTS FROM **THE AGENCIES**

The GWPC has been applying its accumulated technical knowledge base to support the RBDMS eCommerce Initiative in installations nationwide. Great strides have been made in leveraging available funding resources and providing communication and liaison services. However, resources through state channels remain scarce, and the mission, large. The GWPC greatly appreciates support at the national level and welcomes such partners in this ongoing and important work.

As paper-based form submittals and manual processing have been converted to Web-based data processing and publication, the GWPC has been developing, continually improving, and incrementally rolling out RBDMS applications. These RBDMS projects are always managed

within the constraints of member-agency workloads and program funding. A representative sampling of some of the RBDMS projects now underway in the GWPC's member-state agencies is presented in this chapter.

The Technical Advisory Committee encourages sharing code and programming techniques among RBDMS agencies.



Participants in the RBDMS Training meetings work through examples of tasks that RBDMS database administrators must be able to perform. The feedback becomes guidance for future curricula and RBDMS development.

Colorado Oil and Gas Conservation Commission

When new rules imposing greater protections for Colorado's source waters became effective in April 2009, the eForm Web application was ready to be launched to enforce these rules. Additional documents now must be submitted with each location assessment permit, and eForm allows for two-way communication of electronic documents between industry and the agencies. By allowing the operator to submit digital documents, an increase in productivity was achieved along with reducing the amount of paper stored.

Three agencies, two within the Colorado Department of Natural Resources (the COGCC and the Department of Wildlife) and the Colorado Department of Public Health and Environment (CDPHE) are tasked with reviewing and processing information for Form 2A, Oil and Gas Location Assessment, which includes source water and other environmental impacts, in compliance with House Bills 1298 and 134.

Although it does not use the RBDMS database internally, the COGCC partnered with the GWPC in 2007 to begin a project that culminated in the release of eForm, a Web application that multiple states have embraced for receiving permit applications, completion reports, sundry notices, and other regulatory forms over the Web. eForm includes single-form processing, workflow and timing clock notification, a public comment forum, and the ability for sister agencies to share incoming data and to coordinate

recommended conditions of permit approval and other feedback.

eForm application allows the industry operator and the public to monitor exactly where in the review process the form is, what steps remain to be completed before the permit will be approved, and the amount of time remaining for each review task. This functionality is displayed through the Web application main navigation page (see the discussion in Chapter 2). Members of the public also can post comments about the permit application after the operator submits it and while it is under review status.

Roles-based security, a system of document form statuses, and secure socket layer (SSL) features also allow industry to save draft permit applications in a secure area on the agency server through user name and password credentials.

The commitment of DOE funding through the GWPC was instrumental in allowing the project to be approved by the State of Colorado Office of Information of Technology. With this support, the COGCC was able to accomplish better interagency communication at a lower overall cost.

Illinois Department of Natural Resources, Division of Oil and Gas

RBDMS Classic is being installed in Illinois in anticipation of efficiency increases from reducing hard-copy paperwork and introducing electronic storage of well information. With the increased ease of filing, storage, retrieval, and data manipulation RBDMS offers, the agency anticipates greater efficiency in the allocation of staff and resources. Specifically, staff will have better access to the data needed to evaluate well construction information and other data when reviewing permit applications. Likewise, RBDMS will decrease the length of time necessary to issue permits. Public access to the data also is expected to improve, which will also reduce the time staff members spend retrieving data for public requests. The project is expected to be complete in 2010.

The ease of data access and ability to share data with other agencies will be of particular value in the regulation of CO₂ sequestration issues and in dealing with emergency response to such occurrences as crude oil or salt water releases and tank battery fires.

Kentucky Division of Oil and Gas (KDOG)

Kentucky continues to reap the benefits of the GWPC's RBDMS program. As is the case with many state agencies this year, the economic downturn has resulted in budget cuts and staff downsizings at the KDOG. However, the RBDMS program has allowed the Division to continue to provide excellent service to the oil and gas industry.

