Personal statement for EPA hearing related to Penneco Environmental Solutions, LLC Draft Permit No. PAS2D701BALL

26 July 2017
Plum Community Center
499 Center New Texas Rd.
Plum, PA 15239

While I share many of my neighbors concerns for the air and water pollution as well as seismic activity, I will reserve those issues for individuals more well-versed in the subjects than I. Tonight I would like to address the fact that putting this proposed injection well into Plum Borough will directly negatively affect the quality of life for my family and me.

My Husband and I chose to move to Southwestern Pennsylvania when we found out we were expecting our first child. After years of living in Chicago and Las Vegas, we were craving a quieter, friendlier community to raise our family. We chose to move to Westmoreland County as it was relatively free of fracking development compared to other areas surrounding Pittsburgh. We valued the quiet, the winding roads, and beautiful views while still having access to a vibrant city center.

We dreamed of buying a house in a rural area for years and we found our perfect home for our newly-expanded family in Upper Burrell Township. We live on Upper Drennen Road, which is just up the hill from this proposed well.

Near daily my son and I drive down Upper Drennen to Greensburg Road to get to various businesses, parks, and libraries. We travel Greensburg and Old Leechburg roads regularly to take advantage of the opportunities and commerce in this community. Driving around in this area has become a real source of joy in my life. The roads aren't crowded, it is quiet, relatively safe, drivers are cautious and very courteous.

For those of us who experience our daily lives here, this proposed well will have a tremendous impact on our quality of life. Increased construction traffic, truck traffic to the well, flaggers, road closures, and noise pollution are all seemingly minor things that will slowly erode the ambience and experience of living here.

I want to raise my family in this community. We chose this community specifically because we were trying to escape the day-to-day perils and pitfalls of industry and development. Putting in an injection well will deny us that dream and opportunity.

I am not naive to the realities of fracking. I understand the need and demand for places to dispose of wastewater from unconventional drilling. However, the need for a place to put a well should not supersede the needs, dreams, and desires of those of us who choose to live here, love here, and raise our families here. This proposed well will change the ambience and face of our communities forever. Please do not allow this well to come into our community and rob so many of us of the peaceful environment we dreamed of and pursued. Thank you for your time and consideration.

Cari Armstrong
260 Upper Drennen Rd.
New Kensington, PA 15068
cari.r.armstrong@gmail.com

Ann LeCuyer
Concerned Citizen - Outreach Coordinator Protect PT
Request For Rejection Of Underground Injection Well at Sedat #3A, Plum Borough, Pennsylvania

My biggest concern for this injection well is pollution of ground water. There is only so much water here for us to use and once it is polluted there is no going back. Who knows where that water will end up in the years to come, what about in a 100 years, 1000 years, people will still need that water free of pollution. From my reading I have found that although scientific analysis says it can predict how water will move or not move, the evidence is that is does move into private wells and surface waterways. While you can try to predict where the water will go there is no way to actually track it once it is underground. Further, even if the ananlysis of the rock formations were correct, there is no way to predict how the pressure from the injection will change the structure and open up pathways for movement of the water. I found this quote from Mario Salazar, an engineer who worked for 25 years as a technical expert with the EPA's underground injection program in Washington. "In 10 to 100 years we are going to find out that most of our groundwater is polluted, A lot of people are going to get sick, and a lot of people may die."

Besides movement through rock formations there is also the concern of leaks from the containtment. A review, by ProPublica, of well records, case histories and government summaries from a three year period, 2007-2010, found that there was one well integrity viloation issued for every six deep injection wells that were examined. This equalled 17, 000 violations nationally. That is a poor ratio and not one we should be willing to bet on.

I am requesting that this permit be denied becuase it is proposes severe health risks to residents now and in the future.

Food & Water Watch • 2329 Tilbury Avenue • Pittsburgh, PA 15217
T +412.969.5816 • foodandwaterwatch.org

July 26, 2017

ATTN: Grant Scavello
U.S. Environmental Protection Agency
Region III Ground Water & Enforcement Branch (3WP22)
1650 Arch Street.
Philadelphia, Pennsylvania 19103
Email: scavello.grant@epa.gov

Re: Penneco Environmental Solutions, LLC's Application for a UIC Class II-D Permit in Plum Borough, Allegheny County, Pennsylvania Permit No. PAS2D701BALL

Food & Water Watch (FWW), a non-profit consumer advocacy organization with an office and 38,691 members and supporters in Pennsylvania, respectfully submits these comments and urges the U.S. Environmental Protection Agency, Region III (EPA) to deny Penneco Environmental Solutions, LLC's (Penneco) the Underground Injection Control (UIC) Class II-D permit it seeks for Plum Borough, Allegheny County, Pennsylvania.

The proposed underground injection well unnecessarily exposes Plum Borough residents to seismic activity, groundwater contamination and other associated public health and environmental risks that would threaten or diminish the quality of life for Plum Borough's more than 27,000 residents.

Penneco has a poor compliance track record, littered with both environmental and administrative violations. Since 2005, Penneco Oil (an affiliate of Penneco Environmental Solutions) has been fined $123,900 by the Pennsylvania Department of Environmental Protection (PA DEP): $87,300 for environmental health and safety violations and $36,600 for administrative violations. Penneco's environmental violations range from discharging "industrial waste in the form of surfactant onto ground, cattle watering tanks and high quality watershed" to failing to "properly control or dispose of industrial or residual waste to prevent pollution of the water." (*See* the Appendix on pages 8 through 10 for a comprehensive list of all violations committed by Penneco in the state of Pennsylvania.[1])

Furthermore, drilling a UIC well for the disposal of hydraulic fracturing (fracking) wastewater would likely increase truck traffic in Plum Borough — a problem that has been well documented across the state of Pennsylvania as a result of the fracking boom —

[1] Pennsylvania Department of Environmental Protection. Oil and Gas Reports. Oil and Gas Compliance Report. Operator: Penneco Oil. Violation Type: All. January 1, 2005 to July 16, 2017. Accessed July 16, 2017, available at http://www.dep.pa.gov/DataandTools/Reports/Oil%20and%20Gas%20reports/Pages/default.aspx.

resulting in more heavy vehicle accidents (some of which spill fracking wastewater into surface water) and adding to costly wear and tear on roads.[2]

Indeed, fracking and its associated activities (like the disposal of wastewater) has caused many demonstrated public health, climate and environmental problems, and *erodes* the quality of life for the rural communities where most new gas wells are drilled.[3] Now, Penneco wants to expand its polluting footprint by injecting toxic waste underground, which can induce seismic activity and contaminate groundwater.

Injecting Toxic Wastewater Underground Induces Seismic Activity, Even in Typically Non-Seismic Areas

The hydraulic fracturing natural gas drilling technique produces toxic wastewater that requires disposal.[4] This flowback contains, in addition to the original fracking fluids, potentially extreme levels of harmful contaminants, which can include arsenic, lead, hexavalent chromium, barium, strontium, benzene, polycyclic aromatic hydrocarbons, toluene, xylene, corrosive salts and naturally occurring radioactive material, such as radium-226.[5]

A common method to dispose of this toxic waste is through UIC wells, however injecting wastewater underground for disposal has been linked to seismicity. In the eastern and central United States, for example, earthquake activity increased about fivefold, from an annual average of 21 earthquakes above a 3.0 magnitude between 1967 and 2000 to more than 300 over three years from 2010 to 2012.[6] These years correspond the peak fracking years in Pennsylvania, Ohio and West Virginia. According to U.S. Geological Survey (USGS) scientists, this increased seismic activity has been associated with oil and gas wastewater disposal wells in states such as Oklahoma, Colorado, Arkansas, Ohio and Texas.[7]

Induced seismicity occurs when human activity triggers a dormant fault by adding or reducing stress and/or increasing pore pressure.[8] When fluid is injected underground — as

---

[2] Warco, Kathie O. "Fracking truck runs off road; contents spill." *Observer-Reporter* (Washington and Green Counties, PA). October 21, 2010; Bamberger, Michelle and Robert E. Oswald. "Impact of Gas Drilling on Human and Animal Health." *New Solutions*, vol. 22, iss. 1. 2012 at 61 and 62; Efstathiou, Jim. "Taxpayers Pay as Fracking Trucks Overwhelm Rural Cow Paths." *Bloomberg Businessweek*. May 15, 2012.

[3] *See* McDermott-Levy, Ruth et al. "Fracking, the environment, and health." *American Journal of Nursing*. Vol. 113. No. 6. June 2013; Burger, Michael. "Fracking and Federalism Choice." *University of Pennsylvania Law Review*. Vol. 161. Iss. 150. 2013 at 159, 162 and 163.

[4] U.S. Environmental Protection Agency, Office of Research and Development. "Plan to study the potential impacts of hydraulic fracturing on drinking water resources." November 2011 at 15; American Petroleum Institute. "Freeing up energy. Hydraulic fracturing: Unlocking America's natural gas resources." July 19, 2010 at 1, 2, and 4.

[5] Mall, Amy and Dianne Donnelly. Natural Resources Defense Council. "Concerning the Regulation of Wastes Associated with the Exploration, Development, or Production of Crude Oil or Natural Gas or Geothermal Energy." September 2010 at 8 and 9; 76 U.S. Fed. Reg. 66296 (October 26, 2011); Urbina, Ian. "Regulation lax as gas wells' tainted water hits rivers." *The New York Times*. February 26, 2011

[6] U. S. Geological Survey (USGS). "Induced earthquakes." Accessed November 5, 2014, available at http://earthquake.usgs.gov/research/induced/

[7] *Ibid*.

[8] Herringshaw, Liam. Durham Energy Institute, Durham University. [DEI Briefing Note]. "What size of earthquakes can be caused by fracking?" April 2013 at 1; Ellsworth, William L. "Injection-induced earthquakes." *Science*. July 12, 2013 at 1225942 to 1225943.

is done to fracture shale rock and for the disposal of fracking wastewater — it can lubricate fault zones. As fluid moves into a fault zone, pore pressure increases, which can cause the fault to slip and result in an earthquake.[9]

Induced seismic events do not always strike soon after the injection activity begins; it may take a long time to trigger an earthquake, and sometimes not until after the injection activity has ended.[10] Fluid pressure from high-rate disposal wells can migrate, so even if an injection well is not very close to a fault line or to one that is susceptible to earthquakes, the fluid pressure can migrate long distances to reach a fault that is more susceptible.[11]

Colorado example demonstrates seismic risk of underground injection: According to USGS, Colorado tends to have "minor earthquake activity" and the Eastern portion of the state is considered "nearly aseismic."[12] However, injection disposal of fluid waste was linked to *the largest* earthquakes in Denver's history, a 4.8[13] magnitude quake in 1967.[14]

In March 1962, the U.S. Army began injecting fluids in a 12,045-foot well at its Rocky Mountain Arsenal, a chemical weapons manufacturing and disposal plant in the Denver area. Prior to the injection of chemical fluids, this area had low seismicity. From April 1962 to August 1967, however, more than 1,500 earthquakes rumbled through the Denver region.[15] Injection of these fluids at the Arsenal stopped February 1966, and earthquake activity began to slowly subside after November 1967 and stopped by the late 1980s.[16]

Similarly, in 2011, a 5.3 magnitude earthquake, believed to have been triggered by wastewater injection, occurred in Raton Basin,[17] where large quantities of wastewater were produced from drilling for coalbed methane.[18] According to researchers who studied the induced seismic swarm in the Raton Basin, "there was a marked increase in seismicity shortly after major fluid injection began in the Raton Basin in 1999." Only one earthquake equal to or greater than a magnitude of 4 was produced from 1972 through July 2001, but 12 struck between August 2001 and 2013. The researchers determined, "The statistical likelihood that such a rate change would occur if earthquakes behaved randomly in time is 3.0 [percent]."[19]

---

[9] *Ibid*.
[10] Ellsworth (2013) at 1225942 to 1225943.
[11] *See* Keranen, K.M. et al. "Sharp increase in central Oklahoma seismicity since 2008 induced by massive wastewater injection." *Science*. July 3, 2014; Bui, Hoai-Tran. "Wastewater disposal tied to surge in Oklahoma earthquakes." *USA Today*. July 3, 2014.
[12] USGS. "Colorado. Earthquake History." Accessed July 1, 2014, available at http://earthquake.usgs.gov/earthquakes/states/colorado/history.php
[13] Note: Sources conflict on the exact magnitude. A report by the National Research Council states it was 4.8 magnitude; the USGS states it was 5.3 magnitude.
[14] USGS. "Colorado. Earthquake History."; National Research Counci (NRC)l. Induced Seismicity Potential in Energy Technologies. (Pre-publication version.) Washington, DC: The National Academies Press, 2013 at 21 and Box 1.2
[15] *Ibid*
[16] NRC (2013) at 21 and Box. 1.2.
[17] USGS. "Induced Seismicity."
[18] Soraghan, Mike. "USGS links Colo. Quakes to gas drilling." *E & E News*. September 16, 2014.
[19] Rubinstein, Justin L. et al. "The 2001-Present Induced Earthquake Sequence in the Raton Basin of Northern New Mexico and Southern Colorado." *Bulletin of the Seismological Society of America.* Vol. 104. No. 5. October 2014 at 1.

Colorado has also experienced more recent earthquakes that are related to the disposal of fracking wastewater, [20] including a 3.4 magnitude earthquake in May 2014. The quake occurred just miles northeast of the town of Greeley, amid drilling and fracking of the Niobrara Shale formation. It was the first earthquake in the area in about three decades, and it is believed that it was induced by injection wells, two of which were 1.5 miles away from the epicenter.[21]

Oklahoma documented notorious fracking-induced earthquakes: Historically, Oklahoma is not a state known for its seismic activity. From 1975 to 2008, Oklahoma averaged only one to three earthquakes of 3.0 magnitude or greater annually.[22] In 2009, the state had 20 of these 3.0 magnitude or greater earthquakes (the magnitude that is generally needed to be felt). In 2015, that number exploded 45-fold to 902. From 2009 to 2014, as earthquake activity increased drastically, wastewater injection volumes grew by about 43 percent.[23]

In November 2011 Oklahoma experienced a 5.7 magnitude earthquake in the town of Prague – what researchers believe to be *the largest earthquake associated with wastewater injection in history*, according to a March 2014 study by USGS researchers in collaboration with scientists from various universities. The study suggested that an earlier 5.0 magnitude earthquake induced by wastewater injection had triggered the larger earthquake.[24] A USGS geoscientist explained in 2015 that minor earthquakes can lead to major ones, noting that "The more small earthquakes we have it just simply increases the odds we're going to have a more damaging event."[25] Later in September 2016, this state experienced its largest ever recorded earthquake with a magnitude of 5.8 that was induced by fracking.[26]

Eruption of quakes in nearby Youngstown: Ohio has had its fair share of induced seismic activity, some a short car ride away from Plum Borough. In 2011 in Youngstown — a town where there had been no recorded earthquakes since recordkeeping began in 1776 — a series of earthquakes struck after an UIC well for fracking fluid disposal opened nearby.[27] Injection began in December 2010, and the first two seismic events happened three months later, in March 2011. By mid-January 2012, a total of 12 seismic events had occurred, with

---

[20] Soraghan (2014); USGS. [Press Release.] "Earthquake Swarm Continues in Central Oklahoma." October 22, 2013; Colorado earthquake data from USGS, Earthquake Hazards Program, Earthquake Archives. Available at http://earthquake.usgs.gov/earthquakes/search/. Accessed March 6, 2015.

[21] Sperry, Trenton. "Epicenter of Saturday earthquake in Greeley, CO was near oil, gas wastewater injection wells." *Greeley Tribune*. June 1, 2014 ;"Greeley seismic activity may be linked to injection well." *KUSA-TV/NBC 9News*. June 24, 2014; Colorado Geological Survey. Colorado Department of Natural Resources. "Colorado's new oil boom – the Niobrara." *Rock Talk*. Vol. 13. No. 1. Spring 2011 at 1, 3 and 7; Hickey, Chuck. "CU team studying possible oil and gas connection to recent Greeley earthquake." *Fox31 Denver*. June 9, 2014.

[22] Soraghan (2014); USGS (2013).

[23] Earthquake data from Oklahoma Geological Survey. (OGS) Earthquake Catalogue. Available at http://www.okgeosurvey1.gov/pages/earthquakes/catalogs.php. Accessed, November 2016; wastewater injection data from Oklahoma Corporation Commission (OCC), Oil and Gas Division, Oil and Gas Data Files. Available at http://www.occeweb.com/og/ogdatafiles2.htm. Accessed November 2016.

[24] USGS. [Press Release.] "2011 Oklahoma Induced Earthquake May Have Triggered Larger Quake." March 6, 2014.

[25] Borenstein, Seth. "Study: Oklahoma's daily small quakes raise risk of big ones." *Associated Press*. February 14, 2015.

[26] Schabner, Dean. "Earthquake Hits Oklahoma; Damage Reported." *ABC News*. November 6, 2016; USGS. [Press Release.] "Magnitudes for Oklahoma Earthquakes Shift Upward." September 7, 2016.

[27] Resnick, Brian. "Can fracking cause earthquakes?" *National Journal*. September 5, 2013; Tomastik, Tom. Geologist, Ohio Department of Natural Resources, Division of Oil and Gas Resources Management. [Presentation]. "Preliminary report on the Northstar #1 Class II injection well and the seismic events in the Youngstown, Ohio area." at Slides 7 and 12.

the largest earthquake of 4.0 magnitude on December 31, 2011.[28] The UIC well closed for investigation, and later a study confirmed that fluid injection at the well triggered the earthquakes.[29] This year, state regulators finally shut this UIC well down.[30]

Pennsylvania and fracking induced seismicity: Although Pennsylvania's fracking-related earthquake activity has thus far been minor compared to other states, it has not been immune. In February 2017, Pennsylvania regulators confirmed the first fracking-related earthquakes in the state, which trembled across Lawrence County, northwest of Pittsburgh.[31] Although the quakes were not large enough to be felt (ranging from 1.8 to 2.3 magnitude on the Richter scale), they were induced from the fracking process itself, not from injection well disposal;[32] and fracking-induced earthquakes are smaller and less commonly felt than earthquakes produced from UIC wells.[33] Further, it is notable that there were no faults identified along the well bore where the fracking related tremors occurred.[34] The proposed injection well in Plum Borough would expose residents to unnecessary risks from seismic activity, and because UIC wells contribute to more seismicity than fracking wells, the proposed permit may eventually activate more seismicity in Western Pennsylvania.

Toxic Wastewater, Regulatory Loopholes, and Potential for Groundwater Pollution

The proposed Penneco a permit for a UIC well in Plum Borough could put local water resources at risk. As mentioned above, drilling and fracking flowback can bring various volumes of toxins, including hydrogen sulfide, arsenic and selenium to the surface, along with ancient salt waters, or brines.[35] The exact composition of fracking flowback is unknown because the composition of the fracking fluid is considered a proprietary trade secret.[36] However, fracking fluids often contain toxic compounds, including methanol, isopropyl alcohol, 2-butoxyethanol, glutaraldehyde, ethyl glycol and the solvents benzene, toluene, ethylbenzene and xylene (known as BTEX).[37]

---

[28] Tomastik, "Preliminary report on the Northstar #1 Class II injection well and the seismic events in the Youngstown, Ohio area," at Slides 5, 7, 12 and 13.
[29] Resnick, Brian. "Can fracking cause earthquakes?" *National Journal*. September 5, 2013.
[30] O'Brien, Dan. "Application Filed to Plug Well that Triggered Quakes." *The Business Journal*. April 12, 2017.
[31] Frazier, Reid. "Pennsylvania confirms first fracking-related earthquakes." *StateImpact Pennsylvania*. February 18, 2017.
[32] *Ibid*.
[33] USGS. "Man-made earthquakes update." January 17, 2014. Accessed February 23, 2015 available at http://www.usgs.gov/blogs/features/usgs_top_story/man-made-earthquakes/; Herringshaw (2013) at 1 to 3; Ellsworth (2013) at 1225942-3 to 4.
[34] Frazier (2017).
[35] Adgate, John L. et al. "Potential public health hazards, exposures and health effects from unconventional natural gas development." *Environmental Science & Technology*. Vol. 48, Iss. 15. August 5, 2014 at 8310; Vengosh, Avner et al. "A critical review of the risks to water resources from unconventional shale gas development and hydraulic fracturing in the United States." *Environmental Science & Technology*. Vol. 48, Iss. 15. August 5, 2014 at 8338 and 8340.
[36] Konschnik, Katherine E. et al. Harvard Law School. Environmental Law Program. "Legal fractures in chemical disclosure laws: Why the voluntary chemical disclosure registry FracFocus fails as a regulatory compliance tool." April 23, 2013 at 1; Brown, David et al. "Understanding exposure from natural gas drilling puts current air standards to the test." *Reviews on Environmental Health*. Preprint, published online March 2014 at 4; U.S. House of Representatives. Committee on Energy and Commerce. [Minority Staff report]. "Chemicals Used in Hydraulic Fracturing." April 2011 at 2.
[37] Committee on Energy and Commerce (2011) at 1 and 8; Adgate et al. (2014) at 8308.

