This article considers the use and characteristic risks of disposal wells for oilfield wastewater management.
Wastewater management and disposal constitute a significant portion of the operating budget for many upstream oil and gas companies. Often, the most environmentally-sound and cost-effective method of managing wastewater is to inject it into a permitted Class II disposal well. The benefits of using disposal wells are tempered by material business risks associated with their use. What are these risks and how can they be mitigated?

Produced Water is Oilfield Wastewater

Oilfield wastewater, commonly known as produced water, is water that is brought to the surface during the production of oil and gas. Produced water can be either (1) naturally present in the formation with the hydrocarbons, or (2) residual wastewater that has been injected into the formation in order to stimulate production or to maintain formation pressure. The quality of this wastewater varies greatly by formation, but typically contains salts, hydrocarbons, metals, other organic compounds, chemical additives (from hydraulic fracturing), and naturally occurring radioactive materials (NORM). The U.S. oil and gas industry (onshore only) is expected to generate more than 20 billion barrels (840 billion gallons) of produced water in 2016. The characteristics of the wastewater and the sheer volume that is produced make management and disposal of produced water a challenge for operators.

Historically, roughly half (46%) of all onshore produced water is actually reinjected into producing formations for enhanced oil recovery (EOR), as illustrated in Figure 1. The remaining 10 or so billion barrels per year must be gathered, stored, moved, treated, and disposed of, typically one well at a time. Water handling and disposal represents a significant cost—estimated to be $36.9 billion in 2015. Today, most produced water that is disposed of is injected into a permitted Class II disposal well.

Disposal of Oilfield Wastewater

The Safe Drinking Water Act (SDWA) of 1974 and its amendments protect underground sources of drinking water (USDWs) from contamination by prohibiting the injection of materials into USDWs. Under the auspices of SDWA, the U.S. Environmental Protection Agency (EPA) established the underground injection control (UIC) program, which regulates wells used for various purposes, including the safe disposal of hazardous waste.

The UIC program regulates injection through six classes of well:

- Class I – Deep Injection of Hazardous and Non-Hazardous Wastes
- Class II – Oil and Gas Related Fluids
- Class III – Fluids for Solution Mining
- Class IV – Shallow Injection of Hazardous and Radioactive Wastes
- Class V – Non-Hazardous Fluids into or Above USDWs
- Class VI – Sequestration of Carbon Dioxide

The Bentsen Amendment to the Resource Conservation and Recovery Act (RCRA) (40 CFR §261.4(b)(5)) includes a specific
exemption for exploration and production wastes that classify produced water as a nonhazardous waste. This exemption allows produced water to be injected into Class II wells, rather than Class I wells under the UIC program.

Since produced water is generated at every oil and gas well and there are over 500,000 producing onshore wells in the United States, the challenge of gathering and moving water is substantial. When water hauling accounts for more than 80% of all water handling costs,¹ and spills of produced water have more significant effects on the environment than crude oil spills, minimizing the distance that produced water must be moved becomes paramount.

Class II injection wells, when allowed by regulation and made practical by subsurface geology, can be installed near producing fields, thereby minimizing the distance that water must be hauled, minimizing cost and environmental risk. The RCRA exemption for exploration and production waste and the cost of handling and moving water are the true drivers for the widespread use of Class II injection wells for disposal.

**Risks of Using Class II Injection Wells**

If using Class II injection wells is the most cost-effective and environmentally friendly method for disposing of produced water, what is risky about using them? As any business decision, cost must be balanced with risk and that balance should be reevaluated regularly as the business evolves. The onshore oil and gas industry is seeing a rapidly changing business environment, including new operations such as unconventional drilling, sometimes very close to areas unfamiliar with the oil and gas industry; the identification of induced seismicity; changing regulation; and continuing and increasingly strident public opposition to fossil fuels development. Each of these issues changes the risk profile for using Class II wells for disposal.

**Increased Scrutiny**

Onshore operators rely upon Class II disposal wells to help control costs. If these wells become less available, operators will be exposed to the risk of increased costs. Media coverage of several recent issues is increasing the public visibility and scrutiny of the use of Class II disposal wells. Class II disposal wells must be permitted by the state or EPA and issues such as induced seismicity, improper permitting by states, and lax oversight by EPA of the UIC program are putting pressure on this permitting process.

