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Managing Hydrofracking Data in Cloud

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Why Sunshine is the Best Disinfectant

There is little dispute in both scientific and business communities that groundwater protection and water usage in general at hydrofracking sites provide the biggest challenges for this young and promising industry. To date, criticism of fracking has focused mainly on concerns that the chemicals energy companies are mixing with the water could contaminate underground aquifers. Although hydrofracking has been used for decades, the technology has become more powerful and more widely used in recent years, producing far more wastewater and attracting much more public and regulatory scrutiny. The hydrofracking process involves injecting large amounts of water, mixed with sand and chemicals, at high pressures to break up rock formations and release the gas or oil. If not used properly, hydrofracking carries the potential to contaminate groundwater.

Oil industry officials regard that issue as manageable, but they must to prove it to an often-skeptical public and regulators. However, the industry has two other challenges. The biggest challenge to future development, hydrofracking companies say, is simply getting access to sufficient water. But an even bigger problem may be the management of water-quality data.

Water in the Age of Hydrofracking

Water is a finite resource, growing in scarcity as the world's population expands rapidly. The worldwide water shortage is acute—less than three percent of the world's water supply is fresh water (as opposed to salt water), and more than half of this supply is locked in ice at the North and South poles. The rest is distributed in surface water bodies like lakes and rivers and in underground repositories as groundwater.

This general scarcity of water affects hydrofracking activities more than other drilling industries due to political sensitivities surrounding excessive water use and pollution. The high rate of water use in extraction and the state of the water that returns to the surface trouble environmental watchdogs and the members of the communities where the drilling occurs.

Only 10 to 40 percent of the water sent down the well during hydrofracking returns to the surface, but it returns carrying drilling chemicals, very high levels of salts and, at times, naturally occurring radioactive material. Water contaminated during the hydrofracking process and returned to the surface frequently needs to be treated, but the process is generally lengthy, expensive, and energy-intensive. Once contaminated, water needs to be monitored until cleaned. The process is environmentally costly in terms of water loss and contamination risk, requires high energy usage (read: more carbon emissions), and the public—and regulators—are taking note.

And, the more arid the extraction site, the more water drilling companies need to use to extract gas. For example, because of the geology of South Texas, each oil or gas well there uses the equivalent of 10 Olympic swimming pools' worth of water to develop a single well, which is nearly

twice as much as wells in North Texas need for the same rate of extraction, according to industry and academic data. The region's severe drought last year compounded the issues of high water use. Fewer than 2,000 oil and gas wells have been drilled in the past couple of years in South Texas, but the industry expects that number to climb to as many as 25,000 over the next two decades.

And while oil companies also drilled 2,232 new water wells throughout Texas last year, about three times as many as five years earlier, according to a *Wall Street Journal* analysis of Texas Water Development Board records, there is no guarantee that the water wells can meet the demand of the growing hydrofracking activities in Texas.

At a national level, according to a recent *New York Times* article[1], there were more than 493,000 active natural-gas wells in the United States in 2009, almost double the number in 1990. Around 90 percent have used hydrofracking to get more gas flowing, according to the drilling industry.

More oil wells are planned, and as the industry refines its techniques and drills longer and deeper wells, the amount of water used for each well is climbing. The oil industry has long anticipated that its thirst for water could cause problems; the American Petroleum Institute warned against using fresh water for fracking in its 2010 best-practices guidelines. The industry's rate of growth over the next decade will pose more and more challenges in acquiring the water it needs to continue operating and expanding its wells.

Environmental Data Management in the Hydrofracking Industry

All of these activities generate huge quantities of complex data, and those quantities are set to explode over the next few years if the industry continues at its current rate of growth.

For the natural gas industry to stay in compliance with ever-stricter laws to protect drinking water supplies and air emissions, drilling companies need software tools to organize hydrofracking waste and water-quality data in order to demonstrate to the public and regulators that hydrofracking activities are not endangering natural resources, water in particular. They also need to prove that any dangerous waste from the wells is handled in compliance with state and federal laws.