Although the outflow brines differ in composition based on the nature of the targeted rock formation, they typically contain salts (including chlorides, bromides, calcium sulfides, magnesium and sodium), metals (including barium, manganese, iron, strontium and others), radioactive material (including Radium-226), and byproducts of Radium decay (including lead and radon).[38]

With the exception of the fracking chemicals and the byproducts of any fracking chemical reactions, the pollutants driven from the rock formations by fracking had long been safely sequestered and immobilized, deep underground. Now, drilling and fracking bring these pollutants to the surface at levels that risk human health and environmental damage through water, soil, air and climate pollution.

Indeed, wastewater contamination is not just an on-site problem and risks extend beyond the drilling and injection sites. Traffic accidents, spills, and leaks can all put residential property, farms and agricultural land in jeopardy. Fleets of trucks are used to ship hazardous wastewater and toxic materials. Traffic accidents have caused fracking wastewater to be released into nearby freshwater bodies and private property.[39]

Risks to local groundwater resources: Although the U.S. EPA's UIC program is tasked with regulating the oil and gas industry's injections of wastewater into Class II wells – it only regulates injections of fluids (pursuant to hydraulic fracturing operations) if the fluids contain diesel fuel.[40] Colloquially dubbed the Halliburton Loophole, this exemption under the Safe Drinking Water Act omits Class II UIC wells from groundwater quality monitoring.[41] Yet, injecting wastewater punctures more holes underground, changing the geology of the Earth, and enabling waste to travel more easily.[42]

Leaking injection wells may also go undetected – releasing contaminants underground unbeknownst nearby communities. A Texas study, for instance, found that at least 29 injection wells were "likely sending a plume of salt water into the ground unnoticed." And a *ProPublica* analysis of over 220,000 injection well inspections (between late 2007 and late 2010) found that one well integrity violation was issued for every six deep injection wells examined – with over 17,000 violations on a national level. Of these violations, 7,000 wells

---

[38] U.S. Government Accountability Office (GAO). "Information on the Quantity, Quality, and Management of Water Produced During Oil and Gas Production." January 9, 2012 at 12; Vengosh et al. (2014) at 8341 to 8342; International Atomic Energy Agency (IAEA). "Radiation Protection and the Management of Radioactive Waste in the Oil and Gas Industry." Safety Reports Series, No. 34. November 2003 at 53 to 54.

[39] Cooley, Heather and Kristina Connelly. Pacific Institute. "Hydraulic Fracturing and Water Resources: Separating the Frack from the Fiction." June 2012 at 27; Warco (2010); Bamberger and Oswald (2012) at 61 and 62.

[40] 40 CFR §146.1-2; 40 CFR §146.6; U.S. EPA, Underground Injection Control (UIC) Program. "Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels: Underground Injection Control Program Guidance #84." February 2014 at 1 and 4 to 5.

[41] GAO. "Drinking Water. EPA Program to Protect Underground Sources from Injection of Fluids Associated with Oil and Gas Production Needs." (GAO-14-555.) June 2014 at 34.

[42] Lustgarten, Abrahm. "Injection Wells: The Poison Beneath Us." *ProPublica*. June 21, 2012.

showed indications that they were leaking contaminants, and some leaks may have contaminated drinking water sources.[43]

In 2012, a former engineer that worked with the EPA's UIC program for 25 years admitted, "In 10 to 100 years we are going to find out that most of our groundwater is polluted [...] A lot of people are going to get sick, and a lot of people may die."[44]

Aquifers may also be put at risk when injected fluid propagates farther than anticipated, reaching nearby oil and gas wells, or injection wells that have compromised cementing and casing.[45] In 1989, for example, the U.S. General Accounting Office (now the Government Accountablitiy Office) determined that about half of the 27 known or suspected contamination events due to Class II well injections arose because the injected fluids reached underground sources of drinking water via nearby abandoned wells that had integrity problems.[46]

The proposed UIC well could conceivably inject unknown toxins that could migrate to compromised abandoned wells and ultimately enter the groundwater table. There are 2,347 conventional active, inactive, abandoned, plugged and orphaned wells in Allegheny County.[47] Nearly 400 of these wells (387) are in Plum Borough — about 13 wells per every square mile.[48] The density of existing wells would make it easier for any wastewater injections to migrate into wells that could provide a conduit to potentially contaminate groundwater systems.

Conclusion

It would be shortsighted to allow Penneco to drill a UIC well and dispose of wastewater underground, compounding the hazards *the fracking boom has already contributed to in Pennsylvania, including: earthquakes, health issues, traffic snarls, the destruction of the environment and farmland, while releasing climate altering methane emissions into the*

---

[43] *Ibid.*

[44] *Ibid.*

[45] Vaidyanathan, Gayathri. "When 2 wells meet, spills can often follow." *E&E EnergyWire*. August 5, 2013; Vaidyanathan, Gayathri. "Small fortune is lost when oil giant's well collides with family business." *E&E EnergyWire*. October 24, 2013; Vaidyanathan, Gayathri. "As 'frack hits' grew in Alberta, regulators stepped in." *E&E EnergyWire*. January 7, 2014.

[46] GAO. "Safeguards Are Not Preventing Contamination From Injected Oil and Gas Wastes." (GAO/RCED-89-97.) July 1989 at 30 and 31.

[47] Pennsylvania Department of Environmental Protection. Oil and Gas Reports. Oil and Gas Operator Well Inventory. Alleghany County. Well Status: Abandoned, Active, DEP Abandoned, DEP Orphan List, DEP Plugged, Plugged OG Well, Regulatory Inactive Status. Accessed July 17, 2017, available at http://www.dep.pa.gov/DataandTools/Reports/Oil%20and%20Gas%20reports/Pages/default.aspx; Pennsylvania Department of Environmental Protection. Oil and Gas Reports. Oil and Gas Operator Well Inventory. Alleghany County. Well Status: Active. Accessed July 17, 2017, available at http://www.dep.pa.gov/DataandTools/Reports/Oil%20and%20Gas%20reports/Pages/default.aspx.

[48] Plum Borough is 29 square miles. *Calculation based on:* Pennsylvania Department of Environmental Protection. Oil and Gas Reports. Oil and Gas Operator Well Inventory. Alleghany County. Plum Borough. Well Status: Abandoned, Active, DEP Abandoned, DEP Orphan List, DEP Plugged, Plugged OG Well, Regulatory Inactive Status. Accessed July 17, 2017, available at http://www.dep.pa.gov/DataandTools/Reports/Oil%20and%20Gas%20reports/Pages/default.aspx; Borough of Plum Pennsylvania. "About the Borough of Plum." Accessed July 17, 2017, available at http://www.plumboro.com/about-the-borough-of-plum.

atmosphere.[49]

As thoroughly detailed above, the disposal of wastewater into injection wells has long been linked to human-caused earthquakes. As fracking proliferates the amount of produced wastewater grows, increasing the activity of injection wells. But high-pressure injection well sites can trigger earthquakes and threatens groundwater resources, putting people's health, safety and water quality at risk.

FWW urges the EPA Region III to reject Penneco's request for a Class II-D permit in Plum Borough, Allegheny County, Pennsylvania.

Thank you for your consideration,

Douglas A. Shields
W. Pennsylvania Outreach Liaison
dshields@fwwatch.org

P.O. Box 8159
Pittsburgh, PA 15217

Appendix:

Table of Violations Committed by Penneco Oil in Pennsylvania, from 2005 to July 16, 2017

[49] Frazier, Reid. "Pennsylvania confirms first fracking-related earthquakes." *The Allegheny Front*. February 18, 2017; Troutman, Melissa A. et al. "Hidden Data Suggests Fracking Created Widespread, Systemic Impact in Pennsylvania." *Public Herald*. January 23, 2017; Schafft, Kai A. et al. "The Relationship between Marcellus Shale Gas Development in Pennsylvania and Local Perceptions of Risk and Opportunity." *Rural Sociology*. Vol. 78, Iss. 2. June 2013 at 18; Przybycian, Jason. "Mansfield police were busy in 2011, especially with DUI." *The Wellsboro/Mansfield Gazette*. January 23, 2012; Clarke, Cheryl R. "More people, More Crime. Tioga County copes with more vehicles, people and more stress on its police." *Sun Gazette* (Williamsport, PA). March 4, 2012; Gleiter, Sue. "Protesters share anti-fracking message at 2016 PA Farm Show." *PennLive*. January 9, 2016; Ingraffea, Anthony R. et al. "Assessment and risk analysis of casing and cement impairment in oil and gas wells in Pennsylvania, 2000-2012." *Proceedings of the National Academy of Sciences*. Vol. 111, No. 30. July 29, 2014 at 10955, 10958 and 10959.

ENVIRONMENTAL HEALTH & SAFETY VIOLATIONS (Total Environmental Health & Safety Fines: $87,300)
(1) **Penneco - Andres 2 OG Well → Environmental Health & Safety Violation - 3/25/2005**: Discharge of industrial waste in the form of surfactant onto ground, cattle watering tanks and high quality watershed (Browns Creek). After being called to the spill to take a sample, the inspector observed two stock tanks foamy and the water down stream was also foamy. Issued a Notice of Violation.
(2) **Penneco - Corna Unit 1 OG Well → Environmental Health & Safety Violation - 9/30/2005:** Failure to restore a water supply affected by pollution or diminution. Issued an Administrative Order.
(3) **Penneco - Christian Life Church 1 OG Well → Environmental Health & Safety - 3/13/2007:** Failure to restore a water supply affected by pollution or diminution. Issued an Administrative Order.
(4) **Penneco - Andrew 5 OG Well → Environmental Health & Safety - 3/15/2007:** Liner leak - migration of surfactants from sump to spring to HQ Brown's Creek tributary. Stream discharge of IW includes drill cuttings, oil, brine and/or silt. Issued a Notice of Violation.
(5) **Penneco - Scott Durbin 1 OG Well → Environmental Health & Safety Violation - 6/1/2007:** Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under OGA Sec 206(c)(d). Issued a Notice of Violation.
(6) **Penneco - Hildreth 1 OG Well → Environmental Health & Safety Violation - 5/21/2008:** Failure to minimize accelerated erosion implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under OGA Sec 206(c)(d). Issued a Notice of Violation.
(7) **Penneco - Hildreth 1 OG Well → Environmental Health & Safety Violation - 5/21/2008:** Encroachment without Permit or Waiver. Issued a Notice of Violation and a Consent Assessment of Civil Penalty worth $6,700 .
(8) **Penneco - Hildreth 1 OG Well → Environmental Health & Safety Violation - 5/21/2008:** Failure to minimize erosion, implement E&S plan and maintain E&S controls. Failure to stabilize site until total site restoration under OGA Sec 206(c)(d). Issued a Consent Assessment of Civil Penalty worth $6,700.
(9) **Penneco - Don Myers 1 OG Well → Environmental Health & Safety Violation - 7/31/2008:** Failure to minimize accelerated erosion implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under OGA Sec 206(c)(d). Issued a Notice of Violation and a Consent Assessment of Civil Penalty worth $5,400.
(10) **Penneco - Don Myers 1 OG Well → Environmental Health & Safety Violation - 7/31/2008:** Discharge of pollutional material to waters of Commonwealth. Issued a Notice of Violation and a Consent Assessment of Civil Penalty worth $5,400.
(11) **Penneco - Gospel Church 1 Well → Environmental Health & Safety Violation - 9/16/2008:** Discharge of pollutional material to waters of Commonwealth. Issued a Notice of Violation and a Consent Assessment of Civil Penalty worth $5,400.
(12) **Penneco - Swaintek 4 OG Well → Environmental Health & Safety Violation - 12/18/2008:** Failure to comply with terms and conditions of permit. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $6,200.
(13) **Penneco - Roman 1 OG Well → Environmental Health & Safety Violation - 10/23/2009:** Failure to restore site within 9 months of completion of drilling or plugging. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $3,000.
(14) **Penneco - Alan Hill 1 OG Well → Environmental Health & Safety Violation - 11/3/2009:** Failure to restore site within 30 days of permit expiration when well not drilled. Issued a Notice of Violation.
(15) **Penneco - Klemencic 2 OG Well → Environmental Health & Safety Violation - 12/15/2009:** Discharge of pollutional material to waters of Commonwealth after it was discovered that surface water had infiltrated the pit and filled it until it began to overflow after heavy rainfall the previous night. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $3,500.
(16) **Penneco - Haberman 1 OG Well → Environmental Health & Safety Violation - 5/14/2010:** Industrial waste was discharged without permit after a drill pit liner fell into the pit water causing the water (which is classified as industrial waste discharge) to overtop the collapsed pit liner. The silt fence on-site was not installed correctly with additional evidence that runoff is undercutting the silt fence on the lower side of the site. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $5,400.
(17) **Penneco - Haberman 1 OG Well → Environmental Health & Safety Violation - 5/14/2010:** Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under OGA Sec 206(c)(d). Silt fence was not installed correctly and there was evidence of run-off going under the silt fence. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $5,400.
(18) **Penneco - Clawson 1 OG Well → Environmental Health & Safety Violation - 4/29/2011:** Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under OGA Sec 206(c)(d).
(19) **Penneco - Whitten 10H-A OG Well → Environmental Health & Safety Violation - 8/21/2012:** Failure to properly control or dispose of industrial or residual waste to prevent pollution of the waters of the Commonwealth. Issued a Notice of Violation.
(20) **Penneco - Whitten 10H-A OG Well → Environmental Health & Safety Violation - 9/6/2012:** Failure to properly control or dispose of industrial or residual waste to prevent pollution of the waters of the Commonwealth. White fluid was found running down the backside of the well pad and when it was traced back to its source it contain Bentonite and cement returns. The tank appeared to have a hole in the bottom, resulting in the discharge of the substance. The tank also had less than 2 feet of freeboard. Issued a Notice of Violation.
(21) **Penneco - Watson Unit 4H OG Well → Environmental Health & Safety Violation - 7/12/2013:** Failure to properly control or dispose of industrial or residual waste to prevent pollution of the waters of the Commonwealth. An oily substance was released off the site through the pasture and into Claylick Run. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $14,000.
(22) **Penneco - Braddock 12H OG Well → Environmental Health & Safety Violation - 7/14/2014:** Failure to take all necessary measures to prevent spill. Inadequate diking, potential pollution. Material pushed out of the old well impacted a stream running past the old well and this material eventually impacted Long Run. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $2,700.
(23) **Penneco - Braddock 12H OG Well → Environmental Health & Safety Violation - 7/14/2014:** Discharge of pollutional material to waters of Commonwealth. Issued both a Notice of Violation and a Consent Assessment of Civil Penalty of $2,700.
(24) **Penneco - Watson Unit 2H OG Well → Environmental Health & Safety Violation - 3/16/2015:** Operator failed to control and dispose of fluids, residual waste and drill cuttings including tophole water, brines, drilling fluids, drilling muds, stimulation fluids, well servicing fluids, oil and production fluids in a manner that prevents pollution of the waters of the Commonwealth. Issued a Notice of Violation.

(25) **Penneco - Watson Unit 2H OG Well → Environmental Health & Safety Violation - 3/16/2015:** Failure to take necessary measures to prevent pollutants from reaching waters of the Commonwealth. The well discharged approximately 10-15 barrels of crude to the ground around the wellhead. Issued a Notice of Violation.
(26) **Penneco - Plum Boro 2 OG Well → Environmental Health & Safety Violation - 5/11/2015:** Failure to properly store, transport, process or dispose of residual waste. Issued a Notice of Violation.
(27) **Penneco - Plum Boro 2 OG Well → Environmental Health & Safety Violation - 5/11/2015:** Operator failed to collect the brine and other fluids produced during operation, service and plugging of the well in a tank, pit or series of pits or tanks or other device approved by the Department or Operator discharged brine or other fluids on or into the ground or into waters of the Commonwealth. Issued a Notice of Violation.
(28) **Penneco - Hankey Unit 6H OG Well → Environmental Health & Safety Violation - 3/10/2016:** Failure to properly store, transport, process or dispose of a residual waste. Issued a Notice of Violation.
(29) **Penneco - Hankey Unit 6H OG Well → Environmental Health & Safety Violation - 3/10/2016:** Operator failed to collect the brine and other fluids produced during operation, service and plugging of the well in a tank, pit or series of pits or tanks or other device approved by the Department or Operator discharged brine or other fluids on or into the ground or into the waters of the Commonwealth. Issued a Notice of Violation.
(30) **Penneco - Braddock 9H OG Well → Environmental Health & Safety Violation - 5/24/2016:** Operator failed to control and dispose of fluids, residual waste and drill cuttings including tophole water, brines, drilling fluids, drilling muds, stimulation fluids, well servicing fluids, oil and production fluids in a manner that prevents pollution of the waters of the Commonwealth. Issued a Notice of Violation.
(31) **Penneco - Braddock 9H OG Well → Environmental Health & Safety Violation - 5/24/2016:** Failure to properly store, transport, process or dispose of a residual waste. Issued a Notice of Violation.
(32) **Penneco - Charles Whipkey 4H OG Well → Environmental Health & Safety Violation - 10/28/2016:** Operator failed to collect the brine and other fluids produced during operation, service and plugging of the well in a tank, pit or a series of pits or tanks or other device approved by the Department or Operator discharged brine or other fluids on or into the ground into waters of the Commonwealth. Issued a Notice of Violation.
ADMINISTRATIVE VIOLATIONS (Total Administrative Fines: $36,600)
(1) **Penneco - Robison Unit 1 OG Well → Administrative Violation - 2/2/2006:** Impoundment not structurally sound, impermeable, 3rd party protected, greater than 20 of seasonal high groundwater table. Issued a Field Notice of Violation.
(2) **Penneco - Robert Anderson 1 OG Well → Administrative Violation - 3/10/2006:** Failure to maintain a 2' freeboard in an impoundment. Issued a Notice of Violation.
(3) **Penneco - Robert Anderson 1 OG Well → Administrative Violation - 3/10/2006:** Tophole water discharge does not meet standards. Issued a Notice of Violation.
(4) **Penneco - Konkus 1 OG Well → Administrative Violation - 1/17/2007:** Failure to maintain 2' freeboard in an impoundment. Issued a Notice of Violation.
(5) **Penneco - Alworth 1 OG Well → Administrative Violation - 3/16/2007:** Improperly lined pit. Issued a Notice of Violation.
(6) **Penneco - Hill 1 OG Well → Administrative Violation - 8/29/2008:** Inadequate containment of oil tank. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $6,200.
(7) **Penneco - Roman 1 OG Well → Administrative Violation - 10/23/2009:** Failure to submit well record within 30 days of completion of drilling. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $3,000.
(8) **Penneco - Roman 1 OG Well → Administrative Violation - 10/23/2009:** Failure to plug a well upon abandonment. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $3,000.
(9) **Penneco - Klemencic 2 OG Well → Administrative Violation - 12/15/2009:** Improperly lined pit. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $3,500.
(10) **Penneco - Haberman 1 OG Well → Administrative Violation - 5/14/2010:** Failure to maintain 2' freeboard in an impoundment, causing the liner to fall down into the pit with water overtopping it. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $5,400.
(11) **Penneco - Clements 4 OG Well → Administrative Violation - 6/24/2010:** Impoundment not structurally sound impermeable, 3rd party protected, greater than 20" of seasonal high groundwater table. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $5,000.
(12) **Penneco - Behm 49-1 OG Well → Administrative Violation - 2/28/2011:** Failure to maintain 2' freeboard in an impoundment.
(13) **Penneco - Behm 49-1 OG Well → Administrative Violation - 2/28/2011:** Failure to implement and maintain BMPs (best management practices) in accordance with Chapter 102.
(14) **Penneco - Brush Creek Cemetery 3 OG Well → Administrative Violation - 3/4/2011:** Failure to implement and maintain best management practices in accordance with Chapter 102. Issued a Notice of Violation.
(15) **Penneco - Whipkey 1 OG Well → Administrative Violation - 3/4/2011:** Failure to maintain 2' of freeboard in an impoundment.
(16) **Penneco - Shanta 91-1 OG Well → Administrative Violation - 11/9/2011:** Failure to notify DEP, landowner, political subdivision or coal owner 24 hours prior to commencement of drilling. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $4,250.
(17) **Penneco - Shanta 91-1 OG Well → Administrative Violation - 11/9/2011:** Excessive casing seat pressure. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $4,250.
(18) **Penneco - Whitten 10H-A OG Well → Administrative Violation - 8/21/2012:** Failure to maintain 2' of freeboard in an impoundment. Issued a Notice of Violation.
(19) **Penneco - Whitten 10H-A OG Well → Administrative Violation - 9/6/2012:** Failure to maintain 2' freeboard in an impoundment. Issued a Notice of Violation.
(20) **Penneco - Sluss 9H OG Well → Administrative Violation - 11/30/2012:** Failure to maintain 2' freeboard in an impoundment. Issued a Notice of Violation.
(21) **Penneco - Sluss 9H OG Well → Administrative Violation - 11/30/2012:** Improper pit disposal of drill cuttings from above the casing seat. Issued a

Notice of Violation.
(22) **Penneco - Sluss 8H OG Well → Administrative Violation - 7/31/2013:** Failure to submit completion report within 30 days of completion of well.
(23) **Penneco - Flugunt 1 Well → Administrative Violation - 3/31/2014:** Failure to post pit approval number. It was reported that a 20 barrel brine and oil spill occurred on Sunday originating from the tank valve which was previously found open. The inspector observed two areas of oil contaminated soil leading toward a steep hillside. Issued a Notice of Violation.
Total Environmental and Administrative Fines for Violations: $123,900

Source: Pennsylvania Department of Environmental Protection.

