Oil and Gas Development: Impacts of Water Pollution Above and Below Ground

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What's lacking in the regulation of oil and gas wells and pipeline installations across the states is **site-specific geologic investigation** of each activity, **predictive computer modeling** of environmental impacts prior to permit issuance, and **ongoing basic monitoring** of each well's performance to serve its function: deliver gas and natural gas byproducts efficiently and without migration of fluids and gases to underground sources of drinking water.[1] The regular acquisition of data during the permitting process of wells and pipelines about existing fracturing and other geologic disturbances, such as abandoned wells, that could interact with well development and fractures as well as the location of underground sources of drinking water around each well development and injection site are the two pieces of missing information from the US EPA's study of hydraulic fracturing that could have led to a more definitive answer to the question of whether fluids can migrate through fractures during the hydraulic fracturing process.[2]

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[1] *See* Emily A. Collins, *Permitting Shale Gas Development*, 29 J. Land Use & Envtl. Law 117 (2013).

[2] OFFICE OF RESEARCH & DEV., U.S. ENVTL. PROT. AGENCY, EPA/600/R-16/236FA HYDRAULIC FRACTURING FOR OIL AND GAS: IMPACTS FROM THE HYDRAULIC FRACTURING WATER CYCLE ON DRINKING WATER RESOURCES IN THE UNITED STATES (2016). Specifically, the study states: "The potential for hydraulic fracturing fluids or other fluids to reach underground drinking water resources is also related to the fracture network created during hydraulic fracturing. Because fluids travel through the newly-created fractures, the location of these fractures relative to underground drinking water resources is an important factor affecting the frequency and severity of potential impacts on drinking water resources. Data on the relative location of induced fractures to underground drinking water resources are generally not available, because fracture networks are infrequently mapped and because there can be uncertainty in the depth of the bottom of the underground drinking water resource at a specific location.

Without these data, we were often unable to determine with certainty whether fractures created during hydraulic fracturing have reached underground drinking water resources. Instead, we considered the vertical separation distance between hydraulically fractured rock formations and the bottom of underground drinking water resources. Based on computer modeling studies, Birdsell et al. (2015a) concluded that it is less likely that hydraulic fracturing fluids would reach an overlying drinking water resource if (1) the vertical separation distance between the targeted rock formation and the drinking water resource is large and (2) there are no open pathways (e.g., natural faults or fractures, or leaky wells). As the vertical separation distance between the targeted rock formation and the underground drinking water resource decreases, the likelihood

The common refrain that states are doing enough reflects the fact that our nation is currently comfortable with a reactive approach to allegations of groundwater contamination – where tort lawyers are left to litigate property damage and personal injury claims – instead of a proactive approach where problems can be caught prior to drilling, fracturing, producing and transporting gas and its byproducts to markets.[3] Since site-specific geologic information around each well is not required to be disclosed during state permitting processes, we lack the data to make such determinations. Without a federal minimum for state regulatory agencies,[4] the money that would be spent in the regulatory process is instead spent by property owners and industry on legal counsel, expert witnesses and settlements.[5]

At Fair Shake Environmental Legal Services, the nonprofit law firm that I founded and manage in the Appalachian Basin, our case load has reflected this circumstance: in one case affecting an entire neighborhood in Pennsylvania called The Woodlands, we strongly believe that site specific geologic investigation and continuous mechanical well integrity testing – the same that is done regularly for injection wells regulated under the Safe Drinking Water Act – would have both prevented any potential harm and signaled any potential problems with minimal, if any, harm to underground sources of drinking water.[6] And other cases affecting a single property

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of upward migration of hydraulic fracturing fluids to the drinking water resource increases (Birdsell et al., 2015a)."

