FOOD & WATER WATCH

Drilled Too Far:
The Perils of Injection Wells

As oil and gas companies find more ways to extract fossil fuels, the management of their toxic byproducts has become increasingly dangerous.[1] For example, hydraulic fracturing (or "fracking") produces massive amounts of toxic wastewater that is typically disposed of through underground injection in wells. Since the 1980s, oil and gas operators have injected more than 33 trillion gallons of wastewater underground.[2] These wells pose serious threats to nearby communities and groundwater, are linked to earthquakes and can disrupt aquatic habitats.

Fracking 101

Fracking is a method used to extract oil or natural gas from rock formations deep underground. After drilling down into rock, millions of gallons of water mixed with chemicals and a proppant, most commonly sand, are injected under extreme pressure to fracture the rock.[3] The proppant keeps the fracture ajar, allowing natural gas or oil to flow up the well.[4]

Fracking wastewater is laden with the many chemicals used in fracking fluid, as well as radioactive material, heavy metals and other compounds found in the targeted rock.

The fluids used to create fractures flow back up the well as flowback and produced water — both of which can be referred to as wastewater. Flowback typically resurfaces within two weeks after well stimulation, while produced water is generated over the lifespan of the well.[5] Wastewater is laden with the many chemicals used in fracking fluid, as well as radioactive material, heavy metals and other compounds found in the targeted rock.[6]

Although it can be used to frack more wells, wastewater is more commonly disposed of underground.[7] In fact, more than 95 percent of fracking wastewater in the United States is injected into underground wells that are scattered across the country, from Ohio to Oklahoma to California.[8]

Injection Wells

There are six different regulatory classifications of injection wells managed under the U.S. Environmental Protection Agency's (EPA) Underground Injection Control (UIC) well program; the ones designated as Class II are specific to oil and gas production.[9] On a daily basis, at least 2 billion gallons of fluid are injected into these wells, 43,000 of which are wastewater disposal wells.[10]

Wastewater disposal wells are constructed similarly to fracking wells, despite serving different purposes.[11] Injection wells travel deep underground and are lined with tubing, casing and cement in an attempt to prevent wastewater from leaking into aquifers or corroding pipes.[12] With the help of gravity or pressure, wastewater is injected down these wells beyond a confining layer — a layer of low-permeability rock intended to separate underground drinking water sources from where wastewater is kept — into the "injection zone."[13]

Due to the massive amount of wastewater created in fracking operations, some states do not inject all of this waste in-state. For instance, Pennsylvania is one of the top fracking states but is home to only 16 wastewater disposal wells.[14] Most of the wastewater produced in-state designated for injection wells is actually trucked to Ohio for disposal.[15] Residents in Ohio have growing concerns about this practice, with worries about drinking water contamination and earthquakes.[16]

Hazards From Below

Ohio locals are not the only ones apprehensive about the rippling effects of wastewater disposal wells. The widespread risks of these wells have dangerous consequences that are being felt all over the country. Disposal wells have been associated with earthquakes, spills and leaks, drinking water contamination and ecosystem disruption.

Induced Earthquakes

While fracking can cause earthquakes, ones produced by underground injection wells are larger and more frequently felt.[17] When wastewater is injected underground, it can lubricate fault zones and increase pore pressure, which causes fault slips and induces earthquakes.[18] Studies have found that wastewater-induced earthquakes can ripple to far distances.[19] At times, these earthquakes will not even manifest until years after the injection stops.[20]

Wastewater injection-related earthquakes have been felt in Ohio, Colorado and Oklahoma over the decades.[21] In Youngstown, Ohio during 2011, the community experienced 12 low-magnitude earthquakes all within less than a mile from a wastewater injection well.[22] In less than a year's time, Oklahoma experienced a nearly 50 percent increase in the rate of earthquakes, with a higher proportion of residents investing in earthquake insurance than in California.[23] This increase in earthquake activity corresponds to a rise in underground wastewater injection around Oklahoma.[24]

In more recent years, seismic activity related to wastewater disposal has been detected in additional states, including Arkansas, Texas and West Virginia.[25] A 2019 Texas study connected an outbreak of earthquakes in the state to wastewater injection disposal activity.[26] In Arkansas, after scientists made links between wastewater disposal and damaging earthquakes, the Arkansas Oil and Gas Commission put in place the first ever moratorium on wastewater disposal in seismic zones.[27]