Endnotes

Oral Comment on EPA Draft Permit PAS2D701BALL

Thank you for the opportunity to comment on EPA's draft permit PAS2D701BALL ("Permit") and EPA's "Basis" document for conversion of Penneco's Sedat 3A well, API Number 003-21223 to an injection well for disposal of Oil & Gas wastewater. I object to the issuance of this permit on several grounds. My oral comment today is only a summary of my written comments, which include much more detail, and which I am submitting both here and by E-mail.

1. Basis Geologic and Seismic Review (p. 4) shows no evidence of any evaluation of the presence in the Area of Review "AOR" of any intervening coal mines (including undocumented mines) that might interfere with the intended operation or integrity of the injection well or the effectiveness of AOR Confining Zones.

In fact Basis doesn't even mention the word "coal"! Sedat 3A and the entire AOR are located inside a recognized Mine Subsidence Insurance risk area. The Coal Indicator field for the well Sedat 3A in DEP's Oil & Gas Mapping metadata table reads "Coal". It is nothing less than outrageous that this has not been analyzed. If there is any tangible risk whatever of mine subsidence, this should in and of itself ***completely disqualify*** this location from hosting an injection well. EPA should deny outright any application for a UIC disposal well in any Mine Subsidence Insurance risk area.

2. There are 2 additional wells just outside the 0.25 mile buffer around Sedat 3A which were apparently not evaluated, and are close enough to the proposed Area of Review ("AOR") to make the definition of the AOR as published arbitrary and unreasonable.

My written comment shows a topographic map of the area around Sedat 3A including the 5 wells inside the AOR, which Basis does not identify. There are 2 additional wells just outside the AOR, including API 003-21438, CONSOLIDATION COAL CO 8, which is only 0.26 miles from Sedat 3A. A difference of 0.01 miles is geologically insignificant, showing this well should be considered also. The AOR has been drawn ***arbitrarily and unreasonably.*** EPA must deny this application as drafted and demand that Penneco reapply under an amended AOR whose definition is geologically reasonable and takes into account all nearby potential impacts.

3. EPA has failed to properly evaluate the Zone of Endangering Influence by failing to analyze cementing, particularly cementing outside the casing, for the wells inside the AOR.

A cement failure of a well that penetrates the injection zone can allow contaminants to escape the confining layer. Only Sedat 5H was subject to current cementing rules, the other wells are too old. There are no inspection reports showing cementing to the surface was inspected.

4. Basis Geologic and Seismic Review (p. 4) is incomplete and inadequate and does not take account of recent history, including Marcellus and Utica Shales incidents of unanticipated faults and induced seismicity, and actual induced seismicity events in Ohio and Oklahoma.

A series of low-magnitude fracking related earthquakes occured on April 25 2016, not far from a geological feature called the Blairsville-Broadtop Lineament (also known as the Mahoning River Lineament). Sedat 3A is also not far from this feature, showing the area may be more prone to earthquakes than Basis estimates. Injection wells have been known to be associated with earthquakes since the 1960s.

5. There are numerous defects in the permit which must be remedied.

All nearby wells must be recemented outside the casing to the surface. Cement logs must be submitted in all cases and must be public records that are not subject to claims of confidentiality. There must be some form of containment against the threat of surface spills when trucks are connected and disconnected.

FRACKING INFRASTRUCTURE & INJECTION WELL

Jill Antares Hunkler

Belmont County, OH

Exposure: Wells, pipelines, compressor stations & transfer stations ***Harm:*** Ground & surface water contamination, evacuations ***Human Health Impacts:*** Headaches, asthma-like symptoms, rashes & insomnia ***Animal Health Impacts***: Fish kill = 70,000 fish

My name is Jill Antares Hunkler, and I live in Belmont County, Ohio, near the Village of Barnesville's Slope Creek Reservoir where I have lived for 30 years. I have been experiencing the hazards of fracking and witnessing the path of destruction and contamination caused by this polluting industry. My family and I live in close proximity to fracking sites and have experienced negative health impacts including headaches, asthma-like symptoms, rashes, and insomnia due to the industry's invasion of my ancestral homeland.

The first warning signs of the shale industry invasion came with the arrival of the leasing land agents. Area residents formed long lines outside the local high schools to sign over the mineral rights before educating themselves about the potential threats involved with the industry. Landowners and farmers, who had been struggling financially for years, were suddenly being presented with significant amounts of money that they did not refuse. The industry preached of safe development, large royalty checks and independence from foreign oil and gas supplies.

"I never imagined that my quiet country way of life would disappear."

The fracking infrastructure, including pipelines, compressor and transfer stations, began developing rapidly. Injection wells for the radioactive and chemically laden waste were among the first secretive projects to be completed, and Ohio was accepting out-of-state, toxic fracking waste.

Belmont County had entered into a secret contract with a company that had been permitted to take fracking drill cuttings, mix it with coal ash, and use it as fill for an industrial park site one mile from our Village of Barnesville.

I organized a group, Concerned Barnesville Area Residents (CBAR). We gathered factual evidence and presented it to local and county officials, initiated a successful petition drive, placed full-page bulletins, wrote numerous editorials outlining the hazards of the project, and organized a town hall meeting. As a result of the community's voicing of its opposition to the project, the comp withdrew and is not operating in our county. This was a big vict showing what concerted, informed community action can achiev

In March 2014, at a Village of Barnesville council meetin witnessed a Gulfport Energy representative presenting contract the council. The village had already agreed to lease the surface a mineral rights to Gulfport. The contracts being presented to Village called for the locating of two fracking well pads within 5 feet from the shoreline of Slope Creek Reservoir.

Our now respected and powerful group of concerned a residents began campaigning for the protection of the reserv and the abandonment of the fracking wells within the watersh Another successful petition drive resulted in 2300 signatures, whi have been submitted, to Gulfport and the Village, requesting th the company relocate the pads and abandon operations in the Slo Creek Watershed.

In the autumn of 2014, Slope Creek Reservoir, drinking wat supply for 10,000 people, had been depleted from excessive frackir industry withdrawals. Due to public pressure, the Village ceas allowing Gulfport to withdraw water from the reservoir.

This led to fears among the industry about the availability of th water essential for their drilling activities. Another fracking compan Antero Resources, had entered into a five-year contract with th Village for water withdrawals, installed a barge for transportin equipment and a floating pump on the reservoir.

Subsequently, Gulfport Energy filed a lawsuit against the Villag of Barnesville over their contract with Antero for water withdrawals The lawsuit states that the Village has given priority rights to Antero for the water over Gulfport.

This lawsuit has led to international media coverage as a Davic and Goliath story between these large oil companies and the smal village of Barnesville over the fight for water. In a local news interview I stated, "I am grateful to the Village of Barnesville for ceasing wate withdrawals last fall when the water levels became alarmingly low." I then addressed Gulfport, "Don't sue our Village. It is our water. You are a guest here. Respect us, our way of life, and our natural resources."

ThinkProgress ran a story over the water disputes involving Slope Creek with the headline, "600 Million Dollar Fracking Company Sues Tiny Village in Ohio Over Water Usage." This alerted Al Jazeera America of the situation and in March of 2015 they came and interviewed me and aired my story, tied in to the Slope Creek water dispute and lawsuit, on their 24-hour cable news station.

In April of 2015, Al Jazeera America returned with their crew to film the local Source Water Protection Plan meeting where the Village of Barnesville, in cooperation with the Ohio Environmental Protection Agency, presented their draft plan to the residents for public comment. In the packed room, Barnesville area residents raised concerns over the fact that major potential threats from shale gas development had not been included in the plan.

The Al Jazeera America news story, which aired later that week, shows me asking the following questions, "Who decides what is included in this protection plan? Is it the community? " The Mayor of Barnesville responded by saying that the purpose of the meeting was to hear the concerns; he didn't specifically answer the question. So, we are left to wonder and worry what the Village will decide.

Most of my Slope Creek neighbors have already signed their mineral rights over to the industry, but based on my research and observation of irresponsible drilling practices, I have refused to lease my mineral rights to Gulfport. As I told Al Jazeera America, "I could use the money. I have a leaking roof, and my water system is not working, but I value clean air, water, the trees, the land, the animals and their habitat more than money."

Gulfport has informed me that if I do not enter into an agreement with them to lease my minerals by June of 2015, they will file an application for forced unitization with the Ohio Department of Natural Resources for my mineral rights. There will be a hearing before the Chief of the ODNR Oil and Gas Commission where Gulfport and I will both be given an opportunity to present our cases. The ruling in such cases most often favors the industry, even to the extent of declaring that no royalties will be paid to the forced unitized mineral owner until the well has paid for itself 200 times over. The unit in which my property would be forced into will have a well pad located less than a quarter mile from my home, and within a half mile of the of Slope Creek Reservoir dam. There have been documented cases of the fracking process causing smaller earthquakes in Ohio. This is particularly concerning as possible earthquakes caused from this drilling site within such a short distance of the reservoir could compromise the dam's integrity and threaten those who live downstream.

When I first took up the battle many said: "You are wasting your time. You can't stop this industry because they have all the money and the power influencing local, state, and the federal government." Fortunately, we did not listen to such defeatists; instead many concerned residents joined together in truth and achieved a great victory by stopping the radioactive fracking waste facility from being built a mile from our village.

It is my greatest hope that others will be inspired by this story and become informed and work together to take action against harmful and irresponsible shale development. It is not a choice whether to share my story in protective efforts for the land and life-giving water. It continues to be a responsibility that I wholeheartedly accept to help ensure a healthy and protected Mother Earth.

-Jill Antares Hunkler

To see Jill's entire testamonial, go to our website ShalefieldStories.org

Slope Creek Reservior photo courtesy of Max A. Burkhart

Julie Barr

Trumbull County, OH

Exposure: 5 Injection wells ***Harm:*** Ground & surface water contamination, waste water spill/leak, contaminated ponds & wetlands. Industry dishonesty/disregard: Failure to inform family of contents of spill, no ongoing monitoring of well water. Loss of Property Value. ***Animal Health Impacts:*** Dead fish & wildlife.

I have lived in my home for 14 years in Vienna, Ohio. When we moved to what was our dream home, it was country living at its best. We could not have asked for better neighbors: people who cared about one another, people you could count on, and you would think, would look out for you and your family. Today, I have 5 injection wells almost in my backyard. There is no more sitting outside in the evening after a hard day at work. Now, all you hear is the beeping from truck after truck, at times reaching 20 within one hour, all coming to dump brine and waste from hydraulically fractured wells. No more quiet. No more peace. No more waking up in the morning just to watch my children sleep. Now, I have to run and test our water before they get up, so I feel it is safe for them to brush their teeth and take a bath. About two years ago, my nextdoor neighbors passed away, and their children and grandchildren took over the land. At first, not much changed. Then, my old neighbor's grandson's company opened an injection well in the field. Our quiet country life was no more.

One day my family was almost hit by one of the trucks pulling out of the dump site. We were shook up and always on alert after that. Then my biggest fear came true. Right before Easter, there was a leak or a spill, and it was really big. It spread over a mile of wetlands and ponds. We found out on our way home because of all the police and equipment at the end of the street. We were very concerned. At first we got no answers, just what we were able to see - many dead fish and other wild life. I began to cry looking at all the death around me, and then it hit me: my kids and our water! I called the house and told our sitter not to let the kids drink or bathe in the water. No one could tell us what was leaking or from where it was coming. All I was told is that everything was okay, and they didn't THINK anything was wrong with my water. It was only after the spill that we found out there was not one, but five injection wells operating in the field by our house! The Ohio Department of Natural Resources (ODNR) took a water test for us, but the cleanup was still ongoing for weeks afterwards. There was never any monitoring, or follow up to assure us our water would be

Public Comment on EPA Draft Permit PAS2D701BALL

On 06/22/2017, EPA published a Public Notice of intent[1] to issue Permit # PAS2D701BALL ("Permit")[2] to Penneco, LLC, for conversion of the well Sedat 3A, API Number 003-21223, ("Well") to an injection well for disposal of Oil & Gas wastewater, as supported by a Statement of Basis ("Basis")[3]. I object to the issuance of this permit, and in response to EPA's request for public comment, wish to make the following public comments.

1. Basis (p. 1) shows no evidence that the integrity of Well's plug-back to 1,940 feet has been evaluated against injection pressure.

Basis makes the following statement regarding the history of Sedat 3A:

> The well was hydraulically fractured at three depths and produced natural gas until 2015 when it was taken out of service due to low production. The well was plugged back to a depth of 1,940 feet, directly below the Murrysville Sandstone injection zone, ***in accordance with Pennsylvania DEP regulations***. (p. 1, emphasis added).

Evidently EPA is accepting Penneco's word concerning the plug-back to 1,940 feet, and has not sought to verify whether Penneco made any application to DEP for the plug-back. In fact, the Authorization Search facility of DEP[4] for applications under API 003-21223 yields only the original application for a Drill & Operate Well Permit received by DEP on 09/19/1988 and issued on 9/19/1988[5]. DEP's Oil & Gas Mapping web site shows the following status information for this well[6]:

> WELL_STATUS: Active
> WELL_STATUS_CODE: 7

So even the statement "it was taken out of service due to low production" ***DOES NOT AGREE WITH DEP RECORDS***.

Scrutiny of all DEP inspection reports for Sedat 3A[7] yields only the following references to plugging or cement:

---

1 https://www.epa.gov/sites/production/files/2017-06/documents/finaloptimizedforweb.administrative_record_-_penneco_sedat_3a.pdf
2 https://www.epa.gov/sites/production/files/2017-06/documents/finaloptimizedforweb.pennecodraftpermit06.22.17.pdf
3 https://www.epa.gov/sites/production/files/2017-06/documents/finaloptimizedforweb.pennecosobmasterpas2d701ball.pdf
4 http://www.ahs.dep.pa.gov/eFACTSWeb/criteria_auth.aspx
5 http://www.ahs.dep.pa.gov/eFACTSWeb/searchResults_singleAuth.aspx?AuthID=52215
6 http://www.depgis.state.pa.us/arcgis/rest/services/OilGas/OilGasAllStrayGas/MapServer/3/query?where=PERMIT_NUMBER+%3D+%27003-21223%27&text=&objectIds=&time=&geometry=&geometryType=esriGeometryEnvelope&inSR=&spatialRel=esriSpatialRelIntersects&relationParam=&outFields=OBJECTID%2CPERMIT_NUMBER%2CWELL_NAME%2COPERATOR%2COPERATOR_NUMBER%2CWELL_TYPE%2CWELL_TYPE_CODE%2CWELL_STATUS%2CWELL_STATUS_CODE%2CPERMIT_DATE%2CPERMIT_DATE_EXPIRES%2CSPUD_DATE%2CCONSERVATION_IND%2CCOUNTY%2CCOUNTY_ID%2CMUNICIPALITY%2CMUNICIPALITY_TYPE%2CMUNICIPALITY_CODE%2CLATITUDE%2CLONGITUDE%2CPRMRY_FID%2CUNCONVENTIONAL_IND%2CSURFACE_ELEVATION%2CWELL_CONFIG_CODE%2CCOAL_IND%2CWELL_PAD_NAME%2CSHAPE%2CDATE_PLUGGED%2CWELL_PAD_ID%2CUIC_ID%2CUIC_TYPE_DESCRIPTION%2CSTORAGE_FIELD_NAME%2CSITE_ID%2CSITE_NAME&returnGeometry=true&returnTrueCurves=false&maxAllowableOffset=&geometryPrecision=&outSR=&returnIdsOnly=false&returnCountOnly=false&orderByFields=&groupByFieldsForStatistics=&outStatistics=&returnZ=false&returnM=false&gdbVersion=&returnDistinctValues=false&resultOffset=&resultRecordCount=&f=html
7 http://www.depgis.state.pa.us/arcgis/rest/services/OilGas/OilGasAllStrayGas/MapServer/38/query?where=PERMIT_NUMBER+%3D+%27003-21223%27&text=&objectIds=&time=&geometry=&geometryType=esriGeometryPoint&inSR=&spatialRel=esriSpatialRelIntersects&relationParam=&outFields=INSP_PRMRY_FAC_ID%2CSITE_ID%2COWNER_CLNT_ID%2CINSPECTION_COMMENT%2CINSPECTION_DATE%2CINSPECTION_ID%2CINSPECTION_RESULT_DESCRIPTION%2CINSPECTION_TYPE_DESCRIPTION%2CVIOLATION_COUNT%2COPERATOR_RESPONSE_COUNT%2CINSPECTION_REPORT_COUNT%2CWELL_NAME%2CPERMIT_NUMBER&returnGeometry=true&returnTrueCurves=false&maxAllowableOffset=&geometryPrecision=&outSR=epsg

INSP_PRMRY_FAC_ID: 7741
SITE_ID: 5993
OWNER_CLNT_ID: 7674
INSPECTION_COMMENT: A SERVICE RIG IS SET UP. PENNEECO IS PLUGGING BACK TO DO TESTING IN THE MURRYSVILLE FORMATION. THE WELL WAS PRODUCING FROM THE SPEECHLY.
INSPECTION_DATE: 2015-07-20
INSPECTION_ID: 2391244
INSPECTION_RESULT_DESCRIPTION: No Violations Noted
INSPECTION_TYPE_DESCRIPTION: Plugging(Includes Plugged/Mined Through)
VIOLATION_COUNT: null
OPERATOR_RESPONSE_COUNT: null
INSPECTION_REPORT_COUNT: null
WELL_NAME: SEDAT 3A
PERMIT_NUMBER: 003-21223

INSP_PRMRY_FAC_ID: 7741
SITE_ID: 5993
OWNER_CLNT_ID: 7674
INSPECTION_COMMENT: A SERVICE RIG IS UP AND OVER THIS WELL. THERE ARE NO PERSONEL AT THE SITE. PENNECO IS PLANNING TESTING OF THE MURRYSVILLE FORMATION.
INSPECTION_DATE: 2015-07-29
INSPECTION_ID: 2396484
INSPECTION_RESULT_DESCRIPTION: No Violations Noted
INSPECTION_TYPE_DESCRIPTION: Routine/Complete Inspection
VIOLATION_COUNT: null
OPERATOR_RESPONSE_COUNT: null
INSPECTION_REPORT_COUNT: null
WELL_NAME: SEDAT 3A
PERMIT_NUMBER: 003-21223

The well clearly received a plugging inspection on 7/20/2015 but there is no indication of inspection against injection pressure. The inspection report includes the comment: "PENNEECO [sic] IS PLUGGING BACK TO DO TESTING IN THE MURRYSVILLE FORMATION" with no indication whatever of what kind of testing; one can infer that DEP must have assumed Penneco was testing for production from the Murrysville Formation. If Penneco is asserting that the 7/20/2015 inspection inspected the plug-back to 1,940 against injection pressure, the record does not support this.