[3] Jody Freeman, Op-Ed., *The Wise Way to Regulate Gas Drilling*, N.Y. Times, July 5, 2012 at A23, *available at* https://www.nytimes.com/2012/07/06/opinion/the-wise-way-to-regulate-hydraulic-fracturing.html?searchResultPosition=2. *See also The 2018 Babst Calland Report Focuses on the Appalachian Basin Oil & Gas Industry Forging Ahead Despite Obstacles*, PR Newswire, Jun 21, 2018, *available at* https://www.prnewswire.com/news-releases/the-2018-babst-calland-report-focuses-on-the-appalachian-basin-oil--gas-industry-forging-ahead-despite-obstacles-300670469.html.

[4] Congress expressly excluded "the underground injection of fluids or propping agents (other than diesel fuels) pursuant to hydraulic fracturing operations related to oil, gas, or geothermal production activities" from the definition of "underground injection" in the Safe Drinking Water Act. Energy Policy Act of 2005, Pub. L. No. 109-58, § 322, 119 Stat. 594, 694 (codified as amended at 42 U.S.C. § 300h(d)(1)(B)(ii) (2012). Congress otherwise defined "underground injection" to mean "the subsurface emplacement of fluids by well injection." 42 U.S.C. § 300h(d)(1)(A).

[5] *See, i.e.*, Ellen M. Gilmer, *W.Va. Shale Fields Fertile Ground for Nuisance Lawsuits*, E&E News, Sept. 9, 2015, *available at* https://www.eenews.net/stories/1060024357.

[6] *McIntyre v. Rex Energy Corp.*, Plaintiffs' Fourth Amended Complaint, Docket No. 2013-10079, In the Court of Common Pleas of Butler County, Pennsylvania, Feb. 21, 2014; Kevin Begos, *Pa. Woman: Chemicals in My Water in Drilling Area*, Associated Press, Feb 24, 2012, *available at*

owner's well in rural settings make these cases difficult even for tort lawyers to take on because loss of a water supply for any amount of time makes life extremely difficult and potentially creates a circumstance where ingestion of poisonous chemicals impacts people and animals' health, the damages are oftentimes too low for impacts to one rural farm for a tort lawyer's consideration. A recent case for a landowner, James Kiefer in rural Ohio, reflects that circumstance.[7]

Our experience is that these problems could have been prevented, including problems related to pipeline infrastructure, by reviewing local geologic settings prior to development, modeling potential impacts based on knowledge of site-specific geology, and continued monitoring of well and gas infrastructure integrity. In any other scenario that we authorize artificial penetrations into the earth through underground sources of drinking water, we require this information under the Safe Drinking Water Act.[8] The federal exemption of oil and gas drilling, fracturing and production has left states to determine if they want similar data as would be required to permit, for example, a wastewater disposal well.

One state, so far, does require this: Illinois under its Hydraulic Fracturing Review Act.[9] Other states known for oil and gas production, such as Pennsylvania,[10] Ohio,[11] Texas[12] and New

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http://archive.boston.com/news/nation/articles/2012/02/24/w_pa_tests_chemicals_in_drilling_area_water/?page=full; Reid Frazier, *Rex Energy Pays $159k to Woodlands Families to Settle Water Claims*, StateImpact Pennsylvania, Jul 11, 2018, *available at* https://stateimpact.npr.org/pennsylvania/2018/07/11/rex-energy-pays-159k-to-woodlands-families-to-settle-water-claims/.

[7] *See i.e.*, Complaint of James Kiefer, James Kiefer v. Chesapeake Exploration LLC, Docket No. 5:18-cv-02983, U.S. District Court for the Northern District of Ohio Eastern Division.

[8] 40 C.F.R. § 146.24(a) (requiring EPA to consider injection rates, pressure, and quantities; the properties of the injection fluid; and "appropriate geological data on the injection zone and confining zone including lithological description, geologic name, thickness and depth" before issuing a Class II well permit).

[9] Ill. Hydraulic Fracturing Regulatory Act, 225 ILL. COMP. STAT. 732 (2019).

[10] 58 PA. CONS. STAT. ANN. §§ 3211, 3217 (2019); 35 PA. STAT. ANN. §§ 691.301, 691.1 (2019).

