States Well Ahead of EPA on Underground Wastewater Disposal Regulations

5:05pm EST February 13, 2015

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Last week, the U.S. Environmental Protection Agency (EPA) released a report that provides recommendations on minimizing seismic activity from Class II injection wells, specifically those used for underground wastewater disposal. Importantly, the report stressed that many states are addressing this concern proactively with their own regulations. Additionally, it's worth emphasizing – as numerous scientists have concluded – that the vast majority of wastewater injection operations are not linked to seismicity, which the EPA also observed.

Before getting into the specifics on state regulation, since disposal is often conflated with "fracking," it's

important to note what EPA said about the actual risk of seismicity from hydraulic fracturing: Namely, that is exceedingly low. From the report:

> "Although not the emphasis of this effort, seismicity associated with hydraulic fracturing (HF) was addressed by a review of selected literature sources. **HF has a low likelihood of inducing significant seismicity,** for reasons explained below. Unlike wastewater disposal wells where injection occurs for an extended period of time, HF is a short-term event designed to create cracks or permeable avenues in lower permeability hydrocarbon-bearing formations. HF activity is followed by the extraction of reservoir fluids and a decrease in pressure within the formation. Therefore, the "pressure footprint" of a well that has been hydraulically fractured is typically limited to the fracture growth or fracture propagation area (Gidley et al., 1990)." (p. 2; emphasis added)

On disposal wells, EPA has this to say:

> "There are approximately 30,000 Class II active disposal wells in the United States used to dispose of oil and gas related wastes, many of which have operated for decades**. EPA is unaware of any USDW contamination resulting from seismic events related to injection-induced seismicity. Very few of these disposal well sites have produced seismic events with magnitudes greater than M 4.0**. **For example, at the time of this report, there were approximately 2,700 active disposals wells in Louisiana, with no recent significant seismic events occurring as a result of the disposal activities**." (p. 1; emphasis added)

According to the U.S. Geological Survey (USGS), seismic activity of a 3 magnitude earthquake is "similar to the passing of a truck" and "many people do not recognize it as an earthquake." Further, the report is clear that – contrary to anti-fracking activists' claims – EPA has not found any evidence of water contamination from seismic activity that could be associated with injection wells. The reason that seismic events are rare is explained as follows:

> "As mentioned previously, the three key components behind injection-induced seismicity are (1) sufficient pressure buildup from disposal activities, (2) a Fault of Concern, and (3) a pathway allowing the increased pressure to communicate from the disposal well to the fault. **All three components must be present to induce seismicity**. The decision model was designed to identify the presence of any of the three key components. **Based on the historical successful implementation of the UIC program, the decision model would not be applicable to the vast majority of existing Class II disposal wells since most are not associated with seismic activity**. Use of the decision model is predicated on UIC Director discretionary authority. Federal UIC regulations do not specifically address risk consequences associated with seismicity, but allow the UIC Director discretion to ensure protection of USDWs." (p. 27; emphasis added)

What EPA says about the small risk associated with disposal wells has been corroborated by the U.S. Geological Survey, which found that, of the thousands of wells used for oil and natural gas wastewater disposal, "only a small fraction of these disposal wells have induced earthquakes that are large enough to be of concern to the public."

The National Research Council, in noting that "only a very small fraction" of energy-related injection activities have been linked to seismicity, also concluded:

> "Tens of thousands of waste water disposal wells have been drilled in the United States to

> dispose of the water generated by geothermal and oil and gas production operations, including shale gas production. Water injection for disposal has been suspected or determined a likely cause for induced seismicity at approximately 8 sites in the past several decades."

The EPA report goes on to explain that it is "not a guidance document and does not provide specific procedures, but it does provide the UIC Director with considerations for addressing induced seismicity on a site-specific basis, using Director discretionary authority." That's an important clarification, because ***states are already well ahead of EPA in establishing regulations*** that mitigate the risk of seismic activity.

With that said, let's have a look at what some of the states are doing.