The KDOG has updated its RBDMS application in the last year to address several emerging issues. The first is an increasing number of horizontal/directional and multilateral well drilling permit requests. Regulating this well type requires the Division to track down-hole measurements to ensure compliance with the statutory requirements. KY RBDMS was updated this year to show the proposed and the as-drilled location of the well.

A second major issue is the new legislation the Kentucky General Assembly passed into law concerning wells drilled in areas of coal mining. Oil and gas operators are now required to submit an as-drilled plat for each well drilled in a coal area. The operators are also required to submit a directional survey if the proposed well is deemed to be in an active mining area or an inclination survey if the proposed well is deemed to be in inactive mining area.

The Division also is required to track the depth of the lowest workable coal as the surveys must be run from this depth. The new legislation also allows the oil and gas operators a variance of 15 feet from the permitted location on the surface and up to 150 feet from true vertical at the base of the lowest workable coal. A new function was created in RBDMS to allow for a check of the distance between the permitted

location and the as-drilled location to ensure the operator is compliant with the spacing allowances.

The KDOG also has implemented additional automated email communications between all staff to effectively process well transfer requests, non-compliance violations, flow line and/or gathering line application approvals, well testing permits, drilling permits and field inspections. With the assistance of RBDMS, the level of communication has increased among staff, which has resulted in improved service to the oil and gas industry. RBDMS also allows staff to monitor potential problems which could have a negative impact on the environment. The KDOG upgraded RBDMS from SQL Server 2000 to SQL Server 2005 this year.

The Division is in the process of seeking primacy of Class II underground injection control (UIC) wells from the Environmental Protection Agency, Region 4 in Atlanta, Georgia. If granted primacy, several programs would have to be developed and implemented to process UIC permit applications, well records and field inspection reports. In addition, several CO₂ geo-sequestration test wells have been drilled in Kentucky. If these tests prove successful, Kentucky could see an increase in the drilling of these types of wells. If the drilling of CO₂ geo-sequestration wells continues to increase, this Division will use RBDMS to track the pertinent information relating to these wells.

Mississippi State Oil & Gas Board

The MSOGB was one of the first agencies to embrace RBDMS in the late 1990s and continued to use the early Access version of the front-end application until 2007. At that time, the agency decided to invest in a sweeping upgrade of its systems to use the full suite of RBDMS.NET products:

- The RBDMS.NET client-server application (.NET/.SQL Server 2005) is now being rolled out to internal agency staff. The upgrade will eliminate the manual processes now used for handling client, bond, well, permitting, inspection, fee tracking, and docket data (see Exhibits 13 and 14). The MSOGB installation was the first RBDMS.NET installation to include a GIS that is integrated with well record details.
- The eReport.NET application is now being tested with industry operators for monthly production and injection reporting.
- The RBDMS Data Mining application is now available to public users at <http://gis.ogb.state.ms.us/MSOGBOnline>. The application includes filterable views and reporting, and satellite imagery (see Exhibit 13).
- The RBDMS eForm application is now in development and testing by agency staff.

New York State Department of Environmental Conservation, Division of Mineral Resources (NYSDEC DMN)

The NYSDEC DMN has used RBDMS since 2000. With DOE funding through the GWPC, the last 10 years have brought great increase in the DMN's ability to track drilling, production, and environmental compliance with oil and gas regulations.

With the advent of the Marcellus Shale gas play, New York State is embarking on new regulatory approaches to large-scale hydraulic fracturing of low-permeability reservoirs. In response to a directive by the Governor, the DMN is preparing a Supplementary Generic Environmental Impact Statement (SGEIS) to guide the permitting process for oil and gas wells completed with this process. This extensive new regulatory document is being prepared in advance of large-scale HF becoming permissible in New York. Any company planning to conduct a high-volume hydraulic fracturing program before the completion of the SGEIS will be required to complete a site-specific EIS.