2. There are 2 additional wells just outside the 0.25 mile buffer around Sedat 3A which were apparently not evaluated, and are close enough to the proposed Area of Review ("AOR") to make the definition of the AOR as published arbitrary and unreasonable.

Appendix 1 shows a section of the USGS New Kensington East 1:24000 Topographic Map overlaid with Oil & Gas wells (data from the DEP Oil & Gas mapping web site) and a buffer with radius 0.25 miles around the location of Sedat 3A[8]. The map demonstrates that there are two wells just outside the 0.25 mile buffer:

003-21438 CONSOLIDATION COAL CO 8

%3A4326&returnIdsOnly=false&returnCountOnly=false&orderByFields=&groupByFieldsForStatistics=&outStatistics=&returnZ=false&returnM=false&gdbVersion=&returnDistinctValues=false&resultOffset=&resultRecordCount=&f=html

8 Appendix 1 uses DEP's GIS locations for the wells, including Sedat 3A. EPA's published latitude and longitude for application PAS2D701BALL evidently use latitude and longitude rounded to one decimal point of seconds, resulting in a slight discrepancy from DEP records. This mismatch evinces a disregard for detail on EPA's part which is unfortunate.

The well CONSOLIDATION COAL CO 8 in particular is only 0.26 miles from Sedat 3A. A difference of 0.01 miles is geologically insignificant. Accordingly, to exclude these two wells from the AOR makes clear that the AOR has been drawn ***arbitrarily and unreasonably.*** On what basis has EPA concluded that an 0.01 mile distance outside the 0.25 mile buffer is enough to preclude belonging to the "zone of endangering influence"? EPA must deny this application as drafted and demand that Penneco reapply under an amended AOR whose definition is geologically reasonable and takes into account all nearby potential impacts.

3. Basis AOR evaluation (p. 2) does not list identification (e.g. API Number) for the 5 wells within the proposed AOR that penetrate the injection zone.

Basis (p. 2) states:

> "After extensive research of company, local, county and state well records five wells were identified that penetrate the injection zone within the Area of Review. All such wells have been thoroughly evaluated to document proper well construction and/or plugging and abandonment."

So why does not Basis list identifications for these 5 wells, so the public can verify whether this is correct? By not identifying the 5 wells, Basis has been offered for Public Comment prematurely.

Appendix 1 shows the following 5 wells (other than Sedat 3A) within the proposed AOR:

API	Well Name	SPUD Date
003-21287	HOWARD 1	1991-09-24
003-21210	SEDAT 1	1988-03-05
003-21644	SEDAT 4A	2004-06-18
003-22200	SEDAT 5H	2012-01-10
003-21222	SEDAT 2A	1989-01-12

Table 1: Wells within 0.25 miles of Sedat 3A

Are these the same 5 wells as referred to in Basis? If not, EPA must explain! In any event, Basis is deficient for not publishing identification of the 5 wells.

4. Evaluation of Endangerment within the proposed AOR as demonstrated by Basis is incomplete and inadequate.

There are several grounds on which Basis fails to demonstrate evaluation of Endangerment within the proposed AOR. Consider the list of 5 wells above. The most recent SPUD date is 2012, and all but Sedat 5H were SPUD in 2004 or earlier. What was the cementing standard in place at the time these wells were SPUD? Basis shows no evidence that any cement logs for these wells were evaluated. As cited above, Basis notes: "All such wells have been thoroughly evaluated to document ***proper*** well construction and/or plugging and abandonment." [Emphasis added.] What does the word "proper" mean here? The obvious inference is that "proper" means deemed proper ***at the time*** construction and/or plugging and abandonment took place. Sedat 2A was SPUD in 1989. What kind of cementing construction was "proper" in 1989? What tests were made in 1989 to show resistance to injection pressure outside the casing? The truth of the matter is that reasonable cementing standards for Oil & Gas wells were not promulgated in Pennsylvania until 2010[9]. That means of the 5 wells shown above, only Sedat 5H would

9 See e.g. "PENNSYLVANIA Oil and Gas Casing and Cementing Standards, 25 Pa. Code Chapter 78 (relating to Oil and Gas Wells) See 40 Pa.B. 3845 (July 10, 2010) Environmental Quality Board Regulation #7-459 (Independent Regulatory Review Commission #2857) Comment/Response Document " http://files.dep.state.pa.us/PublicParticipation/Public%20Participation%20Center/PubPartCenterPortalFiles/Environmental%20Quality%20Board/2010/October_12_2010/Casing%20and

have been constructed under cementing rules appropriate for protection against endangerment from an injection well. The 2010 cementing and casing rules — which applied to both conventional and unconventional wells — were adopted only after difficult experiences of methane migration (which was admitted by DEP as a genuine issue). By not clarifying whether "proper" means according to today's understanding of proper cementing construction, Basis is in fact not a basis at all for determining protection against endangerment. EPA must require reevaluation of the construction of these wells for cementing issues, including actual documentation of pressure tests and cement bonding logs.

The case of Sedat 5H is particularly troubling. This well would have been subject to the 2010 cementing rules. There are no inspection reports for this well that show that the cementing was ever inspected. If DEP did not inspect cementing for Sedat 5H, how can EPA claim to have evaluated whether the cementing job for this well was "proper"?

Appendix 1 shows there are houses within the proposed AOR — a fact which is not mentioned in Basis. What is the water source for these houses? EPA is negligent in evaluating endangerment if it does not require pre-conversion water testing on all water wells to the same standard as required in Pennsylvania for drilling unconventional gas wells. Failing to evaluate the pre-conversion water quality for houses close to Sedat 3A is simply inexcusable.

Finally, evaluation of endangerment against earthquakes is such a large issue it will be dealt with below (point 8).

5. Basis AOR evaluation (p. 2) shows no evidence of logs or other data by means of which the wells within the proposed AOR have been evaluated for construction integrity (e.g. pressure testing or cementing).

An exhaustive search of DEP inspection reports[10] for the wells listed in Table 1 above shows no instance in which DEP inspected even one of the wells for pressure testing. The case of Sedat 5H is particularly troubling. This is evidently a horizontal[11] Oil and Gas well. Inspection reports note in comments that the well has been fracked, but there is no notation of pressure testing. The only indication that Sedat 5H was inspected for cementing is a single comment in Inspection ID 2054235 stating "US ENERGY RIG DRILLED A PILOT HOLE TO 3450', AND THE CEMENTED BACK TO IT'S KOP." Sedat 5H was subject to the 2010 cementing rules. But there appears to have been no surface inspection of the cementing job. The DEP Oil and Gas Electronic Notifications Report[12] shows no electronic notifications having been sent for this well.

6. Basis Confining Zones evaluation (p. 3) cites no permeability figures for putative confining zones and shows no evidence this was evaluated.

Although EPA evaluated permeability for the injection zone in some detail, Basis provides no detail whatever regarding permeability of the putative confining zones. Do they in fact function as confining zones? What evidence do we have for this? The only thing provided by Basis on this point is Penneco's assertion that they are "confining". And it is worth noting, the Administrative Record Index on this case[13] ("Index") cites no reference whatsoever regarding the Riddlesburg Shale.

7. Basis Confining Zones evaluation (p. 3) cites no methodology for analyzing whether there might be existing fractures in the putative confining zones that would allow transmitting contaminants, and shows no evidence this was evaluated.

Basis states:

%20Cementing/Comment_Response_for_Oil_and_Gas_comments_9_20_101.pdf.

10 Inexplicably, DEP's Oil & Gas Mapping web site shows no inspections whatsoever for Sedat 4A, 003-21644.

11 DEP records are ambiguous as to the configuration of this well. It is referred to in the inspection reports as a horizontal well, but the DEP Oil & Gas Mapping web site metadata for this well lists well configuration as "Deviated".

12 http://www.depreportingservices.state.pa.us/ReportServer?/Oil_Gas/OG_Notifications

13 https://www.epa.gov/sites/production/files/2017-06/documents/finaloptimizedforweb.administrative_record_-_penneco_sedat_3a.pdf

> "According to the applicant, the driller's log shows that the upper confining zone, located immediately above the injection zone, is comprised of the low permeability Riddlesburg Shale. The Riddlesburg Shale layer, a dark gray to greenish and grayish black laminated shale and siltstone layer with occasional sandstone and limestone beds, is approximately 80-90 feet thick in the Sedat #3A AOR."

Basis simply infers that the Riddlesburg Shale will be effective as a confining layer, with no actual analysis cited except for "according to the applicant". Natural existing fractures are pervasive in many shale layers, and play an important role in the effectiveness of hydraulic fracturing. Basis is simply silent on the subject of fractures within the Riddlesburg Shale. Without analysis on this point, evidence that the Riddlesburg Shale will be an effective confining layer is incomplete and inadequate. (And as noted above, Index is totally without reference on this point.)

8. Basis Geologic and Seismic Review (p. 4) is incomplete and inadequate and does not take account of recent history, including Marcellus and Utica Shales incidents of unanticipated faults and induced seismicity, and actual induced seismicity events in Ohio and Oklahoma.

It is likely that there is no greater concern to the public at large from injection wells than the risk of earthquakes, and it would not be surprising if the preponderance of public comments on this case mention this as a top concern. It is clear that Basis did pay some attention to this issue, but unfortunately EPA seems not to be aware of some of the seismicity issues that are part of the historical record here in Western Pennsylvania.

While there is ample scientific agreement that injection into an active fault zone brings the risk of earthquakes — and actual such earthquakes have in fact happened — it was still surprising to many people that earthquakes associated with "ordinary fracking" occurred recently in Northwest Pennsylvania. I call to EPA's attention a document not listed in Index, "Review of Seismic Events in Lawrence County Pennsylvania", January 2017, Pennsylvania Department of Environmental Protection[14] ("Lawrence Review"). Please see also DEP's web page on this event, "Lawrence County Earthquake"[15]. DEP states: "A series of low-magnitude earthquakes that began on April 25 [2016] at 4:17 am in North Beaver, Union, and Mahoning Townships ***showed a marked temporal/spatial relationship to hydraulic fracturing activities*** at Hilcorp's North Beaver NC Development well pad." [Emphasis added.] Although the magnitude of the earthquakes in this case was quite small, it was serious enough for the operator, Hilcorp Energy, to cease hydraulic fracturing temporarily and for DEP to promulgate a plan of corrective action. This is a cautionary tale that even decades of seismic inactivity and lack of identified surface faults can still be prologue to induced seismicity from underground fluid injection.

Figure 1 is a reproduction of Figure 4 from Lawrence Review, showing a feature known as the Blairsville-Broadtop Lineament (also known as the Mahoning River Lineament). This feature has been associated with both the Lawrence County event on April 25 2016 and earthquakes in Ohio (see e.g. Lawrence Review, "Preliminary Report on Earthquakes in Youngstown Caused by an Injection Well" Ohio Department of Natural Resources, March 12, 2012[16]. The location of Sedat 3A is disturbingly close to the Blairsville-Broadtop Lineament (though not as close as the wells associated with the Lawrence County event. Basis shows no analysis of this association, and its implications for the risk of earthquakes from an injection well constructed from the existing well Sedat 3A. This clearly shows EPA's analysis of earthquake risk in Basis is incomplete and inadequate.

14 http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-116109/8100-RE-DEP4711_new.pdf
15 http://www.dep.pa.gov/About/Regional/NorthwestRegion/Community-Information/Pages/Lawrence-County-Earthquake.aspx
16 https://www.slideshare.net/MarcellusDN/preliminary-report-on-earthquakes-in-youngstown-caused-by-an-injection-well

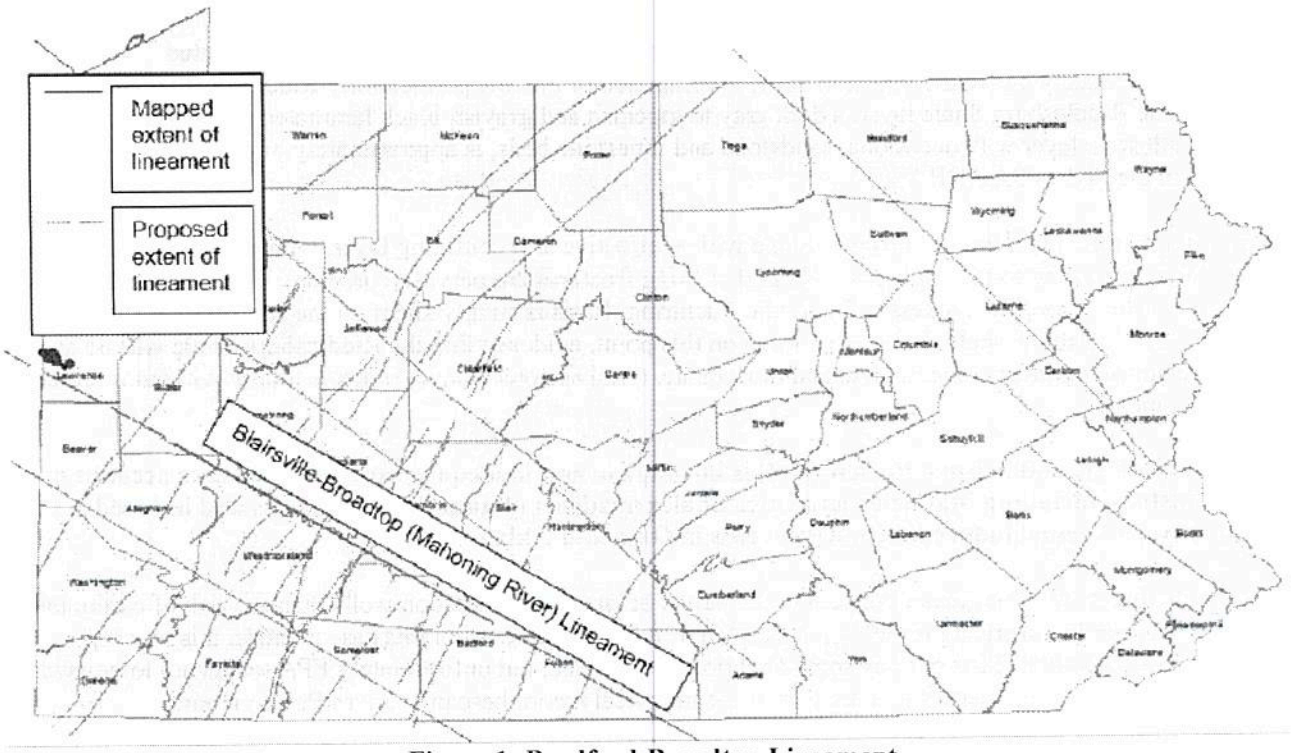


Figure 1: Bradford-Broadtop Lineament

Another example of "geological surprise" in Western Pennsylvania comes from Fayette County, where DEP records show that in the first attempt to drill the horizontal in the well Kikta 4H, API 051-24471, operator Chevron Appalachia, LLC, ***failed*** due to an unanticipated fault. The comment for DEP Inspection Report[17] ID 2065722, 04/10/2012, states:

> "HORIZONTAL MARCELLUS, PATTERSON 325 DRILLING ON FLUID ,CHEVRON DECIDED TO PLUG VERTICAL WELL BORE BACK TO 7100'.TWO ATTEMPTS TO DO HORIZONTAL PORTION HAS FAILED. ***MAJOR FAULT ISSUES***." [Emphasis added.]

Evidently, Chevron had no idea its horizontal was headed straight for a fault until they blundered into it. If a company with the size and Oil & Gas experience and resources of Chevron can be taken by surprise by an unanticipated fault in this manner, what chance does Penneco have of being reasonably certain an injection well at Sedat 3A won't interact with an unknown, unanticipated fault? What chance does EPA have of correctly evaluating this?

9. Basis Geologic and Seismic Review (p. 4) shows no evidence of any evaluation of the presence in AOR of any intervening coal mines (including undocumented mines) that might interfere with the intended operation or integrity of Well or the effectiveness of AOR Confining Zones.

Appendix 2 shows a map of the Mine Subsidence Insurance risk for the area around Sedat 3A[18]. The location of Sedat 3A is clearly notated as "Underground Mining Area – Insurance is recommended". However, Basis is completely silent on this subject. This is simply inexcusable! What would the implications be for an injection well if mine subsidence occurred? What are the implications for Confining Zones? It is nothing less than outrageous that this has not been analyzed. If there is any tangible risk whatever of mine subsidence, this should in and of itself ***completely disqualify*** this location from hosting an injection well. EPA should deny outright any application for a UIC disposal well in any Mine Subsidence Insurance risk area.

17 http://www.depreportingservices.state.pa.us/ReportServer/Pages/ReportViewer.aspx?/Oil_Gas/OG_Compliance

18 http://www.depgis.state.pa.us/msiRisk/

Moreover, DEP Oil & Gas Mapping metadata for Sedat 3A shows the indicator for coal association reading "Coal". This is DEP's own indicator that special measures need be taken in permitting this well due to proximity with a coal mine. A text search of Basis for the word "coal" shows no hits. For EPA to issue an injection well permit with no analysis whatever of coal issues is a very grave deficiency indeed. EPA must require an entire new submission considering all aspects of the risk coal mines, present and past and proposed, and must redraft Basis taking such risk into account. Suitability of this site due to the presence of coal issues is subject to grave doubt.

10. Permit Monitoring Requirements (Section II C, pp. 7-10) does not contain a requirement for monitoring of seismicity and contains no seismicity shutdown threshold.

In response to the Lawrence County earthquake associated with Hilcorp Energy's North Beaver NC Development well pad cited above, DEP recommended Hilcorp adopt a seismic monitoring program as follows[19]:

> "For seismic events of 1.0 or greater magnitude occurring within 6 miles of the wellbore path, the company should notify DEP within 10 minutes via email and within one hour by telephone.
>
> For any succession of three seismic events of 1.5 to 1.9 magnitude that occurs within a three-consecutive-day period and within a 3-mile radius of the wellbore path, Hilcorp should notify the DEP within 10 minutes via email and within one hour by telephone. Actions taken for this magnitude range of seismic events include suspension of stimulation operations, submittal of seismic data to DEP for review and a plan detailing modifications to stimulation operations.
>
> Finally, for any seismic event of 2.0 or greater magnitude that occurs within a 3-mile distance of a wellbore path, Hilcorp should notify the DEP within 10 minutes via email and within one hour by telephone. Actions taken include cessation of stimulation operations, flowing back of the well, submittal of seismic data to DEP for review and a plan detailing any potential modification to stimulation operations."

In light of the extensive history of association between injection wells and earthquakes, EPA should ***require*** (not just "recommend") seismic monitoring for any injection well used for disposal of Oil & Gas wastewater.

11. Permit Construction Requirements must require recementing to current standards of all wells with the expected area of migration of stored fluids, and pressure testing of these well casings to injection pressure.

This issue was discussed above. There is an obvious risk of contaminants being transmitted outside the casing for any well that penetrates the injection zone. At a minimum, this risk must be mitigated by new construction for the existing wells. All casings must be retested in any case of mine subsidence, and if there is no methodology for doing this, the permit must be rejected outright.

12. Permit Construction Requirements Logs and Tests (Section III A 3, p. 15) must require submission of surface casing cement logs <u>in all cases</u>, and not just when "cement returns are not achieved".

Let's be clear: Failure of cement to return to the surface is not just a "defect" in cementing; rather when cement fails to return to the surface this represents ***a total failure*** of cementing. In a case such as this, where did the cement go? It must have gone into a cavity somewhere. Presence of such an underground cavity represents a grave failure of determination of the site as suitable for an injection well, and must result in the immediate revocation of the permit.

Even in cases much less severe than total cement failure, conversion of any well to an injection well must have

---

19 DEP web page "Lawrence County Earthquake", *op cit* (footnote15).

cementing carefully monitored for any and all defects. A CBL ("Cement Bonding Log") can assist in determining if such defects exist. EPA must make submission of logs such as CBL ***mandatory*** in all cases, and must inspect such logs for any sign of defects.

13. Permit Construction Requirements Logs and Tests (Section III A 3, p. 15) must make clear that all logs and tests are public records and not subject to claims of confidentiality (Section I 11 b, p. 6).

There is simply no excuse for withholding from the public logs and tests that might reveal construction defects or other threats to the integrity of Well. Section I 11 b, p. 6, must be amended to include a section (3) stating that EPA will deny any and all claims of confidentiality for logs and tests submitted under Section III A 3, p. 15.