Ohio

The Ohio Department of Natural Resources' (ODNR) Class II injection well regulations were instituted in July 2012, and the state boasts of having the most stringent rules in the country, going above and beyond what EPA regulations require. Below is a chart from a 2012 report by ODNR, which lays out the strength of Ohio's program succinctly:

Comparison of Ohio's Class II Brine Injection Regulations with USEPA Regulations	
Ohio Division of Oil & Gas Resources Management	**United States Environmental Protection Agency**
Unannounced inspections, on average, every 11-12 weeks.	One inspection done per well each year by EPA consultant.
Continuous mechanical integrity monitoring or monthly mini-tests to demonstrate continuous mechanical integrity.	Demonstration of mechanical integrity at least once every five years.
Injection volumes greater than 200 barrels per day require a ½-mile area of review of all other wells. Less than 200 barrels per day is a ¼-mile radius.	All Class II wells shall be cased and cemented to prevent movement of fluids into or between underground sources of drinking water.
ODNR has the authority to require seismic testing and monitoring.	Federal code does not specifically address seismic testing and monitoring.

Beyond inspections, which clearly exceed EPA's requirements, ODNR also has seismic testing and monitoring in place. ODNR can require a variety of tests to determine if a fault exists in an area where a disposal well is planned. These tests include:

- Pressure fall-off testing to ensure tight seals in the reservoir and casing
- Geological investigation of potential faulting within the immediate vicinity of the proposed injection well location, which may include seismic surveys or other methods determined by the chief which will give not only the operator
- Monitoring seismic activity
- Radioactive tracer or spinner survey
- Gamma ray, compensated density-neutron, and resistivity geophysical logging suite on all newly

drilled injection wells to determine slight fractures in unknown geological regions of the state

In 2013, as part of this regulatory program, ODNR greatly expanded its seismic monitoring capabilities. In several cases, private well operators actually installed monitoring equipment at their own cost and shared the data in real-time with ODNR. This effort nearly doubled the number of seismic monitors operating in Ohio, detecting all types of seismic activity, including natural, non-felt events. In September 2014, a 2.1 magnitude earthquake was detected at the American Water Management Services (AWMS) injection well. Due to the seismic monitoring that was put in place by ODNR, regulators were alerted to the problem and a closure order was issued out of an abundance of caution. Reports found that the public wasn't even aware of the earthquake.

Oklahoma

The Oklahoma Corporation Commission (OCC) has actually adopted the recommendations outlined in a 2013 report by the National Academy of Sciences (NAS) for Class II injection wells – namely, its "Traffic Light" approach. From that NAS report,

> "If the level of seismic impacts becomes unacceptable, direct mitigation measures are needed to further control the seismicity. A 'traffic light' system can allow operations to continue as is (GREEN), or require changes in the operations to reduce the seismic impact (AMBER), or require a suspension of operations (RED) to allow time for further analysis. Indirect mitigation may include community support and compensation."

According to the OCC, this system has been effective in locating problematic areas for seismicity:

> "The OCC Oil and Gas Conservation Division has adopted the "Traffic Light" approach as recommended by the National Academy of Sciences in the permitting and operation of injection wells. Under this system, the OCC, OGS, and industry work in a cooperative manner to identify and take precautionary measures in those rare cases where there have been identified areas of potential concern. Example: In Love County, after OGS revised its initial findings regarding an earthquake swarm, an injection well of interest was directed by the OCC to reduce its injection operation. This was done with the full cooperation of the operator, who has since voluntarily shut in the well in question."

In September of 2014, the OCC increased its monitoring and inspections of disposal wells in areas prone to seismic activity. This year, Oklahoma strengthened its oversight by adding more to its list of earthquake areas of interest.

Texas

Late last year, the Texas Railroad Commission (RRC) unanimously adopted Class II injection well rule amendments, which constitute the fourth significant updates to strengthen RRC's oversight in the last three years. These rule amendments went into effect in November 2014. According to the RRC's press release, the main components of the amendments are:

- requiring applicants for new disposal wells to conduct a search of the U.S. Geological Survey seismic database for historical earthquakes within a circular area of 100 square miles around a proposed, new disposal well;
- clarifying the Commission's staff authority to modify or suspend or terminate a disposal well permit, including modifying disposal volumes and pressures or shutting in a well if scientific data indicates a disposal well is likely to be or determined to be contributing to seismic activity;
- allowing Commission staff to require operators to disclose the current annually reported volumes

and pressures on a more frequent basis if staff determines a need for this information; and
- allowing Commission staff to require an applicant for a disposal well permit to provide additional information, including pressure front boundary calculations, to demonstrate that disposal fluids will remain confined if the well is to be located in an area where conditions exist that may increase the risk that the fluids may not be confined.