[11] OHIO REV. CODE ANN. §§ 1509.03(A)(2), 1509.06(F) (2019).

[12] TEX. NAT. RES. CODE ANN. §§ 91.101(a)(1)-(2), .1015 (2019); 16 TEX. ADMIN. CODE § 3.8(b) (2019).

Mexico[13] have existing statutory authority to do this, but have chosen not request to review site specific geologic information or other localized data to determine the potential for endangerment of underground sources of drinking water.[14]

My firm has also handled cases related to wastewater treatment and the impacts to surface water from discharges of shale gas wastewater. We typically utilize citizen suits under the Clean Water Act to deal with indirect discharges to Publicly Owned Treatment Works, and, at times, discharges from centralized wastewater treatment plants. We also spend a great deal of time working on client matters related to erosion & sedimentation control and land use.

The options for shale gas wastewater disposal in the Appalachian Basin include underground injection wells, centralized wastewater treatment facilities, landfills and publicly owned treatment works after some level of pretreatment. The regulatory environments for those disposal options include the Clean Water Act, the Resource Conservation and Recovery Act, the Clean Air Act and the Safe Drinking Water Act and their state counterparts.

As an example of the complexity of treating shale gas wastewater, I have attached an analysis of chloride and radionuclides as disclosed in several wastewater facilities in Western and Central Pennsylvania permit applications for discharge and in their discharge monitoring reports. The federal chloride water quality criteria reflect science in the late 1980s rather than a review of the chloride impacts imposed by shale gas wastewater. In addition, the presence of radionuclides in shale gas wastewater has been under studied and left to monitoring and reporting.

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[13] N.M. STAT. ANN. 1978 §§ 70-2-12(B)(7), (15), 70-12-4(A) (2019); N.M. CODE R. § 19.15.16.9(A) (2019).

[14] *See generally* Emily A. Collins, *Permitting Shale Gas Development*, 29 J. Land Use & Envtl. Law 117 (2013).

Chloride Characteristics

- Shale gas wastewater may contain:
  - NaCl
  - KCl
  - $MgCl_2$
  - $CaCl_2$
- Most studies look at the impact of NaCl.

Chloride Characteristics

	Ronco Facility	TerrAqua	Mon Valley Brine	Somerset Regional	Ridgway Borough
Chloride (mg/l)	228,000	62,600	99,469	113,000	214,660

Influent concentrations reported in NPDES applications.

Seawater typically contains 19,000 mg/l of chloride.

Chloride in effluent discharges

	WQS	Ridgway Boro STP	FRS Creekside	Waste Treatment Corporation	FRS Josephine	Brockway WWTP
Chloride (mg/l)	250 mg/l	627-1,655 mg/l	69,450 - 78,100 mg/l	69,250 – 80,610 mg/l	72,850 – 92,350 mg/l	864-1,835 mg/l

Chloride Impacts

- South Fork Tenmile Creek: abundance of halophilic taxa from 244 mg/l; freshwater taxa at 28.5 mg/l
- POTW digesters: 4,000 mg/l threshold according to DEP
- Dunkard Creek fish kill: 4,000 mg/l
- 1988 EPA Guidelines: 230 mg/l (chronic); 860 mg/l (acute)
- Chloride-based “impairment” of the Allegheny River in Warren around O&G discharge.

Radionuclides in influent & effluent

	WQS	TerrAqua Influent	Ridgway Borough Influent	Ronco Facility Influent	Brockway WWTP Effluent
Gross Alpha (pCi/L)	None (15 pCi/L)	6,586	8,494	4,760	0-80.49
Gross Beta (pCi/L)		2,687	3,380	1,900	
Radium-226	None (5 pCi/L)	NR	2,226	1,810	1.79-4.06

Radionuclides in Stream Sediment

- DEP has issued Consent Order & Agreements for remediation of stream beds and banks downstream of CWT facilities.
- Radium 226 and 228 found above background levels in sediment.