As part of these changes, the DMN will require modifications of and extensions to the existing RBDMS to effectively track these new regulatory requirements. The new requirements include water usage from source to disposal, chemical tracking, and changes to the environmental assessment forms. GWPC will be funding the development of this extensive new

module with DOE grant funding, and the project is scheduled to begin in mid-2010.

The GWPC also assisted the DMN with the installation of a Web-based permit application called OGePermit, which is now in testing. The application, which eliminates the need to transcribe data and improves data quality control, will permit more in-depth review of applications to drill, deepen, or plugback wells. The OGePermit application allows electronic transfers of permit applications to be sent to other divisions within the agency, thus speeding the time it takes to issue a permit. Future extension of the application will include completion reports for industry operators. Base code for the ePermit application was adapted from the Utah agency's installation to handle additional requirements.

An online searchable database that the DMN installed with GWPC assistance and DOE funding is now helping to open New York oil and gas resources to industry exploration. With the Data Mining application, yearly production data is being made available to the public for the first time. Additionally, well location data can be exported and plotted with freeware such as Google Earth.

In 2010, the NYSDEC will partner with the GWPC to release a version of the RBDMS Well Schematic Utility in Adobe Flash.

New Mexico Oil Conservation Division (OCD)

In New Mexico, RBDMS is the repository for hydraulic fracturing data for individual wells. This data is available to field staff for review. It also is used to track data for tertiary recovery of oil and gas with CO₂ EOR wells. As a tracking system for permitting and discharge permit renewals for oil and gas related activities, RBDMS greatly reduces the time staff needs to spend in review of permit issuance by providing data access easily. The OCD uses RBDMS to track activities related to oil and gas service companies, gas processing plants, gas compressor stations, refineries, crude pump stations, Class I and III injection wells, and underground gas storage, among other uses.

RBDMS is also used for information exchange with the OCD's sister agencies and the public. For example, the enhanced recovery tax reductions offered by the State are tracked through RBDMS. The OCD uses the data from RBDMS to notify the Tax Revenue Department where the appropriate tax reductions should be allotted, a procedure that promotes the innovative recovery efforts of operators. Various facilities, especially refineries, may be regulated by different agencies within New Mexico. As discussed on page 12, OCD RBDMS provides data access to other state agencies for their review upon potential issuance of a permit(s) as well as data exchange with the BLM.

RBDMS serves as the interface for all scanned documents associated with individual wells, hearing orders, and environmental permits submitted to the OCD. The public then has access to all of these documents for online review and printing.

In 2008, New Mexico experienced two brine well collapses. RBDMS was used to determine if nearby wells or other oil field related infrastructure could potentially be impacted by the collapses. Currently, permits for brine wells (active and plugged) are tracked through RBDMS. The OCD is using the data stored with the permits to anticipate potential collapses and to formulate possible steps for preventing such collapses.