As RRC Chairman Christi Craddick said when the amendments were announced,

> "Once again the Texas Railroad Commission is taking the lead in ensuring our rules follow science in protecting our natural resources while at the same time providing a stable regulatory environment for our oil and gas operators."

California

In California, Class II injection wells are regulated by the California Division of Oil, Gas & Geothermal Resources (DOGGR) under the California Department of Conservation, which has had this to say about the process:

> "Class II injection wells provide a viable and safe method to enhance oil and gas production and dispose of produced fluids and other fluids associated with oil- and gas-production operations. In California, Class II injection wells have an outstanding record for environmental protection. A peer review conducted by a national organization, the Ground Water Protection Council, found the Division has an excellent program that effectively protects underground sources of drinking water."

The California Department of Conservation is the same department that houses the California Geological Survey, made up of experts with a deep understanding of geology and California's faulting system. Importantly, there has never been a seismic event triggered by a wastewater disposal well in California. As the California Department of Conservation has said about seismicity specifically,

> "The reports of induced seismicity associated with hydraulic fracturing are actually related to long-duration, high-volume injection of waste fluids in disposal wells. Hydraulic fracturing is a short-duration production well stimulation treatment. **In California, existing Underground Injection Control regulations already address sustained injection pressures in waste fluid disposal wells that would exceed the natural fracture limit of the formation. Therefore, induced seismicity has not been an issue in California**." (emphasis added)

Colorado

The Colorado Oil and Gas Conservation Commission (COGCC) regulates Class II injection wells in the state. In its thorough explanation of how it regulates, the COGCC explains that there are "safeguards in place to reduce the likelihood of induced seismicity":

> "The current safeguards defined by COGCC permit process are injection volume; pressure below the fracture gradient; and, input from the Colorado Division of Water Resources (CDWR) and [Colorado Geological Society] CGS to reduce the potential for induced seismicity related to UIC Class II wells."

The COGCC continues,

> "Beginning in September of 2011, the COGCC UIC permit review process was expanded to

include a review for seismicity by the CGS. CGS uses their geologic maps, the USGS earthquake database, and area-specific knowledge to provide an opinion of seismic potential. If historical seismicity has been identified in the vicinity of a proposed Class II UIC well, COGCC requires an operator to define the seismicity potential and the proximity to faults through geologic and geophysical data prior to any permit approval."

To provide one example of how Colorado's system works: In June, 2014, after COGCC determined that two seismic events could have been linked to an injection well in Greeley, regulators immediately shut down the well to assess the situation. The agency allowed it to begin operating again one month later under the condition that the company would continue at lower pressure and volumes and that it would plug 400 feet of the well to ensure the water didn't flow into a fault. The operator was also required to install a seismic monitor, which COGCC could review, and maintained that it would shut down the well again if problems persisted.

States leading the way

The bottom line is that the regulatory actions taken by the states are far more advanced than what EPA would require. Further, as we've seen from these examples, since states like Ohio, Oklahoma, Texas, California and Colorado have the flexibility to implement their own programs, they can easily update and strengthen their regulations whenever improvements are needed, without having to navigate a lengthy federal bureaucracy.

In short: EPA's latest report confirms that seismic risk associated with underground wastewater disposal remains low, and that state actions remain on the forefront of addressing and reducing that risk.

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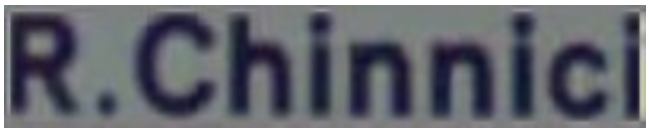

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