Nearly all of the activities associated with hydrofracking, including the assessment of site characteristics, the ongoing monitoring of site conditions and air emissions, management of production water, and the remediation of adverse environmental impacts, involve the collection and analysis of large quantities of data. The specialized software to organize, manage, validate, visualize, store, and report this information did not exist until recently or, at best, existed as series of unconnected applications running on the PCs of industry consultants serving their hydrofracking customers.

The hydrofracking industry has been in the spotlight in recent months and needs tools to prove its case to the public and regulators that natural gas production using hydrofracking can be done safely and transparently. The industry needs a tracking method that offers a centralized and less-expensive solution to manage and monitor water, waste, wastewater, drilling fluids, radionuclides, energy usage, and air emissions more effectively than desktop applications. Almost all natural gas production sites have a need for such a tool to prove to regulators and the public that the extraction technology is safe for groundwater and avoids surface water contamination.

Enter the Cloud

Cloud computing is a software outsourcing model that offers great promise for managing environmental information of any type. It is slowly making its way into companies that have to manage large quantities of water-quality data and meet routine compliance requirements. The model fits the way environmental information needs to be managed through mashups (applications that integrate data or functionality from multiple sources or technologies), and has the potential to

completely upend the way corporations organize, manage, and report their environmental data and information. Companies that have large portfolios of hydrofracking exploration and production sites can use Cloud computing as a very low-cost means to take control of their mission-critical environmental data and information, gain new functionality and capabilities, and at the same time circumvent the involvement of their IT department if they so desire.

Cloud-based data management can completely replace existing stand-alone data systems and reporting tools to provide a comprehensive integrated solution to the hydrofracking industry's one of the most vexing problems—the centralization and management of complex data pertaining to contaminated water, groundwater, soil, and air.

At many oil and gas exploration sites that use conventional drilling and exploration technologies, or at nuclear facilities and other sites contaminated with radionuclides such as Los Alamos National Laboratory in New Mexico, Cloud-based information management systems already provide market-tested solutions that were rapidly deployed and provide a high level of functionality and data security, an extensive set of QA/QC standards, and scalability.

The Cloud provides a platform for the complete electronic processing of analytical data, beginning with the upload of electronic data deliverables from labs, and terminating in state-mandated or federal regulatory exports and reporting. When companies use such Software as a Service (SaaS) models, they eliminate most of the difficulties associated with the management of hydrofracking data while offering the opportunity for more rapid customization of data reporting to meet the changing needs of the industry. But perhaps the most important element of Cloud-based software is that site owners may choose the transparency that the industry badly needs to shed the negative image of a major water polluter. As U.S. Supreme Court Justice Louis Brandeis once said, "Sunshine is the best disinfectant." The benefits of openness and transparency include calming public concerns of secret toxic dumping, unmonitored resource use, and unmitigated environmental impacts. Industries and companies that have long promoted transparency in corporate reporting in general have done better from those who did not.

More Regulations on the Way

In the past the industry received extraordinary protection from Congress. They have been made exempt from regulation and monitoring under the Superfund Law and the Clean Water and Clean Air Acts, and when the Energy Policy Act of 2005 was passed, it included a clause that exempted hydrofracking from the Safe Drinking Water Act (this clause has become known as the "Halliburton Loophole"). The Energy Policy Act also allows natural gas companies to keep the identity of the chemicals they use in hydrofracking fluid secret from the public, supposedly so competitors could not steal the information. But all of this tolerance of secrecy will change. State governments are shifting their focus from compliance-based monitoring and reporting of effluents to reporting on the composition of chemicals being mixed with production water and their potential impact to the environment and, in particular, its influence on the quality of drinking water supplies. Five states (Texas, Wyoming, Arkansas, Pennsylvania, and Michigan) have already passed laws or administrative rules requiring drilling companies to reveal some of the chemicals they use when injecting fluids to free natural gas and oil from underground rock formations. Some new regulations expected to affect the hydrofracking industry in the near future will require more monitoring and reporting of both groundwater and surface water contamination at and around hydrofracking sites. In effect the industry will be required to monitor its complete "water footprint." As such, water accounting is the next big challenge for hydrofracking industry.