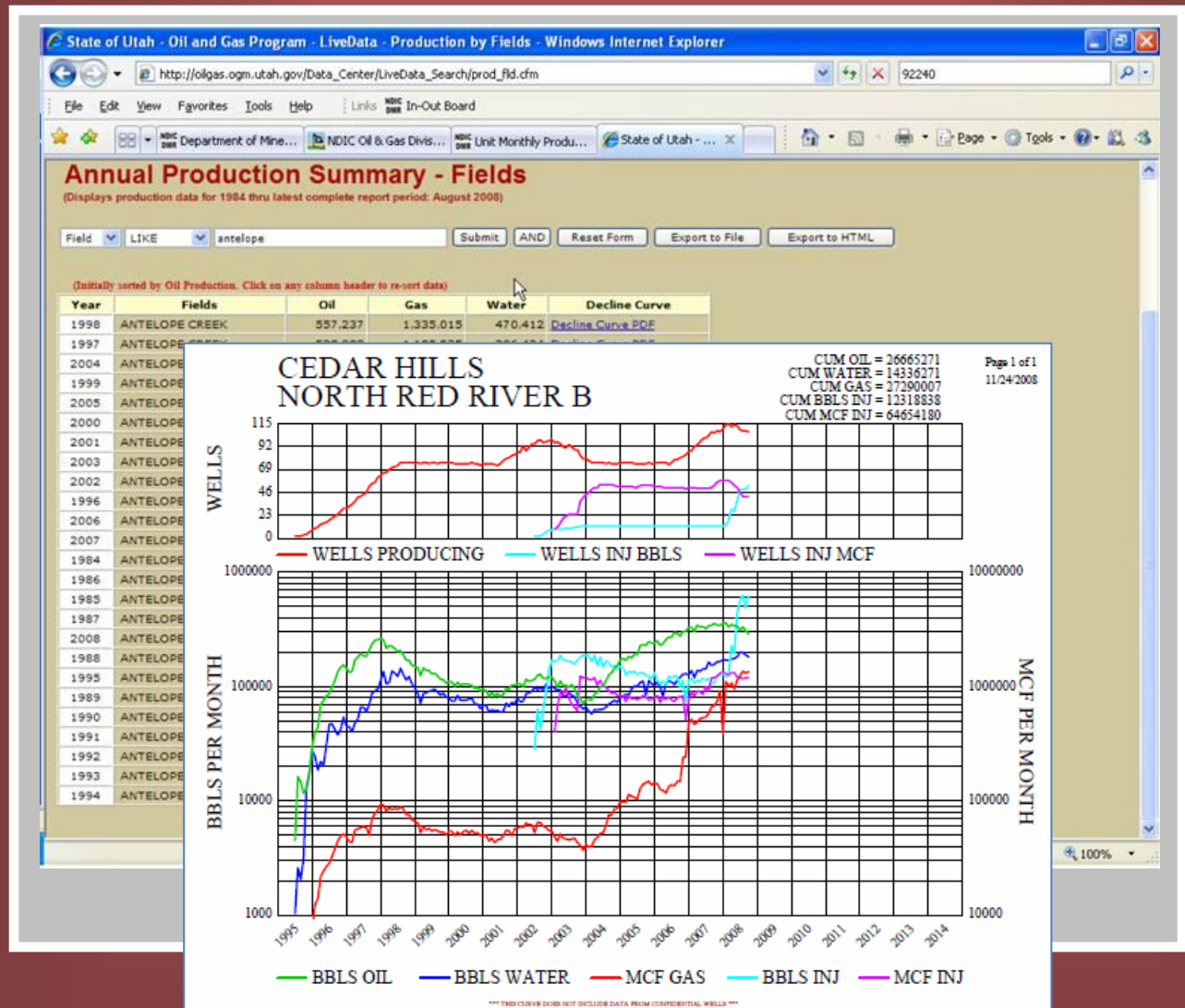
RBDMS increases protection of New Mexico's water resources in several ways:

- By tracking abandoned wells, the OCD can ensure that these wells are plugged in a timely manner.
- By tracking mechanical integrity test results, the OCD can ensure that the integrity of injection is maintained.
- By tracking the conditions imposed on well permit approvals to protect water resources.
- By tracking discharge permits, the OCD can ensure that the respective facilities are inspected for compliance with their permits.
- By tracking site remediation plans and groundwater abatement plans, the OCD can monitor the timely remediation of contaminated sites.

EXHIBIT 16. This year the UDOGM adopted the PDF Performance Curve utility that the NDIC developed for use with RBDMS Classic.

North Dakota Industrial Commission Utah Division of Oil, Gas, and Mining (UDOGM)

The NDIC and the UDOGM are both long-time participants in the RBDMS Initiative and have been leaders in the nationwide program to promote the benefits of RBDMS. Most recently, the NDIC developed a visual utility to evaluate performance curves on the basis of data from producing fields and wells through RBDMS applications. The UDOGM Utah has installed and customized the ND PDF performance curve to run on its Web site for both field curves and well curves. The field curve link is shown in the Utah RBDMS Data Mining application at <http://oilgas.ogm.utah.gov> in Exhibit 16.