14. Permit Construction Requirements (Section III A, pp. 14-16) must include a requirement for some form of containment against the threat of surface spills when trucks delivering material to be injected are connected and disconnected.

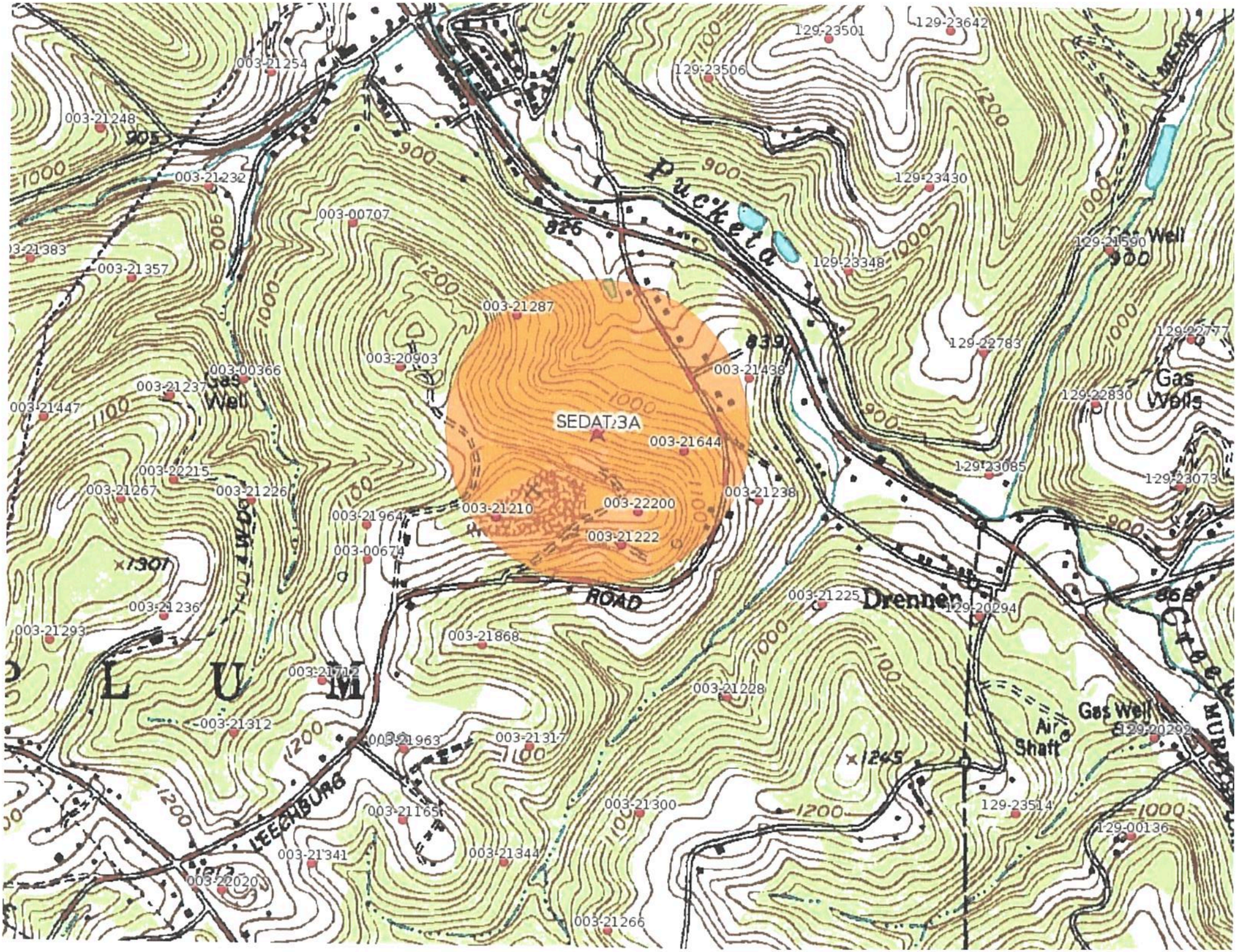
This point is so obvious that it should be embarrassing to an organization with "Environmental Protection" in its name that is it left for us citizens to point out. The material intended for disposal in Well is classified by DEP as "Residual Waste". It is worth noting that the use of the term "residual" rather than "hazardous" is not the result of any scientific finding concerning the lack of impact on health of exposure to such waste; rather, exemption from being classified as being hazardous is the result of specific statutory language in the Energy Policy Act of 2005[20] which has no scientific basis. Surface spills of such waste are a direct threat to the health and safety of any waters to which they may migrate. For EPA not to require maximum protection against such surface spills is outrageous and inexcusable. Containment of possible surface spills is a bare minimum of the level of protection that should be required. EPA must amend Permit Construction Requirements (Section III A, pp. 14-16) to include the strongest possible protections against the threat of surface spills.

James E. Rosenberg
jr@amanue.com
555 Davidson Road
Grindstone, PA 15442

20 This is known colloquially (and infamously) as "The Halliburton Loophole".

Appendix 1

USGS "geotiff" New Kensington East 1:24000 Topographic Map
Overlaid with the 0.25 Mile Proposed AOR
and Nearby Oil & Gas Wells


SEDAT 3A
003-21644
003-21287
003-20903
003-21438
003-21210
003-22200
003-21222
003-21964
003-00674
003-21238
003-21225
003-21868
003-21228
003-21317
003-21963
003-21312
003-21165
003-21300
003-21341
003-21344
003-22020
003-21266
003-21254
003-21248
003-21232
003-00707
003-21383
003-21357
003-00366
003-21237
003-21447
003-22215
003-21267
003-21226
003-21236
003-21293
003-21712
129-23501
129-23642
129-23506
129-23430
129-23348
129-21590
129-22777
129-22783
129-22830
129-23085
129-23073
129-20294
129-20292
129-23514
129-00136
Puckett
Gas Well
Gas Wells
Drennen
ROAD
LEECHBURG
Air Shaft
L U M
905
900
826
839
1000
1100
1200
1300
1245

Appendix 2

DEP Mine Subsidence Insurance Risk Map
for the Vicinity of Sedat 3A


Latitude: 40.527385 ; L
Underground Mining Area
Underground Mining Area - Insurance is recommended
Merwin Rd
Old Leechburg Rd
Drennen Rd
Webster Rd
Hempfield Hollow Rd
Fault Rd
Lincoln Blvd
Myers Dr
Wolfgang Dr
Marlin Rd
Wrenn Rd
Fieldcrest Rd
Burl Dr
Sarah St
366

The Case to Reject Sadat 3A as an Injection Well
Submitted to EPA by RON SLABE

For many years we have been told that our area is unsuited for injection wells. Our geology not adequate or safe. But now, since Ohio is supposedly phasing out its injection well program by 2018, our area is being considered and actively sought even though our geology is know to be uncertain at best.

A ProPublica report sites the fact that injection wells are notorious for their repeated leaking. ** This leakage is known to surface and seep into shallow aquifers and our drinking water. And what is leaking into our aquifers are toxic carcinogen wastes such as strontium and arsenic as well as other radioactive materials that are deposited into an injection well. So many of these wells are leaking that scientists have lost count showing that science has not kept pace with the reality of injection wells and overall oversight is not working.

Pressure, temperature, and fractures change the underground system allowing wastes to flow freely or migrate, and thus contaminate ground water. This underground migration can travel long distances, undetected and hidden from view.* And once contamination of the aquifer occurs, there is no way of reversing the process. The contamination is permanent.

Keeping count of waste migration has become a major problem but in 2010 alone, more than 7500 violations occurred and 2300 wells failed. Excessive pressure used by deep well operators has been another source of leakage and in 2008, for example, some 1100 violations occurred. Thus, the inability to assure well integrity, the migration of toxic wastes, the wrong underground geology as well as lack of regulatory enforcement all call for rejecting the permitting of any injection wells for this area.

In our present case of the proposed Penneco Sadat 3A and the other wells in the Area of Review, we question whether they have even been checked for cement integrity, if they conform to any up-to-date standard, or if they are even lined with cement to begin with. To our knowledge, the EPA hasn't checked cementing jobs on the five wells nor was this been done by the DEP.

The EPA has not evaluated cementing for any of the wells in the AOR nor has the EPA done a science review of the upper confining layer called the Riddlesburg Shale as a guard against leakage.

There are 5 wells in the AOR, area of review. But the AOR is an arbitrary, made up area, consisting of a .25 mile radius. Yet just outside are two wells and the Consolidated Coal Co 6, at the .26 mile area. In other words, important wells & other structures that need to be taken into account, are not. And are not taken into account for any risk assessment.

Mine subsidence is a really big problem and this area which is a risk area. Yet injection wells are being proposed for this area where mine subsidence insurance is recommended yet the DEP did no checking into this. There seems to be no analysis of the coal mining issue and how an injection well will affect this.

Also, just outside the AOR is Puckety Creek which runs into the Allegheny River. If a spill or leakage occurs and Puckety Creek is compromised, the Allegheny River could be threatened and the Allegheny is the water source for countless thousands in the area. An injection well is a major threat to our drinking water and especially to people using private water wells.

Finally injection wells are known for creating earthquakes. Earthquakes have occurred in Lawrence County in PA and Ohio where the geological feature known as the Blairsville-Broadtop Alignment runs and extends to the area of the Sadat 3A. And we have all been made aware of the hundreds of earthquakes across the country and Oklahoma, especially. And the source of these countless earthquakes has been traced to deep injection wells. We do not need that risk here!

Summary of final points:

1. Cementing of well casing for the Sadat 3A and other wells in the AOR are unknown leaving open the question of well integrity.

2. EPA hasn't done a science review of the upper confining layer of the Riddlesburg Shale as a guard against leakage.

3. There are other wells and a coal mine just outside the AOR that have not been taken into account and should be.

4. This proposed area is riddled with abandoned mines and mine subsidence is a problem that has not been taken into account.

5. Puckety Creek is just outside the AOR. Should a spill or migration occur, the water supply for countless thousands would be in jeopardy since the Puckety empties in the Allegheny River.

6. Finally, earthquakes are a real possibility since the area is part of the Blairsville-Broadtop Alignment where quakes have occurred in Ohio and Lawrence County, PA.

In conclusion, deep injection wells are a source of toxic water contamination and a major risk to our drinking water. Our geology is just not made for this type of waste disposal. And permitting these wells in our area raises the risk of earthquakes. Because of these factors, I urge you to reject any and all permitting of such wells for this area.

RON SLABE
516 Angelcrest Drive
Upper Burrell, PA 15068
724-337-7470
rslabe6041@msn.com

*Pace Environmental Law Review

**See also recent USGS study finding unconventional waste-water in surface water and sediments near a Fayettsville, West VA, underground injection site, 2016.

Food & Water Watch • 2329 Tilbury Avenue • Pittsburgh, PA 15217
T +412.969.5816 • foodandwaterwatch.org

July 26, 2017

ATTN: Grant Scavello
U.S. Environmental Protection Agency
Region III Ground Water & Enforcement Branch (3WP22)
1650 Arch Street.
Philadelphia, Pennsylvania 19103
Email: scavello.grant@epa.gov

Re: Penneco Environmental Solutions, LLC's Application for a UIC Class II-D Permit in Plum Borough, Allegheny County, Pennsylvania Permit No. PAS2D701BALL

Food & Water Watch (FWW), a non-profit consumer advocacy organization with an office and 38,691 members and supporters in Pennsylvania, respectfully submits these comments and urges the U.S. Environmental Protection Agency, Region III (EPA) to deny Penneco Environmental Solutions, LLC's (Penneco) the Underground Injection Control (UIC) Class II-D permit it seeks for Plum Borough, Allegheny County, Pennsylvania.

The proposed underground injection well unnecessarily exposes Plum Borough residents to seismic activity, groundwater contamination and other associated public health and environmental risks that would threaten or diminish the quality of life for Plum Borough's more than 27,000 residents.

Penneco has a poor compliance track record, littered with both environmental and administrative violations. Since 2005, Penneco Oil (an affiliate of Penneco Environmental Solutions) has been fined $123,900 by the Pennsylvania Department of Environmental Protection (PA DEP): $87,300 for environmental health and safety violations and $36,600 for administrative violations. Penneco's environmental violations range from discharging "industrial waste in the form of surfactant onto ground, cattle watering tanks and high quality watershed" to failing to "properly control or dispose of industrial or residual waste to prevent pollution of the water." (*See* the Appendix on pages 8 through 10 for a comprehensive list of all violations committed by Penneco in the state of Pennsylvania.[1])

Furthermore, drilling a UIC well for the disposal of hydraulic fracturing (fracking) wastewater would likely increase truck traffic in Plum Borough — a problem that has been well documented across the state of Pennsylvania as a result of the fracking boom —

[1] Pennsylvania Department of Environmental Protection. Oil and Gas Reports. Oil and Gas Compliance Report. Operator: Penneco Oil. Violation Type: All. January 1, 2005 to July 16, 2017. Accessed July 16, 2017, available at http://www.dep.pa.gov/DataandTools/Reports/Oil%20and%20Gas%20reports/Pages/default.aspx.

resulting in more heavy vehicle accidents (some of which spill fracking wastewater into surface water) and adding to costly wear and tear on roads.[2]

Indeed, fracking and its associated activities (like the disposal of wastewater) has caused many demonstrated public health, climate and environmental problems, and *erodes* the quality of life for the rural communities where most new gas wells are drilled.[3] Now, Penneco wants to expand its polluting footprint by injecting toxic waste underground, which can induce seismic activity and contaminate groundwater.

Injecting Toxic Wastewater Underground Induces Seismic Activity, Even in Typically Non-Seismic Areas

The hydraulic fracturing natural gas drilling technique produces toxic wastewater that requires disposal.[4] This flowback contains, in addition to the original fracking fluids, potentially extreme levels of harmful contaminants, which can include arsenic, lead, hexavalent chromium, barium, strontium, benzene, polycyclic aromatic hydrocarbons, toluene, xylene, corrosive salts and naturally occurring radioactive material, such as radium-226.[5]

A common method to dispose of this toxic waste is through UIC wells, however injecting wastewater underground for disposal has been linked to seismicity. In the eastern and central United States, for example, earthquake activity increased about fivefold, from an annual average of 21 earthquakes above a 3.0 magnitude between 1967 and 2000 to more than 300 over three years from 2010 to 2012.[6] These years correspond the peak fracking years in Pennsylvania, Ohio and West Virginia. According to U.S. Geological Survey (USGS) scientists, this increased seismic activity has been associated with oil and gas wastewater disposal wells in states such as Oklahoma, Colorado, Arkansas, Ohio and Texas.[7]

Induced seismicity occurs when human activity triggers a dormant fault by adding or reducing stress and/or increasing pore pressure.[8] When fluid is injected underground — as

---

[2] Warco, Kathie O. "Fracking truck runs off road; contents spill." *Observer-Reporter* (Washington and Green Counties, PA). October 21, 2010; Bamberger, Michelle and Robert E. Oswald. "Impact of Gas Drilling on Human and Animal Health." *New Solutions*, vol. 22, iss. 1. 2012 at 61 and 62; Efstathiou, Jim. "Taxpayers Pay as Fracking Trucks Overwhelm Rural Cow Paths." *Bloomberg Businessweek*. May 15, 2012.

[3] *See* McDermott-Levy, Ruth et al. "Fracking, the environment, and health." *American Journal of Nursing*. Vol. 113. No. 6. June 2013; Burger, Michael. "Fracking and Federalism Choice." *University of Pennsylvania Law Review*. Vol. 161. Iss. 150. 2013 at 159, 162 and 163.

[4] U.S. Environmental Protection Agency, Office of Research and Development. "Plan to study the potential impacts of hydraulic fracturing on drinking water resources." November 2011 at 15; American Petroleum Institute. "Freeing up energy. Hydraulic fracturing: Unlocking America's natural gas resources." July 19, 2010 at 1, 2, and 4.

[5] Mall, Amy and Dianne Donnelly. Natural Resources Defense Council. "Concerning the Regulation of Wastes Associated with the Exploration, Development, or Production of Crude Oil or Natural Gas or Geothermal Energy." September 2010 at 8 and 9; 76 U.S. Fed. Reg. 66296 (October 26, 2011); Urbina, Ian. "Regulation lax as gas wells' tainted water hits rivers." *The New York Times*. February 26, 2011

[6] U. S. Geological Survey (USGS). "Induced earthquakes." Accessed November 5, 2014, available at http://earthquake.usgs.gov/research/induced/

[7] *Ibid*.

[8] Herringshaw, Liam. Durham Energy Institute, Durham University. [DEI Briefing Note]. "What size of earthquakes can be caused by fracking?" April 2013 at 1; Ellsworth, William L. "Injection-induced earthquakes." *Science*. July 12, 2013 at 1225942 to 1225943.

is done to fracture shale rock and for the disposal of fracking wastewater — it can lubricate fault zones. As fluid moves into a fault zone, pore pressure increases, which can cause the fault to slip and result in an earthquake.[9]

Induced seismic events do not always strike soon after the injection activity begins; it may take a long time to trigger an earthquake, and sometimes not until after the injection activity has ended.[10] Fluid pressure from high-rate disposal wells can migrate, so even if an injection well is not very close to a fault line or to one that is susceptible to earthquakes, the fluid pressure can migrate long distances to reach a fault that is more susceptible.[11]

Colorado example demonstrates seismic risk of underground injection: According to USGS, Colorado tends to have "minor earthquake activity" and the Eastern portion of the state is considered "nearly aseismic."[12] However, injection disposal of fluid waste was linked to *the largest* earthquakes in Denver's history, a 4.8[13] magnitude quake in 1967.[14]

In March 1962, the U.S. Army began injecting fluids in a 12,045-foot well at its Rocky Mountain Arsenal, a chemical weapons manufacturing and disposal plant in the Denver area. Prior to the injection of chemical fluids, this area had low seismicity. From April 1962 to August 1967, however, more than 1,500 earthquakes rumbled through the Denver region.[15] Injection of these fluids at the Arsenal stopped February 1966, and earthquake activity began to slowly subside after November 1967 and stopped by the late 1980s.[16]

Similarly, in 2011, a 5.3 magnitude earthquake, believed to have been triggered by wastewater injection, occurred in Raton Basin,[17] where large quantities of wastewater were produced from drilling for coalbed methane.[18] According to researchers who studied the induced seismic swarm in the Raton Basin, "there was a marked increase in seismicity shortly after major fluid injection began in the Raton Basin in 1999." Only one earthquake equal to or greater than a magnitude of 4 was produced from 1972 through July 2001, but 12 struck between August 2001 and 2013. The researchers determined, "The statistical likelihood that such a rate change would occur if earthquakes behaved randomly in time is 3.0 [percent]."[19]

---

[9] *Ibid*.
[10] Ellsworth (2013) at 1225942 to 1225943.
[11] *See* Keranen, K.M. et al. "Sharp increase in central Oklahoma seismicity since 2008 induced by massive wastewater injection." *Science*. July 3, 2014; Bui, Hoai-Tran. "Wastewater disposal tied to surge in Oklahoma earthquakes." *USA Today*. July 3, 2014.
[12] USGS. "Colorado. Earthquake History." Accessed July 1, 2014, available at http://earthquake.usgs.gov/earthquakes/states/colorado/history.php
[13] Note: Sources conflict on the exact magnitude. A report by the National Research Council states it was 4.8 magnitude; the USGS states it was 5.3 magnitude.
[14] USGS. "Colorado. Earthquake History."; National Research Counci (NRC)l. Induced Seismicity Potential in Energy Technologies. (Pre-publication version.) Washington, DC: The National Academies Press, 2013 at 21 and Box 1.2
[15] *Ibid*
[16] NRC (2013) at 21 and Box. 1.2.
[17] USGS. "Induced Seismicity."
[18] Soraghan, Mike. "USGS links Colo. Quakes to gas drilling." *E & E News*. September 16, 2014.
[19] Rubinstein, Justin L. et al. "The 2001-Present Induced Earthquake Sequence in the Raton Basin of Northern New Mexico and Southern Colorado." *Bulletin of the Seismological Society of America.* Vol. 104. No. 5. October 2014 at 1.