Water management issues represent a potentially huge area of risk for the gas exploration industry. Reducing one's water footprint should be part of the environmental strategy of the hyrofracking industry, just like reducing one's carbon footprint or energy usage already is.

However, meeting emission standards for compliance purposes is one thing; managing the "hydro" component of hydrofracking technology is of paramount importance for the industry's image and

long-term survival. Leaders who implement water-quality transparency at their companies' hydrofracking sites before others do, and who formulate specific and measurable targets with respect to their water footprint reduction, can turn this practice into a competitive advantage. Cloud-based software can help them achieve that objective faster by streamlining their data management so that monitoring the environmental impacts becomes easier and emissions reporting helps them to identify and address issues more quickly.

No doubt many companies who rely on an army of consultants and their spreadsheets to meet their reporting requirements will choose to ignore Cloud computing, given that it is just in its infancy and the option of doing nothing is the easiest one to pursue. However, such a decision may not be tenable in the long run as Cloud computing is looking more and more like the technology that will help companies aggregate their data in the most meaningful and actionable form over the short and long term.

Cloud Computing Advantages

Cloud computing provides key advantages to hydrofracking companies that have to manage large water-quality databases. These advantages include:

Quick implementation. Companies do not need to purchase, install, test, or configure hardware. Implementation is as fast as the customer can manage. Since the system is already functioning and being used by others, the customer can begin accessing it immediately.

Ability to try the system. Because Cloud computing systems are already set up and running, testing out the system or running a pilot is very easy.

Less risk. Cloud computing is less financially risky to companies because they do not need to commit as much internal time and money to implement the system; there is no need to invest in additional IT equipment, nor must the internal IT staff get involved to set up or configure any application.

Quicker problem resolution. Bugs happen in all software—it's a given. Cloud computing systems are much quicker to fix, and the corrections are rolled out immediately. This "rolling upgrade" approach provides huge savings to Cloud customers.

Direct access to the vendor. Cloud computing vendors are in front of their products and actively maintain and upgrade them. In contrast, client/server or "Web-enabled," on-premises or hosted systems sold through third-party resellers must contact the original software vendor for any issues involving customization or performance.

Cloud computing vendors are consultant-neutral. Many consultants, in an attempt to compete with Cloud vendors, are beginning to offer to host their clients' data on the Web using their home-built solutions and spreadsheets. This method will not work in the long run because engineers or geologists did not built those applications as robust data management platforms, and they are not true Web-based enterprise applications. These stop-gap solutions are not as dynamic and customizable for customers as a true Cloud-based system.

Switching costs. Companies in the environmental industry switch consultants and labs frequently. Sometimes they initiate the action. Other times, it is forced on them when consultants change ownership through mergers and acquisitions, or go out of business. Cloud-based software keeps data ownership with the site owner, so changes to a company's consultants or labs don't affect business operations.

Access to innovation and features from other Web sources. Anyone using Google or Yahoo! maps knows the power of these applications, which did not exist several years ago. Today, Web applications for water-quality management can access these and other vendors' Web sites, extract relevant information from them, then make this information available to customers in the form of a

mashup. The architecture of the Web allows one system to “consume” information generated by others, which in turn allows customers to get the best-in-class information delivered to them in their applications without needing to procure the individual services themselves.

Transparency. If the company chooses to embrace transparency as part of its overall mission of environmental stewardship, it is easy with a Cloud-based system to make its data transparent to regulators and the public. In turn this reduces reporting costs and becomes easier to stay in compliance, avoid non-compliance fines, and manage its public image with clearer reporting.

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[1] *Regulation Lax as Gas Wells’ Tainted Water Hits Rivers*, New York Times, February 27, 2011.

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