Harms to Drinking Water

The EPA's UIC program — under the Safe Drinking Water Act (SDWA) — is an attempt to ensure safe disposal of fluids and to protect drinking water sources from injection well contamination.[28] Still, wastewater disposal has the potential to affect underground aquifers that provide drinking water.[29]

In the poor, majority black community of DeBerry, Texas, groundwater near a wastewater injection well was found to be contaminated beyond acceptable drinking water standards, containing substances harmful to human health including benzene, arsenic, lead and mercury.[30] The tested water also was found to have high levels of chemicals specific to drilling wastewater.[31] Additionally, residents in this community have reported cloudy, metallic, salty-tasting and sharp smelling water and stomach problems after consuming the water.[32] They were advised not to drink the water.[33]

A government photo shows damage to a home in central Oklahoma from a magnitude 5.6 earthquake on November 6, 2011. Research conducted by the United States Geological Survey suggests the earthquake was induced by wastwater injection into deep disposal wells in the Wilzetta North field.

In North Dakota, a man who managed a wastewater injection well pled guilty to multiple counts for violating the SDWA by injecting wastewater into a well that had not been tested by the state.[34] And in California, for years oil and gas companies were permitted to inject into protected aquifers.[35] Despite pushback, California regulators have continued to allow the injection of millions of gallons of wastewater into underground drinking water aquifers.[36]

Leaks, Spills and Water Contamination

Spills from trucks carrying wastewater and leaks from faulty well casings can increase concentrations of methane, metals and other contaminants in underground and/or surface water supplies, which can be detrimental to human health.[37]

In 2017, a truck carrying fracking wastewater tipped over near an injection well after hitting an embankment and tree, spilling close to 1,500 gallons of salty, toxic wastewater on a roadside in Ohio.[38] In another accident, a truck hauling oil wastewater to a disposal well was hit by a train, spilling 3,200 gallons of contaminated wastewater, flowing into nearby farmland.[39] Residents described fumes from the incident as "horrible."[40]

Failed or deteriorated well casings pose other challenges. A company operating wells in Pennsylvania was fined close to $160,000 for knowingly disposing wastewater into a well that had a deteriorating piping, casing and cement

layer, which created pathways for leakage.[41] Discharges of fracking wastewater at an injection disposal facility in West Virginia resulted in increased levels of toxic chemicals found in streams nearby, which can disrupt the reproductive systems and development of wildlife.[42]

Well Regulations and How to Intervene

The EPA regulates the UIC program nationwide, but the regulatory authority is primarily delegated to states.[43] While the way states handle UIC regulation differs among jurisdictions, nearly all of them require operators to acquire a permit before they "drill, reopen, deepen, plug back, rework or use a well" for wastewater injection.[44] After applications are submitted for permits the public is notified, in some instances through agency circulars, legal notices in newspapers and delivery of notices to other well operators in the area.[45]

Following publication of the notice, people who wish to comment or make objections can file them, in writing, to the corresponding state's natural resources department.[46] For instance, in Ohio the time frames are brief — 15 days from last publication — and if no objections are filed, division chiefs can still deny a permit if a project jeopardizes public health or safety or does not comply with conservation practices.[47] Hearings can be held if objections from the public are brought up, but it is vitally important that those working toward halting UIC projects remain vigilant on notice publication and remain involved during all phases of the permitting process.

Given that oil and gas production and demand for injection wells are increasing, the EPA cannot consistently perform reviews of state programs. The agency is also inconsistent in incorporating changes or updates from state programs into federal requirements, which would allow for enforcement.[48] But in the past, state agencies have taken up fights against injection well operators as a safeguard against the increasing dangers of these wells. In Ohio, the state's Department of Natural Resources temporarily closed down two underground wastewater injection wells following an earthquake — a decision that was later appealed by the operator.[49]

Conclusion

There are no good management or treatment options for fracking wastewater. The best way to stop these radioactive and chemical-laden wastes from further imperiling communities and the environment is by banning drilling and fracking everywhere.

The EPA and state agencies have an obligation to protect the environment and health. Wastewater injection wells pose serious risks as earthquakes, drinking water contamination, spills and leaks continue to surge as a result of underground disposal. Instead of investing in more oil and gas infrastructure that supports toxic extraction processes like fracking, our country should be making a fair and just transition to 100 percent clean, renewable energy.

Endnotes

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