Colorado has also experienced more recent earthquakes that are related to the disposal of fracking wastewater, [20] including a 3.4 magnitude earthquake in May 2014. The quake occurred just miles northeast of the town of Greeley, amid drilling and fracking of the Niobrara Shale formation. It was the first earthquake in the area in about three decades, and it is believed that it was induced by injection wells, two of which were 1.5 miles away from the epicenter.[21]

Oklahoma documented notorious fracking-induced earthquakes: Historically, Oklahoma is not a state known for its seismic activity. From 1975 to 2008, Oklahoma averaged only one to three earthquakes of 3.0 magnitude or greater annually.[22] In 2009, the state had 20 of these 3.0 magnitude or greater earthquakes (the magnitude that is generally needed to be felt). In 2015, that number exploded 45-fold to 902. From 2009 to 2014, as earthquake activity increased drastically, wastewater injection volumes grew by about 43 percent.[23]

In November 2011 Oklahoma experienced a 5.7 magnitude earthquake in the town of Prague – what researchers believe to be *the largest earthquake associated with wastewater injection in history*, according to a March 2014 study by USGS researchers in collaboration with scientists from various universities. The study suggested that an earlier 5.0 magnitude earthquake induced by wastewater injection had triggered the larger earthquake.[24] A USGS geoscientist explained in 2015 that minor earthquakes can lead to major ones, noting that "The more small earthquakes we have it just simply increases the odds we're going to have a more damaging event."[25] Later in September 2016, this state experienced its largest ever recorded earthquake with a magnitude of 5.8 that was induced by fracking.[26]

Eruption of quakes in nearby Youngstown: Ohio has had its fair share of induced seismic activity, some a short car ride away from Plum Borough. In 2011 in Youngstown — a town where there had been no recorded earthquakes since recordkeeping began in 1776 — a series of earthquakes struck after an UIC well for fracking fluid disposal opened nearby.[27] Injection began in December 2010, and the first two seismic events happened three months later, in March 2011. By mid-January 2012, a total of 12 seismic events had occurred, with

---

[20] Soraghan (2014); USGS. [Press Release.] "Earthquake Swarm Continues in Central Oklahoma." October 22, 2013; Colorado earthquake data from USGS, Earthquake Hazards Program, Earthquake Archives. Available at http://earthquake.usgs.gov/earthquakes/search/. Accessed March 6, 2015.

[21] Sperry, Trenton. "Epicenter of Saturday earthquake in Greeley, CO was near oil, gas wastewater injection wells." *Greeley Tribune*. June 1, 2014 ;"Greeley seismic activity may be linked to injection well." *KUSA-TV/NBC 9News*. June 24, 2014; Colorado Geological Survey. Colorado Department of Natural Resources. "Colorado's new oil boom – the Niobrara." *Rock Talk*. Vol. 13. No. 1. Spring 2011 at 1, 3 and 7; Hickey, Chuck. "CU team studying possible oil and gas connection to recent Greeley earthquake." *Fox31 Denver*. June 9, 2014.

[22] Soraghan (2014); USGS (2013).

[23] Earthquake data from Oklahoma Geological Survey. (OGS) Earthquake Catalogue. Available at http://www.okgeosurvey1.gov/pages/earthquakes/catalogs.php. Accessed, November 2016; wastewater injection data from Oklahoma Corporation Commission (OCC), Oil and Gas Division, Oil and Gas Data Files. Available at http://www.occeweb.com/og/ogdatafiles2.htm. Accessed November 2016.

[24] USGS. [Press Release.] "2011 Oklahoma Induced Earthquake May Have Triggered Larger Quake." March 6, 2014.

[25] Borenstein, Seth. "Study: Oklahoma's daily small quakes raise risk of big ones." *Associated Press*. February 14, 2015.

[26] Schabner, Dean. "Earthquake Hits Oklahoma; Damage Reported." *ABC News*. November 6, 2016; USGS. [Press Release.] "Magnitudes for Oklahoma Earthquakes Shift Upward." September 7, 2016.

[27] Resnick, Brian. "Can fracking cause earthquakes?" *National Journal*. September 5, 2013; Tomastik, Tom. Geologist, Ohio Department of Natural Resources, Division of Oil and Gas Resources Management. [Presentation]. "Preliminary report on the Northstar #1 Class II injection well and the seismic events in the Youngstown, Ohio area." at Slides 7 and 12.

the largest earthquake of 4.0 magnitude on December 31, 2011.[28] The UIC well closed for investigation, and later a study confirmed that fluid injection at the well triggered the earthquakes.[29] This year, state regulators finally shut this UIC well down.[30]

Pennsylvania and fracking induced seismicity: Although Pennsylvania's fracking-related earthquake activity has thus far been minor compared to other states, it has not been immune. In February 2017, Pennsylvania regulators confirmed the first fracking-related earthquakes in the state, which trembled across Lawrence County, northwest of Pittsburgh.[31] Although the quakes were not large enough to be felt (ranging from 1.8 to 2.3 magnitude on the Richter scale), they were induced from the fracking process itself, not from injection well disposal;[32] and fracking-induced earthquakes are smaller and less commonly felt than earthquakes produced from UIC wells.[33] Further, it is notable that there were no faults identified along the well bore where the fracking related tremors occurred.[34] The proposed injection well in Plum Borough would expose residents to unnecessary risks from seismic activity, and because UIC wells contribute to more seismicity than fracking wells, the proposed permit may eventually activate more seismicity in Western Pennsylvania.

Toxic Wastewater, Regulatory Loopholes, and Potential for Groundwater Pollution

The proposed Penneco a permit for a UIC well in Plum Borough could put local water resources at risk. As mentioned above, drilling and fracking flowback can bring various volumes of toxins, including hydrogen sulfide, arsenic and selenium to the surface, along with ancient salt waters, or brines.[35] The exact composition of fracking flowback is unknown because the composition of the fracking fluid is considered a proprietary trade secret.[36] However, fracking fluids often contain toxic compounds, including methanol, isopropyl alcohol, 2-butoxyethanol, glutaraldehyde, ethyl glycol and the solvents benzene, toluene, ethylbenzene and xylene (known as BTEX).[37]

---

[28] Tomastik, "Preliminary report on the Northstar #1 Class II injection well and the seismic events in the Youngstown, Ohio area," at Slides 5, 7, 12 and 13.
[29] Resnick, Brian. "Can fracking cause earthquakes?" *National Journal*. September 5, 2013.
[30] O'Brien, Dan. "Application Filed to Plug Well that Triggered Quakes." *The Business Journal*. April 12, 2017.
[31] Frazier, Reid. "Pennsylvania confirms first fracking-related earthquakes." *StateImpact Pennsylvania*. February 18, 2017.
[32] *Ibid*.
[33] USGS. "Man-made earthquakes update." January 17, 2014. Accessed February 23, 2015 available at http://www.usgs.gov/blogs/features/usgs_top_story/man-made-earthquakes/; Herringshaw (2013) at 1 to 3; Ellsworth (2013) at 1225942-3 to 4.
[34] Frazier (2017).
[35] Adgate, John L. et al. "Potential public health hazards, exposures and health effects from unconventional natural gas development." *Environmental Science & Technology*. Vol. 48, Iss. 15. August 5, 2014 at 8310; Vengosh, Avner et al. "A critical review of the risks to water resources from unconventional shale gas development and hydraulic fracturing in the United States." *Environmental Science & Technology*. Vol. 48, Iss. 15. August 5, 2014 at 8338 and 8340.
[36] Konschnik, Katherine E. et al. Harvard Law School. Environmental Law Program. "Legal fractures in chemical disclosure laws: Why the voluntary chemical disclosure registry FracFocus fails as a regulatory compliance tool." April 23, 2013 at 1; Brown, David et al. "Understanding exposure from natural gas drilling puts current air standards to the test." *Reviews on Environmental Health*. Preprint, published online March 2014 at 4; U.S. House of Representatives. Committee on Energy and Commerce. [Minority Staff report]. "Chemicals Used in Hydraulic Fracturing." April 2011 at 2.
[37] Committee on Energy and Commerce (2011) at 1 and 8; Adgate et al. (2014) at 8308.

Although the outflow brines differ in composition based on the nature of the targeted rock formation, they typically contain salts (including chlorides, bromides, calcium sulfides, magnesium and sodium), metals (including barium, manganese, iron, strontium and others), radioactive material (including Radium-226), and byproducts of Radium decay (including lead and radon).[38]

With the exception of the fracking chemicals and the byproducts of any fracking chemical reactions, the pollutants driven from the rock formations by fracking had long been safely sequestered and immobilized, deep underground. Now, drilling and fracking bring these pollutants to the surface at levels that risk human health and environmental damage through water, soil, air and climate pollution.

Indeed, wastewater contamination is not just an on-site problem and risks extend beyond the drilling and injection sites. Traffic accidents, spills, and leaks can all put residential property, farms and agricultural land in jeopardy. Fleets of trucks are used to ship hazardous wastewater and toxic materials. Traffic accidents have caused fracking wastewater to be released into nearby freshwater bodies and private property.[39]

Risks to local groundwater resources: Although the U.S. EPA's UIC program is tasked with regulating the oil and gas industry's injections of wastewater into Class II wells – it only regulates injections of fluids (pursuant to hydraulic fracturing operations) if the fluids contain diesel fuel.[40] Colloquially dubbed the Halliburton Loophole, this exemption under the Safe Drinking Water Act omits Class II UIC wells from groundwater quality monitoring.[41] Yet, injecting wastewater punctures more holes underground, changing the geology of the Earth, and enabling waste to travel more easily.[42]

Leaking injection wells may also go undetected – releasing contaminants underground unbeknownst nearby communities. A Texas study, for instance, found that at least 29 injection wells were "likely sending a plume of salt water into the ground unnoticed." And a *ProPublica* analysis of over 220,000 injection well inspections (between late 2007 and late 2010) found that one well integrity violation was issued for every six deep injection wells examined – with over 17,000 violations on a national level. Of these violations, 7,000 wells

---

[38] U.S. Government Accountability Office (GAO). "Information on the Quantity, Quality, and Management of Water Produced During Oil and Gas Production." January 9, 2012 at 12; Vengosh et al. (2014) at 8341 to 8342; International Atomic Energy Agency (IAEA). "Radiation Protection and the Management of Radioactive Waste in the Oil and Gas Industry." Safety Reports Series, No. 34. November 2003 at 53 to 54.

[39] Cooley, Heather and Kristina Connelly. Pacific Institute. "Hydraulic Fracturing and Water Resources: Separating the Frack from the Fiction." June 2012 at 27; Warco (2010); Bamberger and Oswald (2012) at 61 and 62.

[40] 40 CFR §146.1-2; 40 CFR §146.6; U.S. EPA, Underground Injection Control (UIC) Program. "Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels: Underground Injection Control Program Guidance #84." February 2014 at 1 and 4 to 5.

[41] GAO. "Drinking Water. EPA Program to Protect Underground Sources from Injection of Fluids Associated with Oil and Gas Production Needs." (GAO-14-555.) June 2014 at 34.

[42] Lustgarten, Abrahm. "Injection Wells: The Poison Beneath Us." *ProPublica*. June 21, 2012.

showed indications that they were leaking contaminants, and some leaks may have contaminated drinking water sources.[43]

In 2012, a former engineer that worked with the EPA's UIC program for 25 years admitted, "In 10 to 100 years we are going to find out that most of our groundwater is polluted [...] A lot of people are going to get sick, and a lot of people may die."[44]

Aquifers may also be put at risk when injected fluid propagates farther than anticipated, reaching nearby oil and gas wells, or injection wells that have compromised cementing and casing.[45] In 1989, for example, the U.S. General Accounting Office (now the Government Accountablitiy Office) determined that about half of the 27 known or suspected contamination events due to Class II well injections arose because the injected fluids reached underground sources of drinking water via nearby abandoned wells that had integrity problems.[46]

The proposed UIC well could conceivably inject unknown toxins that could migrate to compromised abandoned wells and ultimately enter the groundwater table. There are 2,347 conventional active, inactive, abandoned, plugged and orphaned wells in Allegheny County.[47] Nearly 400 of these wells (387) are in Plum Borough — about 13 wells per every square mile.[48] The density of existing wells would make it easier for any wastewater injections to migrate into wells that could provide a conduit to potentially contaminate groundwater systems.

Conclusion

It would be shortsighted to allow Penneco to drill a UIC well and dispose of wastewater underground, compounding the hazards *the fracking boom has already contributed to in Pennsylvania, including: earthquakes, health issues, traffic snarls, the destruction of the environment and farmland, while releasing climate altering methane emissions into the*

---

[43] *Ibid.*

[44] *Ibid.*

[45] Vaidyanathan, Gayathri. "When 2 wells meet, spills can often follow." *E&E EnergyWire*. August 5, 2013; Vaidyanathan, Gayathri. "Small fortune is lost when oil giant's well collides with family business." *E&E EnergyWire*. October 24, 2013; Vaidyanathan, Gayathri. "As 'frack hits' grew in Alberta, regulators stepped in." *E&E EnergyWire*. January 7, 2014.

[46] GAO. "Safeguards Are Not Preventing Contamination From Injected Oil and Gas Wastes." (GAO/RCED-89-97.) July 1989 at 30 and 31.

[47] Pennsylvania Department of Environmental Protection. Oil and Gas Reports. Oil and Gas Operator Well Inventory. Alleghany County. Well Status: Abandoned, Active, DEP Abandoned, DEP Orphan List, DEP Plugged, Plugged OG Well, Regulatory Inactive Status. Accessed July 17, 2017, available at http://www.dep.pa.gov/DataandTools/Reports/Oil%20and%20Gas%20reports/Pages/default.aspx; Pennsylvania Department of Environmental Protection. Oil and Gas Reports. Oil and Gas Operator Well Inventory. Alleghany County. Well Status: Active. Accessed July 17, 2017, available at http://www.dep.pa.gov/DataandTools/Reports/Oil%20and%20Gas%20reports/Pages/default.aspx.

[48] Plum Borough is 29 square miles. *Calculation based on:* Pennsylvania Department of Environmental Protection. Oil and Gas Reports. Oil and Gas Operator Well Inventory. Alleghany County. Plum Borough. Well Status: Abandoned, Active, DEP Abandoned, DEP Orphan List, DEP Plugged, Plugged OG Well, Regulatory Inactive Status. Accessed July 17, 2017, available at http://www.dep.pa.gov/DataandTools/Reports/Oil%20and%20Gas%20reports/Pages/default.aspx; Borough of Plum Pennsylvania. "About the Borough of Plum." Accessed July 17, 2017, available at http://www.plumboro.com/about-the-borough-of-plum.

atmosphere.[49]

As thoroughly detailed above, the disposal of wastewater into injection wells has long been linked to human-caused earthquakes. As fracking proliferates the amount of produced wastewater grows, increasing the activity of injection wells. But high-pressure injection well sites can trigger earthquakes and threatens groundwater resources, putting people's health, safety and water quality at risk.

FWW urges the EPA Region III to reject Penneco's request for a Class II-D permit in Plum Borough, Allegheny County, Pennsylvania.

Thank you for your consideration,

Douglas A. Shields
W. Pennsylvania Outreach Liaison
dshields@fwwatch.org

P.O. Box 8159
Pittsburgh, PA 15217

Appendix:

Table of Violations Committed by Penneco Oil in Pennsylvania, from 2005 to July 16, 2017

[49] Frazier, Reid. "Pennsylvania confirms first fracking-related earthquakes." *The Allegheny Front*. February 18, 2017; Troutman, Melissa A. et al. "Hidden Data Suggests Fracking Created Widespread, Systemic Impact in Pennsylvania." *Public Herald*. January 23, 2017; Schafft, Kai A. et al. "The Relationship between Marcellus Shale Gas Development in Pennsylvania and Local Perceptions of Risk and Opportunity." *Rural Sociology*. Vol. 78, Iss. 2. June 2013 at 18; Przybycian, Jason. "Mansfield police were busy in 2011, especially with DUI." *The Wellsboro/Mansfield Gazette*. January 23, 2012; Clarke, Cheryl R. "More people, More Crime. Tioga County copes with more vehicles, people and more stress on its police." *Sun Gazette* (Williamsport, PA). March 4, 2012; Gleiter, Sue. "Protesters share anti-fracking message at 2016 PA Farm Show." *PennLive*. January 9, 2016; Ingraffea, Anthony R. et al. "Assessment and risk analysis of casing and cement impairment in oil and gas wells in Pennsylvania, 2000-2012." *Proceedings of the National Academy of Sciences*. Vol. 111, No. 30. July 29, 2014 at 10955, 10958 and 10959.

ENVIRONMENTAL HEALTH & SAFETY VIOLATIONS (Total Environmental Health & Safety Fines: $87,300)
(1) **Penneco - Andres 2 OG Well → Environmental Health & Safety Violation - 3/25/2005**: Discharge of industrial waste in the form of surfactant onto ground, cattle watering tanks and high quality watershed (Browns Creek). After being called to the spill to take a sample, the inspector observed two stock tanks foamy and the water down stream was also foamy. Issued a Notice of Violation.
(2) **Penneco - Corna Unit 1 OG Well → Environmental Health & Safety Violation - 9/30/2005:** Failure to restore a water supply affected by pollution or diminution. Issued an Administrative Order.
(3) **Penneco - Christian Life Church 1 OG Well → Environmental Health & Safety - 3/13/2007:** Failure to restore a water supply affected by pollution or diminution. Issued an Administrative Order.
(4) **Penneco - Andrew 5 OG Well → Environmental Health & Safety - 3/15/2007:** Liner leak - migration of surfactants from sump to spring to HQ Brown's Creek tributary. Stream discharge of IW includes drill cuttings, oil, brine and/or silt. Issued a Notice of Violation.
(5) **Penneco - Scott Durbin 1 OG Well → Environmental Health & Safety Violation - 6/1/2007:** Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under OGA Sec 206(c)(d). Issued a Notice of Violation.
(6) **Penneco - Hildreth 1 OG Well → Environmental Health & Safety Violation - 5/21/2008:** Failure to minimize accelerated erosion implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under OGA Sec 206(c)(d). Issued a Notice of Violation.
(7) **Penneco - Hildreth 1 OG Well → Environmental Health & Safety Violation - 5/21/2008:** Encroachment without Permit or Waiver. Issued a Notice of Violation and a Consent Assessment of Civil Penalty worth $6,700 .
(8) **Penneco - Hildreth 1 OG Well → Environmental Health & Safety Violation - 5/21/2008:** Failure to minimize erosion, implement E&S plan and maintain E&S controls. Failure to stabilize site until total site restoration under OGA Sec 206(c)(d). Issued a Consent Assessment of Civil Penalty worth $6,700.
(9) **Penneco - Don Myers 1 OG Well → Environmental Health & Safety Violation - 7/31/2008:** Failure to minimize accelerated erosion implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under OGA Sec 206(c)(d). Issued a Notice of Violation and a Consent Assessment of Civil Penalty worth $5,400.
(10) **Penneco - Don Myers 1 OG Well → Environmental Health & Safety Violation - 7/31/2008:** Discharge of pollutional material to waters of Commonwealth. Issued a Notice of Violation and a Consent Assessment of Civil Penalty worth $5,400.
(11) **Penneco - Gospel Church 1 Well → Environmental Health & Safety Violation - 9/16/2008:** Discharge of pollutional material to waters of Commonwealth. Issued a Notice of Violation and a Consent Assessment of Civil Penalty worth $5,400.
(12) **Penneco - Swaintek 4 OG Well → Environmental Health & Safety Violation - 12/18/2008:** Failure to comply with terms and conditions of permit. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $6,200.
(13) **Penneco - Roman 1 OG Well → Environmental Health & Safety Violation - 10/23/2009:** Failure to restore site within 9 months of completion of drilling or plugging. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $3,000.
(14) **Penneco - Alan Hill 1 OG Well → Environmental Health & Safety Violation - 11/3/2009:** Failure to restore site within 30 days of permit expiration when well not drilled. Issued a Notice of Violation.
(15) **Penneco - Klemencic 2 OG Well → Environmental Health & Safety Violation - 12/15/2009:** Discharge of pollutional material to waters of Commonwealth after it was discovered that surface water had infiltrated the pit and filled it until it began to overflow after heavy rainfall the previous night. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $3,500.
(16) **Penneco - Haberman 1 OG Well → Environmental Health & Safety Violation - 5/14/2010:** Industrial waste was discharged without permit after a drill pit liner fell into the pit water causing the water (which is classified as industrial waste discharge) to overtop the collapsed pit liner. The silt fence on-site was not installed correctly with additional evidence that runoff is undercutting the silt fence on the lower side of the site. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $5,400.
(17) **Penneco - Haberman 1 OG Well → Environmental Health & Safety Violation - 5/14/2010:** Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under OGA Sec 206(c)(d). Silt fence was not installed correctly and there was evidence of run-off going under the silt fence. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $5,400.
(18) **Penneco - Clawson 1 OG Well → Environmental Health & Safety Violation - 4/29/2011:** Failure to minimize accelerated erosion, implement E&S plan, maintain E&S controls. Failure to stabilize site until total site restoration under OGA Sec 206(c)(d).
(19) **Penneco - Whitten 10H-A OG Well → Environmental Health & Safety Violation - 8/21/2012:** Failure to properly control or dispose of industrial or residual waste to prevent pollution of the waters of the Commonwealth. Issued a Notice of Violation.
(20) **Penneco - Whitten 10H-A OG Well → Environmental Health & Safety Violation - 9/6/2012:** Failure to properly control or dispose of industrial or residual waste to prevent pollution of the waters of the Commonwealth. White fluid was found running down the backside of the well pad and when it was traced back to its source it contain Bentonite and cement returns. The tank appeared to have a hole in the bottom, resulting in the discharge of the substance. The tank also had less than 2 feet of freeboard. Issued a Notice of Violation.
(21) **Penneco - Watson Unit 4H OG Well → Environmental Health & Safety Violation - 7/12/2013:** Failure to properly control or dispose of industrial or residual waste to prevent pollution of the waters of the Commonwealth. An oily substance was released off the site through the pasture and into Claylick Run. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $14,000.
(22) **Penneco - Braddock 12H OG Well → Environmental Health & Safety Violation - 7/14/2014:** Failure to take all necessary measures to prevent spill. Inadequate diking, potential pollution. Material pushed out of the old well impacted a stream running past the old well and this material eventually impacted Long Run. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $2,700.
(23) **Penneco - Braddock 12H OG Well → Environmental Health & Safety Violation - 7/14/2014:** Discharge of pollutional material to waters of Commonwealth. Issued both a Notice of Violation and a Consent Assessment of Civil Penalty of $2,700.
(24) **Penneco - Watson Unit 2H OG Well → Environmental Health & Safety Violation - 3/16/2015:** Operator failed to control and dispose of fluids, residual waste and drill cuttings including tophole water, brines, drilling fluids, drilling muds, stimulation fluids, well servicing fluids, oil and production fluids in a manner that prevents pollution of the waters of the Commonwealth. Issued a Notice of Violation.