Oklahoma Corporation Commission

The OCC is now in the process of installing RBDMS.NET for internal agency staff use in managing data associated with as many as 140,000 active wells in Oklahoma. The work comes as part of a \$1 million overhaul to replace two antiquated computer systems, an Oracle system and a COBOL “green screen” application, with a single SQL Server 2005. A major focus of the OCC’s project is electronic import of well locations and inspection data with the goal of making the information available over the Web (Exhibit 17). The project is scheduled for completion in mid-2010.

Pennsylvania Bureau of Oil and Gas Management

The economic factors that led oil and gas operators to consider large-scale production from the Marcellus Shale formation both feasible and desirable have had significant consequences for the Pennsylvania Department of Environmental Protection (DEP) Bureau of Oil and Gas Management (BOGM). Essentially, this “oil-patch agency” is now tasked with the regulatory oversight of a world-class gas play. The DEP hired 68 new inspectors in February 2010 as one result, and permit requests for the last few years are sharply above historic levels. Streamlining the permitting process is considered another critical focus of the upgrade to RBDMS.NET for the BOGM, which currently processes 6,510 related permits per year. The time to issue a permit now averages 28 days for the agency, and management believes that the completion of RBDMS.NET and the installation of the eForm application will cut this time to 1 to 2 days for routine permits such as sundry notices, allowing staff to focus greater technical review on new permits. The DEP BOGM is now completing a needs assessment and other analysis to begin a project to customize RBDMS.NET to meet its rapidly changing business rule requirements.

The BOGM now manages a great deal of its program-specific data related to oil and gas well permitting and field inspection activities with numerous Access databases. Company, bonding, facility (well inventory), and enforcement information is shared with many other bureaus within the DEP and statewide through an Oracle database named eFACTS, which flows data to several public information Web applications. In the course of their duties, BOGM technical staff members also consult a second Oracle database,

the Well Information System (WIS), which is owned by the Department of Conservation and Natural Resources (DCNR).

The GWPC will assist the PA DEP to install a comprehensive RBDMS program to meet the challenges and goals of centralizing oil and gas regulatory information from all of these sources and to establish desired data flows to the eFACTS database to continue feeding existing public-access Web sites. Furthermore, the project will enhance public data access by integrating RBDMS datasets (well location, construction, ownership, permitting, and production) through RBDMS Data Mining; automate and streamline the permitting process through RBDMS eForm; and offer a field inspection utility with merge replication to RBDMS.NET.

The need for a mobile platform is critical, and a major challenge will be meeting the technical requirements for the field inspection module and the data ownership requirements for RBDMS.NET and eFACTS. The project will provide readiness for tracking data elements associated with hydraulic fracturing and a new approach to reporting production data. In short, RBDMS.NET will provide the BOGM with the technical data management system it needs to accommodate the nascent and evolving regulatory rules for oil and gas company activities within the Marcellus Shale play.

Phase 1 to install and customize RBDMS.NET to meet the BOGM business rule requirements is scheduled to last 20 months. The eForm Web application will be installed and made available to industry operators as a Phase 2 effort. Other work to meet the requirements of regulating hydraulic fracturing and protecting state watersheds will follow.



Photo courtesy of The Oklahoman.

EXHIBIT 17. Bob Griffith/OCC inspects a well. A strong emphasis in the current OK RBDMS development work is electronically importing the well locations into the database.

In Acknowledgement and with Appreciation...

The groundbreaking work described in this document is performed with the oversight of the RBDMS Steering and Technical Advisory Committees and the GWPC Technical Director. These individuals, listed here, volunteer their time and professional skills to ensure the success of these programs and to provide direct technical support to their peers. The extent of the program commitments the GWPC has been able to support is thanks in large part to these “RBDMS ambassadors.”