Induced seismicity, particularly in Oklahoma, led the Oklahoma Corporation Commission (OCC) to put in place a volume reduction plan for disposal wells in specific areas of the state in August 2015. This plan curtailed the disposal volume by 38% in the affected area.² While the OCC admits that the science justifying this plan is not yet settled, it was compelled to act, stating:

“This is an issue completely outside the scope of the experience of not only this agency, but all our partner agencies and stakeholders as well. There was a time when the scientific, legal, policy and other concerns related to this issue had to first be carefully researched and debated in order to provide a valid framework for such action. That time is over. Based on the research and analysis of the data compiled, we must continue to take progressive steps, and do so as quickly as possible as part of the continuing efforts to resolve this complex and challenging issue.”

Operators in Oklahoma now face the real risk of the immediate reduction in availability of disposal wells and increased costs associated with produced water disposal.

For instance, a recent article published online in *WorldOil* magazine,³ reported:

“[Oklahoma’s] disposal regulations will lead to further cuts in oil production, says Kim Hatfield, vice chairman of the Oklahoma Independent Petroleum Association, a trade group of oil and gas producers. ‘If you can’t dispose, you can’t produce,’ he says. Another option is to treat and recycle the water, which [experts] estimate would cost from $2.50–3/bbl [barrel]. Hatfield says the reality is closer to $5. Given the state’s 10-to-1 ratio of water to oil production that would mean oil prices need to be at least in the $50/bbl range for producers to cover their water treatment costs. ‘I probably review at least one project a week promising to turn bad water into good,’ Hatfield says. ‘Can they do it? Absolutely. Can they do it economically? No.’”

In California, EPA revealed that the state’s Division of Oil, Gas, and Geothermal Resources (DOGGR), which had been delegated primacy of the UIC program by EPA, had permitted some disposal of produced water into non-exempt aquifers with nearby water supply wells.⁴ This revelation has led the state to undertake a comprehensive review of its UIC program and the EPA to issue new guidance for the review of aquifer exemption requests from the states. California’s UIC program and the permitting process for Class II disposal wells will certainly change in light of these revelations.

Additionally, the Government Accountability Office (GAO) has issued a report on EPA’s oversight of the UIC program and found that it needs improvement. The GAO found that among

³80% of all water handling costs,¹ and spills of produced water is substantial. When water hauling accounts for more than
other things, “EPA [should] review emerging risks related to class II program safeguards and ensure that it can effectively oversee and efficiently enforce class II programs.”

The publicly reported impacts to citizens through seismicity coupled with the identification of shortcomings of the state UIC programs and EPAs oversight of them leads one to expect changes to the Class II disposal well regulations sooner or later. Changes to regulations, as always, will introduce new business risks to those operators who rely upon disposal wells and could materially change their operating costs.

**Approaches for Mitigating Risks**

Understanding that the use of Class II disposal wells represents a material portion of onshore oil and gas operating costs, it is wise for those operators to be proactive in mitigating the risks associated with their use. The following approaches can help operators manage their risk.

**Pre-Screen Class II Wells and Operators**

Operators who use commercial disposal wells pay a third-party by the barrel for accepting and injecting their produced water. By transferring the waste, the operator also transfers some of the risk associated with the waste. By pre-screening third-party operators prior to use, operators can help ensure that they are working with a reliable counterparty. Operators should vet third-party disposal facilities for:

- financial stability;
- history of environmental violations;
- well construction;
- mechanical integrity testing and pressure monitoring history; and
- health and safety training/recordkeeping.

**Close the Loop on Waste Tracking**

Understanding and being able to document how much produced water has been disposed of and where provides operators with not only a basis for cost management, but also with a mechanism to understand potential risks associated with waste disposal activities. Even though produced water is an exempt waste under RCRA, the RCRA waste tracking requirements provide a good guide for waste tracking documentation. Tracking waste shipments from the point of generation to the point of disposal and ensuring that generation and disposal volume match is a wise best-practice. Should there ever be an issue with a disposal facility the operator would be able to determine if any of their waste was involved.

**Regularly Audit Well Operators**

Even if commercial disposal facilities were thoroughly reviewed prior to use, regular auditing of commercial (and operator-owned) disposal facilities helps manage risk. Most Class II disposal facilities are required to file regular reports under their permits. By ensuring that these reports are filed timely, operators can ensure that their waste resides in facilities that are being run responsibly. Any discrepancies identified by audits can be examined across the enterprise to determine if there are patterns or trends in the waste management program that should be addressed.

**Have and Follow a Waste Management Plan**

Planning for handling, transporting, and disposing of waste is the best way to manage risks. Through the process of preparing a plan that documents anticipated sources, volumes, the nature of wastes, and their ultimate resting place, operators have the opportunity to minimize waste volumes, cost and risk, simultaneously. While there is no regulation that requires such a plan, having one provides not only a planning tool, but a standard for audit, and written guidance for operations teams to work within.

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