(25) **Penneco - Watson Unit 2H OG Well → Environmental Health & Safety Violation - 3/16/2015:** Failure to take necessary measures to prevent pollutants from reaching waters of the Commonwealth. The well discharged approximately 10-15 barrels of crude to the ground around the wellhead. Issued a Notice of Violation.
(26) **Penneco - Plum Boro 2 OG Well → Environmental Health & Safety Violation - 5/11/2015:** Failure to properly store, transport, process or dispose of residual waste. Issued a Notice of Violation.
(27) **Penneco - Plum Boro 2 OG Well → Environmental Health & Safety Violation - 5/11/2015:** Operator failed to collect the brine and other fluids produced during operation, service and plugging of the well in a tank, pit or series of pits or tanks or other device approved by the Department or Operator discharged brine or other fluids on or into the ground or into waters of the Commonwealth. Issued a Notice of Violation.
(28) **Penneco - Hankey Unit 6H OG Well → Environmental Health & Safety Violation - 3/10/2016:** Failure to properly store, transport, process or dispose of a residual waste. Issued a Notice of Violation.
(29) **Penneco - Hankey Unit 6H OG Well → Environmental Health & Safety Violation - 3/10/2016:** Operator failed to collect the brine and other fluids produced during operation, service and plugging of the well in a tank, pit or series of pits or tanks or other device approved by the Department or Operator discharged brine or other fluids on or into the ground or into the waters of the Commonwealth. Issued a Notice of Violation.
(30) **Penneco - Braddock 9H OG Well → Environmental Health & Safety Violation - 5/24/2016:** Operator failed to control and dispose of fluids, residual waste and drill cuttings including tophole water, brines, drilling fluids, drilling muds, stimulation fluids, well servicing fluids, oil and production fluids in a manner that prevents pollution of the waters of the Commonwealth. Issued a Notice of Violation.
(31) **Penneco - Braddock 9H OG Well → Environmental Health & Safety Violation - 5/24/2016:** Failure to properly store, transport, process or dispose of a residual waste. Issued a Notice of Violation.
(32) **Penneco - Charles Whipkey 4H OG Well → Environmental Health & Safety Violation - 10/28/2016:** Operator failed to collect the brine and other fluids produced during operation, service and plugging of the well in a tank, pit or a series of pits or tanks or other device approved by the Department or Operator discharged brine or other fluids on or into the ground into waters of the Commonwealth. Issued a Notice of Violation.
ADMINISTRATIVE VIOLATIONS (Total Administrative Fines: $36,600)
(1) **Penneco - Robison Unit 1 OG Well → Administrative Violation - 2/2/2006:** Impoundment not structurally sound, impermeable, 3rd party protected, greater than 20 of seasonal high groundwater table. Issued a Field Notice of Violation.
(2) **Penneco - Robert Anderson 1 OG Well → Administrative Violation - 3/10/2006:** Failure to maintain a 2' freeboard in an impoundment. Issued a Notice of Violation.
(3) **Penneco - Robert Anderson 1 OG Well → Administrative Violation - 3/10/2006:** Tophole water discharge does not meet standards. Issued a Notice of Violation.
(4) **Penneco - Konkus 1 OG Well → Administrative Violation - 1/17/2007:** Failure to maintain 2' freeboard in an impoundment. Issued a Notice of Violation.
(5) **Penneco - Alworth 1 OG Well → Administrative Violation - 3/16/2007:** Improperly lined pit. Issued a Notice of Violation.
(6) **Penneco - Hill 1 OG Well → Administrative Violation - 8/29/2008:** Inadequate containment of oil tank. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $6,200.
(7) **Penneco - Roman 1 OG Well → Administrative Violation - 10/23/2009:** Failure to submit well record within 30 days of completion of drilling. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $3,000.
(8) **Penneco - Roman 1 OG Well → Administrative Violation - 10/23/2009:** Failure to plug a well upon abandonment. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $3,000.
(9) **Penneco - Klemencic 2 OG Well → Administrative Violation - 12/15/2009:** Improperly lined pit. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $3,500.
(10) **Penneco - Haberman 1 OG Well → Administrative Violation - 5/14/2010:** Failure to maintain 2' freeboard in an impoundment, causing the liner to fall down into the pit with water overtopping it. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $5,400.
(11) **Penneco - Clements 4 OG Well → Administrative Violation - 6/24/2010:** Impoundment not structurally sound impermeable, 3rd party protected, greater than 20" of seasonal high groundwater table. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $5,000.
(12) **Penneco - Behm 49-1 OG Well → Administrative Violation - 2/28/2011:** Failure to maintain 2' freeboard in an impoundment.
(13) **Penneco - Behm 49-1 OG Well → Administrative Violation - 2/28/2011:** Failure to implement and maintain BMPs (best management practices) in accordance with Chapter 102.
(14) **Penneco - Brush Creek Cemetery 3 OG Well → Administrative Violation - 3/4/2011:** Failure to implement and maintain best management practices in accordance with Chapter 102. Issued a Notice of Violation.
(15) **Penneco - Whipkey 1 OG Well → Administrative Violation - 3/4/2011:** Failure to maintain 2' of freeboard in an impoundment.
(16) **Penneco - Shanta 91-1 OG Well → Administrative Violation - 11/9/2011:** Failure to notify DEP, landowner, political subdivision or coal owner 24 hours prior to commencement of drilling. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $4,250.
(17) **Penneco - Shanta 91-1 OG Well → Administrative Violation - 11/9/2011:** Excessive casing seat pressure. Issued a Notice of Violation and a Consent Assessment of Civil Penalty of $4,250.
(18) **Penneco - Whitten 10H-A OG Well → Administrative Violation - 8/21/2012:** Failure to maintain 2' of freeboard in an impoundment. Issued a Notice of Violation.
(19) **Penneco - Whitten 10H-A OG Well → Administrative Violation - 9/6/2012:** Failure to maintain 2' freeboard in an impoundment. Issued a Notice of Violation.
(20) **Penneco - Sluss 9H OG Well → Administrative Violation - 11/30/2012:** Failure to maintain 2' freeboard in an impoundment. Issued a Notice of Violation.
(21) **Penneco - Sluss 9H OG Well → Administrative Violation - 11/30/2012:** Improper pit disposal of drill cuttings from above the casing seat. Issued a

Notice of Violation.
(22) **Penneco - Sluss 8H OG Well → Administrative Violation - 7/31/2013:** Failure to submit completion report within 30 days of completion of well.
(23) **Penneco - Flugunt 1 Well → Administrative Violation - 3/31/2014:** Failure to post pit approval number. It was reported that a 20 barrel brine and oil spill occurred on Sunday originating from the tank valve which was previously found open. The inspector observed two areas of oil contaminated soil leading toward a steep hillside. Issued a Notice of Violation.
Total Environmental and Administrative Fines for Violations: $123,900

Source: Pennsylvania Department of Environmental Protection.

Endnotes

I ask you to oppose the application before you permitting the Sedat 3A conventional well to become an injection well. My concern is over the suitability of this existing well to preserve pressurized injected radioactive material into safe, drinking water. The idea of "repurposing" a vertical well to an injection well requires BEST practices. To the public who depend on water in close proximity, I see no use of these practices. The resulting stuff leaching into safe, clean water from the existing well casing should concern everyone. Casing and cement impairment, due to the date of the original well's construction sometime in the 1980's demonstrates no protection against ground water contamination, something for which there is ample evidence of when examining the literature of unconventional injection wells.

I'm also a respiratory therapist who performs lung function testing for all types of suspected of lung disease. I have heard from neighbors in Southwest PA who wish horizontal drilling had never occurred on the land where they and their neighbors once tasted clean water and breathed fresh air. Those two essential rights, breathing clean air and having safe water are constitutionally guaranteed under Article 1, Section 27 of the Pennsylvania constitution.

So, these neighbors and I are concerned about injection well contamination below our ground drinking water. As matter of record, this water should be separated as part of the drilling process by proper use of casing and cement. Cemented surface casing is essential in well construction to preserve this drinking water. Yet, we have poor, if any evidence that the once conventional well being permitted here, has any evidence of having proper casing and cement. The age of this well correlates with NO safeguarding for this by its design. Therefore, *flowback and produced water* will infiltrate into what should be preserved safe water. This so-called, *overland flow* infiltrates to nearby surface water and contaminates the population. The population seek medical care. The future for the land and people on it are in danger.

Please reject this application.
Lois Drumheller, Monroeville

Assessment and risk analysis of casing and cement impairment in oil and gas wells in Pennsylvania, 2000–2012

Anthony R. Ingraffea[a,b,1], Martin T. Wells[c], Renee L. Santoro[b], and Seth B. C. Shonkoff[d,e]

[a]School of Civil and Environmental Engineering and [c]Department of Statistical Sciences, Cornell University, Ithaca, NY 14853; [b]Physicians, Scientists, and Engineers for Healthy Energy, Ithaca, NY 14850; [d]Physicians, Scientists, and Engineers for Healthy Energy, Oakland, CA 94612; and [e]Department of Environmental Science, Policy, and Management, University of California, Berkeley, CA 94720-3114

Edited by William H. Schlesinger, Cary Institute of Ecosystem Studies, Millbrook, NY, and approved May 30, 2014 (received for review December 17, 2013)

Casing and cement impairment in oil and gas wells can lead to methane migration into the atmosphere and/or into underground sources of drinking water. An analysis of 75,505 compliance reports for 41,381 conventional and unconventional oil and gas wells in Pennsylvania drilled from January 1, 2000–December 31, 2012, was performed with the objective of determining complete and accurate statistics of casing and cement impairment. Statewide data show a sixfold higher incidence of cement and/or casing issues for shale gas wells relative to conventional wells. The Cox proportional hazards model was used to estimate risk of impairment based on existing data. The model identified both temporal and geographic differences in risk. For post-2009 drilled wells, risk of a cement/casing impairment is 1.57-fold [95% confidence interval (CI) (1.45, 1.67); $P < 0.0001$] higher in an unconventional gas well relative to a conventional well drilled within the same time period. Temporal differences between well types were also observed and may reflect more thorough inspections and greater emphasis on finding well leaks, more detailed note taking in the available inspection reports, or real changes in rates of structural integrity loss due to rushed development or other unknown factors. Unconventional gas wells in northeastern (NE) Pennsylvania are at a 2.7-fold higher risk relative to the conventional wells in the same area. The predicted cumulative risk for all wells (unconventional and conventional) in the NE region is 8.5-fold [95% CI (7.16, 10.18); $P < 0.0001$] greater than that of wells drilled in the rest of the state.

shale oil and gas | casing integrity | cement integrity | onshore wells | wellbore integrity

Oil and natural gas production has increased substantially in the United States in recent years, predominantly due to innovations such as high-volume hydraulic fracturing and directional drilling in shale formations (1). Concurrent with this increase, concerns have mounted regarding effects of this oil and gas development process on groundwater quality, human health, public safety, and the climate, due, in part, to subsurface migration of methane and other associated hydrocarbon gases and volatile organic compounds. Economic development of gas and oil from shale formations requires a high well density, at least one well per 80 surface acres, over large continuous areas of a play. Osborn et al. (2) and Jackson et al. (3) identified a positive relationship between the concentration of thermogenic methane in private water wells in Pennsylvania and the proximity of those water wells to the nearest unconventional (i.e., Marcellus shale) gas production well. These studies also identified three possible mechanisms for explaining this relationship, and concluded that the most likely of these is subsurface migration from leaking gas wells. Other researchers have observed thermogenic and other subsurface-sourced methane in atmospheric concentrations high above background levels near conventional and unconventional gas development (4–6), suggesting that leaking wells may also contribute to fugitive methane and other associated gas emissions, with clear climatic and air quality consequences (7).

Leaking oil and gas wells have long been recognized as a potential mechanism of subsurface migration of thermogenic and biogenic methane, as well as heavier n-alkanes, to the surface (7–11). A leaking well, in this context, is one in which zonal isolation along the wellbore is compromised due to a structural integrity failure of one or more of the cement and/or casing barriers. Such loss of integrity can lead to direct emissions to the atmosphere through one or more leaking annuli and/or subsurface migration of fluids (gas and/or liquid) to groundwater, surface waters, or the atmosphere. Cement barriers may fail at any time over the life of a well for a number of reasons, including hydrostatic imbalances caused by inappropriate cement density, inadequately cleaned bore holes, premature gelation of the cement, excessive fluid loss in the cement, high permeability in the cement slurry, cement shrinkage, radial cracking due to pressure fluctuations in the casings, poor interfacial bonding, and normal deterioration with age (12). Casing may fail due to failed casing joints, casing collapse, and corrosion (13). Loss of zonal isolation creates pressure differentials between the formations intersected by the wellbore and the open barrier(s). The pressure gradient thus created allows for the flow of gases or other formation fluids between geological zones (i.e., interzonal migration) and possibly to the surface (14–16), where it might manifest as sustained casing pressure (SCP) or sustained casing vent flow.

Annuli are often vented, as noted in inspection records, and may contribute to fugitive emissions from the well site. Low-pressure

Significance

Previous research has demonstrated that proximity to unconventional gas development is associated with elevated concentrations of methane in groundwater aquifers in Pennsylvania. To date, the mechanism of this migration is poorly understood. Our study, which looks at more than 41,000 conventional and unconventional oil and gas wells, helps to explain one possible mechanism of methane migration: compromised structural integrity of casing and cement in oil and gas wells. Additionally, methane, being the primary constituent of natural gas, is a strong greenhouse gas. The identification of mechanisms through which methane may migrate to the atmosphere as fugitive emissions is important to understand the climate dimensions of oil and gas development.

Author contributions: A.R.I. designed research; R.L.S. performed research; M.T.W. and R.L.S. analyzed data; and A.R.I., M.T.W., R.L.S., and S.B.C.S. wrote the paper.

The authors declare no conflict of interest.

This article is a PNAS Direct Submission.

Freely available online through the PNAS open access option.

[1]To whom correspondence should be addressed. E-mail: ari1@cornell.edu.

This article contains supporting information online at www.pnas.org/lookup/suppl/doi:10.1073/pnas.1323422111/-/DCSupplemental.

leaks may continue to be periodically bled off and monitored, although recent studies warn that bleeding pressure to zero may actually lead to gas migration (17). High-risk (e.g., rapid repressuring of the annulus following bleed down) leaks must be structurally remedied (i.e., cement squeeze, gel squeeze, use of packers, topping off cement). State regulations (Pennsylvania code 25 §78.86) mandate that wells with leaks that cannot be vented or adequately repaired be permanently plugged, which may reduce but not eliminate the interzonal flow of gases and liquids. Leaks that continue undetected or inadequately remedied may lead to the contamination of shallow aquifers, accumulation of explosive gases within and around residences and other structures, and emission of methane and other associated gases to the atmosphere.

Although not every instance of loss of zonal isolation will lead to such events, the incidence rate of cement/casing impairments and failures can provide some insight into the scale of current and future problems. However, the structural integrity failure rate of oil and gas well barriers continues to be a subject of debate. The rates most commonly cited (from 2 to >50%) are based upon industry reporting for offshore wells in the Gulf of Mexico (13, 14) and Canadian onshore (mostly conventional) wells (16). Watson and Bachu (16) note that wells drilled during periods of rapid development activity and/or wellbores deviated from vertical (e.g., horizontal wellbores) may be more prone to casing vent flow and/or gas migration away from the wellhead.

Due to the lack of publicly available structural integrity monitoring records for onshore wells from industry, more recent studies have used data from state well inspection records to estimate the proportion of unconventional wells drilled that develop cement and/or casing structural integrity issues. For instance, Considine et al. (18) analyzed Pennsylvania Department of Environmental Protection (PADEP) notice of violation (NOV) records for 2008–2011 and found that between 1% and 2% of wells had one or more potential structural integrity issues during that time period. Vidic et al. (19), using the 2008–2013 data from the PADEP database, found that 3.4% of all monitored unconventional wells drilled to date in Pennsylvania might have structural integrity failures based on NOVs related to cement/casing integrity. However, neither study adequately accounts for non-NOV indicators of cement/casing integrity impairment or temporal or spatial dimensions of such impairments.

Earlier work found that the NOV count alone does not account for all incidences of cement/casing failure (20). State regulatory agencies and the oil and gas industry monitor many of the wells showing signs of SCP or other indicators of cement and/or casing impairment. Remedial action is often attempted once or many times on a monitored well, but a NOV is not issued by the agency. Additionally, violation codes are sometimes entered incorrectly as non-cement/casing issues and later corrected in violation comments. By not accounting for these, previous assessments based on PADEP inspection records (18, 19) may underestimate the actual proportion of wells with cement and/or casing problems in Pennsylvania.

Failure to account for temporal dimensions of the data may also skew results. Previous studies on cement/casing impairment have noted that wells drilled during boom periods may be more susceptible to loss of zonal isolation because operators might cut corners in an attempt to increase the number of wells drilled over a short period (16). The increased risk of zonal isolation problems as wells age and the increased probability of identifying these issues with more inspections may also create a time lag between the date that drilling of the well commences (i.e., the spud date) and the entry of a cement/casing issue in the inspection records. This time lag is due to the fact that wells drilled in recent years have not been subject to the same duration of analysis or number of inspections as older wells. Thus, inspection records on newer wells are incomplete relative to those of older wells.

Here, we offer an in-depth analysis of the complete inspection records, including NOVs, observations and corrections noted in the inspector comments, for 32,678 oil and gas production wells drilled in Pennsylvania between 2000 and 2012. We use a time-dependent risk analysis model to assess the cumulative risk of cement/casing problems for wells based on the historical occurrence of cementing/casing impairment events.