RBDMS Steering Committee:

Stan Belieu, Nebraska Oil and Gas Conservation Commission

Mark Bohrer, North Dakota Industrial Commission

Don Drazan, New York State Department of Environmental Conservation

Tom Richmond, Montana Board of Oil and Gas Conservation

RBDMS Technical Committee:

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Chuck Borchert, Nebraska Oil and Gas Conservation Commission

Kim Collings, Kentucky Division of Oil and Gas

Dave English, Pennsylvania Department of Environmental Protection

Steve Davies, Alaska Oil and Gas Conservation Commission

Marc Fine, Colorado Oil and Gas Conservation Commission

Bob Griffith, Oklahoma Corporation Commission

Jimmy Hall, Alabama Oil and Gas Board

Jim Halvorson, Montana Board of Oil and Gas Conservation

Dan Jarvis, Utah Division of Oil, Gas & Geothermal Resources

Thom Kerr, Colorado Oil and Gas Conservation Commission

Jim Lindholm, North Dakota Industrial Commission

Karen Lundblade, Kansas Corporation Commission

Dan Pearson, Arkansas Oil and Gas Commission

Rick Sims, Mississippi State Oil and Gas Board

Amanda Trotter, New York State Department of Environmental Conservation

Technical Consultants:

- ALL Consulting, LLC
- Coordinate Solutions, Inc.
- Digital Design Group
- Troy Web Consulting, Inc.
- Virtual Engineering Solutions, Inc.

Ground Water Protection Council:

Paul Jehn, Technical Director

This program is made possible by ongoing support from the **US Congress** and the **US DOE**.

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CALENDAR OF UPCOMING RBDMS EVENTS

The schedule for RBDMS activities and projects for the remainder of 2010 and into 2011 is shown at right.

Work to kickoff the **RBDMS.NET** project in Pennsylvania starts the week of July 19, 2010. Discussion will focus on mapping the data requirements of the PA BOGM to RBDMS data structures.

The GWPC Annual Forum and Water/Energy Symposium in September will feature demonstrations of **RBDMS for Water** and a workshop in the requirements for tracking and reporting in the **RBDMS Hydraulic Fracturing** module.

RBDMS Fall Training in Albany in October will feature hands-on instruction in configuring **RBDMS eForm** for electronic permitting and completion reporting; demonstrations of the **RBDMS Wellbore Diagramming Tool**; and an overview of using **RBDMS Classic** with Office 2007.

In RBDMS Spring Training in Lido Beach in April 2011, participants will discuss progress in these ongoing project areas in addition to hands-on work with updated development tools for RBDMS rollouts.

Federal, state, and local government representatives and industry operators are welcome to attend the Annual Forum and the training events. Limited scholarships may be available to RBDMS member-agency employees. If you are interested in learning more, please contact Paul Jehn (<mailto:pauljehn@gmail.com>).

Major Project Meeting:

PENNSYLVANIA RBDMS.NET KICKOFF MEETING
July 19-23, 2010
 PA BOGM Offices
 Rachel Carson State Office Building
 400 Market Street, Harrisburg, PA

GWPC Annual Forum:

WATER/ENERGY SYMPOSIUM
September 26-29, 2010
 Sheraton Station Square
 Pittsburgh, PA
 July 19-23, 2010

RBDMS Training Events:

RBDMS FALL TRAINING
October 13-15, 2010
 NYSDEC Offices
 625 Broadway Avenue
 Albany, NY

RBDMS SPRING TRAINING
April 9-14, 2011
 Lido Beach Hotel
 Lido Beach, FL

July 2010						
Su	Mo	Tu	We	Th	Fr	Sa
27	28	29	30	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

August 2010						
Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

September 2010						
Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

October 2010						
Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

April 2011						
Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
1	2	3	4	5	6	7