Results and Discussion

Comparison of state inspection and well spud reports (where the "spud" date is the start date of drilling) indicates a loss of well integrity in 1.9% of the oil and gas production wells spudded between 2000 and 2012. This value agrees well with some previous estimates in the literature; however, this superficial indication comes with important caveats and is an incomplete assessment. The data suggest large differences in structural integrity issues between well types, with unconventional wells showing a sixfold higher incidence of cement and/or casing issues relative to conventional wells statewide (Table 1 and *SI Appendix*, Table S14). Even within the unconventional well category, a wide range (1.49–9.84%) of incident rates is observed among wells spudded during different time periods and in different regions. Unconventional wells spudded before 2009 in the northeastern (NE) counties of the state are associated with the highest occurrence of loss of structural integrity (9.84%). It can be argued that this subcategory reflects a small number of observed cases (61 wells) and the earliest industry experience in the Marcellus play, and thus should not be used as an indication of current practices. However, unconventional wells spudded in the NE region since 2009 (2,714 wells) show a similarly high rate of occurrence (9.18%).

As already noted, direct comparison of rates of loss of well integrity in young wells to those of much older wells is misleading. Assuming an increased risk of cement/casing issues as the materials (cement/casing) age, it must follow that the risk of structural integrity loss and likelihood of state inspectors identifying a cement/casing problem will increase through time as a well accumulates additional inspections. Thus, a well spudded 3 y ago, which will ideally have a 3-y record of inspections from which to draw observations, is more likely to have an indicator

Table 1. Percentage of wells showing loss of structural integrity by temporal (pre- and post-2009 spuds), geographic (non-NE and NE counties), and well type (conventional and unconventional) categories

	Non-NE counties		NE counties	
Wells spudded	Conventional	Unconventional	Conventional	Unconventional
Pre-2009	0.73%	1.49%	5.21%	9.84%
Post-2009	2.08%	1.88%	2.27%	9.14%

Statewide, rate of loss of structural integrity for conventional and unconventional wells spudded between 2000–2012 are 1.0% and 6.2%, respectively (weighted average = 1.9%).

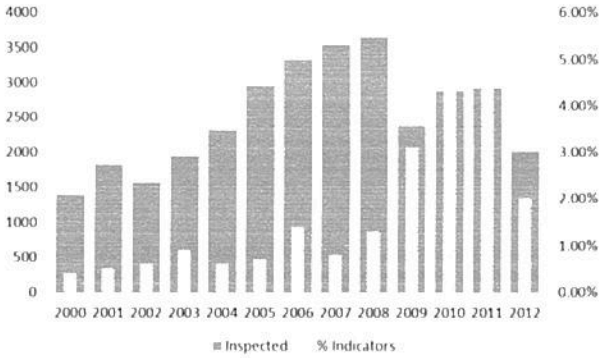


Fig. 1. Annual trends of indicators for wells spudded in the state of Pennsylvania, 2000–2012. The percentage of spuds with integrity issues reflects the number of unique wells spudded in a given year for which an indicator was found at any time within the inspection record (13 y). The rates of incidence noted in the inspection records for pre-2009 spuds hover around 1% for the several years before spiking in 2010. These trends may represent differences in state emphasis on locating leaking wells following widely publicized contamination events or actual increases in loss of structural integrity.

of cement/casing integrity loss noted in the inspection record than a similar well spudded only 1 y ago and associated with just one-third of the observation time. The effects of this temporal dependency can be seen in Fig. 1. Annual trends for wells spudded in 2010 and 2011 show rates of incidence similar to the cumulative unconventional rate reported in Table 1 (unconventional wells make up 57.5% and 66.3% of spuds in 2010 and 2011, respectively). However, wells spudded in 2012 and subject to an observation period ≤1 y appear to have a much lower incidence of cement/casing issues. This raises an important question: Are wells spudded in 2012 more sound than those spudded in previous years, or is the apparent decline in indicators in state inspection reports an artifact of an incomplete inspection history?

Note that incomplete inspection records may also occur in older wells that have not been regularly inspected through time. Inspection records for modeled wells indicate an average of 2.75 inspections per well statewide, despite nearly 71.6% of wells being >3 y old. Moreover, PADEP records indicate that of the more than 41,000 oil and gas production wells spudded between 2000 and 2013, 24% of conventional and 4% of unconventional well spuds have never received facility-level inspections or the relevant inspections are not included in the PADEP online database (8,703 wells in total). It should be noted that these wells might have received inspections under the client- or site-level category, which generally are carried out as part of large-scale contamination/gas migration investigations, but these types of inspections are not included in our analysis because the details of such inspections often do not include a full listing of wells of interest. Assuming that the individual wells observed in these larger scale investigations did, in fact, receive facility-level inspections and are included in our analysis, we would expect a negligible impact from excluding client- and site-level investigations because the individual well inspections would have likely been flagged by at least one of the indicators before a large-scale contamination event. The impact of wells investigated in the client- and site-level inspections but not receiving a facility-level inspection (i.e., not included in this analysis) may be significant but cannot be assessed with the data available. Not all wells inspected in large-scale contamination investigations are found to be leaking and, although the count of impairment events from such wells could increase, the rate of impairment (the number of events per wells inspected) might not.

Hazard analysis captures such temporal dependencies through the nonparametric baseline hazard rates and hazard ratios of the inspection count variable, thus allowing us to predict what the incidence rate for wells might be if they were to acquire comparable observation times and inspection counts. Results from hazard modeling of temporal and geographic strata are given next.

Hazard Model: Temporal Strata. Wells spudded before 2009 make up almost 72% of the total wells modeled but just 31% of the total count of unique wells with documented cement/casing indicator events from the 2000–2012 modeled dataset. Unconventional wells make up 16.8% of the wells in this stratum. The first unconventional well in the modeled dataset has a 2002 spud date; however, unconventional drilling activity remained relatively low until 2009 (Fig. 2). Pre-2009 unconventional wells show a modest but statistically insignificant increase in hazard [1.07-fold greater risk relative to pre-2009 conventional wells, 95% confidence interval (CI) (0.18, 1.52); Table 2]. However, in the post-2009 stratum, risk of a cement/casing event is 1.58-fold [95% CI (1.45, 1.67); $P < 0.0001$] higher in an unconventional well relative to a conventional well spudded within the same time period (Table 2).

Fig. 3 shows estimated cumulative hazards for conventional and unconventional wells across the state for pre- and post-2009 strata, respectively. These figures are plotted in the units of the Nelson–Aalen estimator of the cumulative hazard function (i.e., the definite integral, from zero up to the indexed time, of the hazard function). These plots are used for visually examining differences in distributions in time-to-event data and are interpreted here as the fractional probability that a well will be identified as having a cement and/or casing problem at time t, assuming that the event has not occurred before time t. Wells spudded after January 1, 2009, show significantly higher ($P < 0.0001$) predicted hazards across comparable analysis times, regardless of well type, relative to pre-2009 well spuds [4.58 hazard ratio, 95% CI (3.84–5.47)].

It is unclear whether these temporal differences reflect more thorough inspections and greater emphasis on finding well leaks, more detailed note taking in the available inspection reports, or real changes in rates of structural integrity loss. The percentage of wells inspected in the first year has risen, from an average of 76% in pre-2009 spuds to 88.7% in the post-2009 spuds (*SI Appendix*, Table S3), and this may partially account for the increase in documented cement/casing problems. Additionally, more than one-half (53.2%) of the nonevent wells (i.e., no indicator of loss of structural integrity found) lack inspector

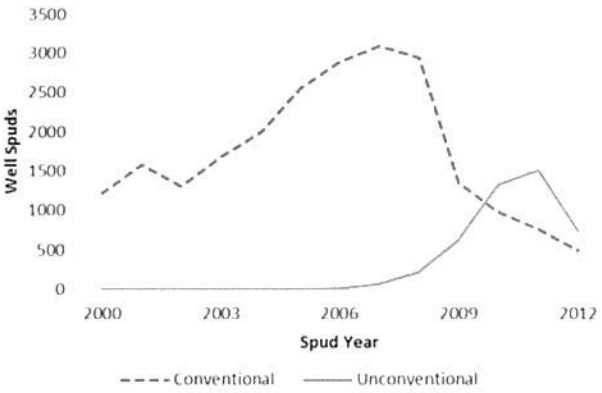


Fig. 2. Conventional and unconventional spud counts: 2000–2012 (Source: PADEP, 2013).

EPA HEARING IN PLUM BOROUGH, Allegheny County

What: EPA Public Hearing
Date: Wednesday, July 26
Time: 6:30 p.m.
Location: Plum Community Center (499 Center New Texas Road, Pittsburgh, PA 15239)

The EPA is proposing to allow a company to dispose large quantities of fracking wastewater at a site in Plum Borough. This hearing was publically announced just last week. If you are concerned, please attend and testify to let the EPA know how you feel.

EPA is proposing to issue a permit to Penneco Environmental Solutions to allow them to retrofit a closed gas well in Plum Borough in Allegheny County for disposal of oil and gas wastewater. The permit would allow Penneco to inject over 27 million gallons per year of oil and gas wastewater into the old gas well, and the permit would run for a 10-year period.

If approved by federal regulators, this permit will move on the state DEP for its stamp of approval. It is believed that the Plum Zoning Commission must also approve the permit.

Talking Points

-Experts says that underground injection wells risk causing earthquakes because of the large volumes of water being pumped into them. Earlier this year, **Pennsylvania DEP confirmed** the first gas drilling-related earthquakes in the Commonwealth.
StateImpact – "Pennsylvania confirms first fracking-related earthquakes"

-Scientific evidence links injection wells with seismic activity. Oklahoma, a state with intense oil and gas activity and more than 3,000 wells, experienced some 7,000 earthquakes in 2015. Nearly two-dozen published scientific reports have concluded that disposal wells and earthquakes are most likely connected.

-The injection well would be located at an old well site ¼ mile south of the intersection of Old Leechburg Road and Route 366. If the permit is approved, Penneco would be allowed to pump up to 54,000 barrels of oil and gas brine monthly about 1,900 feet under the surface.

-27,000 residents of Plum will be at risk. It will bring a dirty industry to the doorstep of Plum residents who will be subject to increased traffic and the risk of earthquakes and well water contamination.

-This "shallow" injection could impact nearby water sources. The gas industry produces large amounts of brine that can contain toxic metals and radioactive substances, according to the EPA. Deep underground wells often isolate this brine from drinking water, but THIS IS A SHALLOW WELL. See EPA Oil and Gas Related Injection Wells.
-The site will be upgraded with new roads. A storage tank and unloading facilities will be added. This will greatly increase truck traffic going back and forth every day.

-If this injection well is approved, it must be strictly monitored. To address concerns around potential earthquakes, DEP officials have attached conditions to the 11 injection well permits approved so far in the state. These conditions require the operator to install seismic-detection equipment, and ensure that

data gathered is reported in a timely manner. These conditions were attached to injection wells, in Elk and Indiana Counties, approved by DEP in March.

-Environmentalists warn that the risks of seismic activity will only increase as Pennsylvania's natural gas industry grows.

-Penneco says this injection well will be shallow and will not cause earthquakes. EPA engineers should study this further before this determination can be safely made.

-DEP regs also force the operators to shut down wells that cause earthquakes of magnitude 2.0 or greater. Magnitude 2.0 and smaller seismic events are considered microearthquakes and are generally too subtle for humans to feel.

EPA United States Environmental Protection Agency

Class II Oil and Gas Related Injection Wells

On this page:

Use of Class II wells

Class II wells are used only to inject fluids associated with oil and natural gas production. Class II fluids are primarily brines (salt water) that are brought to the surface while producing oil and gas. It is estimated that over 2 billion gallons of brine are injected in the United States every day. Most oil and gas injection wells are in Texas, California, Oklahoma, and Kansas.

The number of Class II wells varies from year to year based on fluctuations in oil and gas demand and production. Approximately 180,000 Class II wells are in operation in the United States.

Class II wells fall into one of three categories.

- Disposal wells
- Enhanced recovery wells
- Hydrocarbon storage wells

Class II well types

Disposal wells

During oil and gas extraction, brines are also brought to the surface. Brines are separated from hydrocarbons at the surface and reinjected into the same or similar underground formations for disposal. Wastewater from hydraulic fracturing activities can also be injected into Class II wells.

Class II disposal wells make up about 20 percent of the total number of Class II wells.

Enhanced recovery wells

Fluids consisting of brine, freshwater, steam, polymers, or carbon dioxide are injected into oil-bearing formations to recover residual oil and in limited applications, natural gas.

The injected fluids thin (decrease the viscosity) or displace small amounts of extractable oil and gas. Oil and gas is then available for recovery. In a typical configuration, a single injection well is surrounded by multiple production wells that bring oil and gas to the surface.

The UIC program does not regulate wells that are solely used for production. However, EPA does have authority to regulate hydraulic fracturing when diesel fuels are used in fluids or propping agents. During hydraulic fracturing, another enhanced recovery process, a viscous fluid is injected under high pressure until the desired fracturing is achieved, followed by a proppant such as sand. The pressure is then released and the proppant holds the fractures open to allow fluid to return to the well.

Enhanced recovery wells are the most numerous type of Class II wells. They represent as much as 80 percent of the total number of Class II wells.

Hydrocarbon storage wells

Liquid hydrocarbons are injected into underground formations (such as salt caverns) where they are stored, generally, as part of the U.S. Strategic Petroleum Reserve.

Over 100 liquid hydrocarbon storage wells operate in the United States.

Protecting drinking water resources

Extration of oil and gas usually produces large amounts of brine. Often saltier than seawater, this brine can contain toxic metals and radioactive substances. Brines can damage the environment and public health if discharged to water or land. Deep underground injection of brines in formations isolated from underground sources of drinking water prevents soil and water contamination.

When states began to implement rules preventing disposal of brine to surface water bodies and soils, injection became the preferred way to dispose of this waste fluid. All oil and gas producing states require the injection of brine into the originating formation or similar formations.

Class II well requirements

States (including federally recognized tribes and U.S. territories) have the option of requesting primacy for Class II wells under either Section 1422 or 1425 of the SDWA.

Under Section 1422 states must meet EPA's minimum requirements for UIC programs. Programs authorized under section 1422 must include well owner and operator requirements for:

- Construction
- Operation
- Monitoring and testing
- Reporting

- Closure requirements

Under Section 1422 enhanced recovery wells may either be issued permits or be authorized by rule. Disposal wells are issued permits. The owners or operators of the wells must meet all applicable requirements, including strict construction and conversion standards and regular testing and inspection.

Under Section 1425 states must demonstrate that their existing standards are effective in preventing endangerment of USDWs. These programs must include requirements for:

- Permitting
- Inspections
- Monitoring
- Record-keeping
- Reporting

Diesel fuels hydraulic fracturing

Oil and gas producers use hydraulic fracturing to stimulate wells and recover oil and natural gas from geologic formations. Source rocks include:

- Coalbeds
- Shales
- Tight sandstones

Source rocks are fractured by fluids injected under high pressure. The fractures allow oil and gas to flow to production wells.

In the Energy Policy Act of 2005, Congress created a broad exemption for hydraulic fracturing under the SDWA. Specifically, hydraulic fracturing – except when using diesel fuel – is excluded from the definition of underground injection and is not subject to regulation under the UIC program (SDWA Section 1421(d)(1)(B)).

In 2014 EPA released information clarifying UIC program requirements for underground injection of diesel fuels in hydraulic fracturing. The Agency also released guidance for EPA permit writers implementing UIC Class II requirements.

The EPA has developed the information and guidance to:

- Explain that owners or operators must obtain a UIC Class II permit before injecting diesel fuels for hydraulic fracturing
- Explain EPA's interpretation of the SDWA term "diesel fuels" for permitting purposes
- Describe existing UIC Class II program requirements for permitting underground injection of diesel fuels in hydraulic fracturing
- Provide guidance for EPA's permit writers preparing UIC Class II permits for diesel fuels use in hydraulic fracturing

Read EPA's revised guidance for diesel fuels hydraulic fracturing and related documents.

Additional information

Visit the regulations page to read more about the requirements for owners and operators of Class II wells.

Learn More

Guidance for diesel fuels hydraulic fracturing

Primary enforcement authority

Compliance requirements for injection well owners or operators and UIC state programs

Cross-sectional diagram showing UIC Class II wells

Requirements for all Class I Wells and Class I Hazardous Waste Wells

SITING – Fluids must be injected into a formation that is below the lowermost formation containing, within ¼ mile of the well, a USDW. To demonstrate this, owners and operators are required to provide the following information:

Requirements for All Class I Wells	Additional Requirements for Hazardous Waste Wells
Geologic Studies of the injection and confining zones to determine that: • The receiving formations are sufficiently permeable, porous, homogeneous, and thick enough to receive the fluids at the proposed injection rate without requiring excessive pressure • Formations are large enough to prevent pressure buildup and injected fluid would not reach aquifer recharge areas • There is a low-permeability confining zone to prevent vertical migration of injection fluids • Injected fluids are compatible with well materials and with rock and fluid in injection zone • The area is geologically stable • The injection zone has no economic value	Additional **structural** studies to demonstrate: • Injection and confining formations are free of vertically transmissive fissures or faults • Low seismicity and probability of earthquakes • Proposed injection will not induce earthquakes or increase the frequency of naturally occurring earthquakes
Area Of Review (AoR) analysis of the surrounding area to identify artificial penetrations, such as other wells, that might allow fluid to move out of the injection zone • Minimum area of review is ¼ mile • Can be a fixed radius around the well or mathematically calculated • Includes a corrective action plan to address improperly completed or plugged wells within the AoR	Additional **review** required: • Minimum AoR of 2 miles • No-migration petition demonstrating that fluids will remain in the injection zone for as long as they are hazardous (modeling conducted to show either the waste will remain in the injection zone for 10,000 years or it will be rendered non-hazardous before migration)

CONSTRUCTION – Wells must have a multilayered design to prevent fluids from entering USDWs.

Requirements for All Class I Wells	Additional Requirements for Hazardous Waste Wells

• Approved engineering schematics and subsurface construction details
• At least 2 layers of concentric casing and cement
• Outer (or surface) casing cemented to the surface
• Tubing and packer design based on
  ○ well depth
  ○ characteristics of the injected fluid
  ○ injection and annular pressure
  ○ injection rate
  ○ temperature and volume of injected fluid
  ○ size of well casing
  ○ cementing requirements
• Tests during drilling to ensure no vertical migration of fluid
	• Detailed requirements for tubing and packer
	• Long-string (inner) casing fully cemented to surface
	• UIC Program approval of casing, cement, tubing, and packer prior to construction

OPERATION – Provides multiple safeguards to ensure the injected wastewater is fully confined.

Requirements for All Class I Wells	Additional Requirements for Hazardous Waste Wells
• Maintain injection at pressures that will not initiate new fractures or propagate existing fractures • Approved fluids and permitted pressures must be maintained in the annular space • Continuous monitoring and recording devices	• Automatic alarms and shutdown devices • Notify permitting authority within 24 hours if problem occurs • Cease injection and resume only with UIC Program Director's permission

MONITORING AND TESTING – Ensures that there are no leaks in the casing, tubing, or packer and the injected fluid is contained within the injection zone.

Requirements for All Class I Wells	Additional Requirements for Hazardous Waste Wells

• Continuously monitor:
  ○ Annulus pressure (to detect leaks in the casing, tubing, or packer; and any fluid movement into a USDW)
  ○ Containment in the injection zone
  ○ Characteristics of injected waste
  ○ Monitor for fluid movement into USDWs within the AoR
• Internal and external mechanical integrity test (MIT) every 5 years
	• Explicit procedures for reporting and correcting problems due to lack of mechanical integrity
	• Develop and follow a waste analysis plan
	• Analyze wastewaters as specified in the plan
	• Internal MIT every year
	• Test cement at base of well annually

REPORTING AND RECORD KEEPING – Informs the UIC Program about the operation of the well and all testing results.

Requirements for All Class I Wells	Additional Requirements for Hazardous Waste Wells
• Quarterly on injection and injected fluids and monitoring of USDW in the area of review • Every 5 years on internal and external MITs • Changes to the facility, progress on compliance schedule, loss of mechanical integrity (MI), or noncompliance with permit conditions	• Results from the waste analysis program and geochemical compatibility • Internal MIT yearly • Maximum injection pressure quarterly • Volume of fluid injected

CLOSURE –Ensures that the well is safely and properly abandoned when injection is completed.

Requirements for All Class I Wells	Additional Requirements for Hazardous Waste Wells
• Submit plugging and abandonment report	• Conduct pressure fall off and mechanical integrity tests • Continue ground water monitoring until injection zone pressure cannot influence USDW • Flush well with non-reactive fluid • Inform authorities about the well, its location, and zone of influence

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Locate Site | Legend

Legend

Underground Mining Area

Coal Exists - Possibly Mined

County

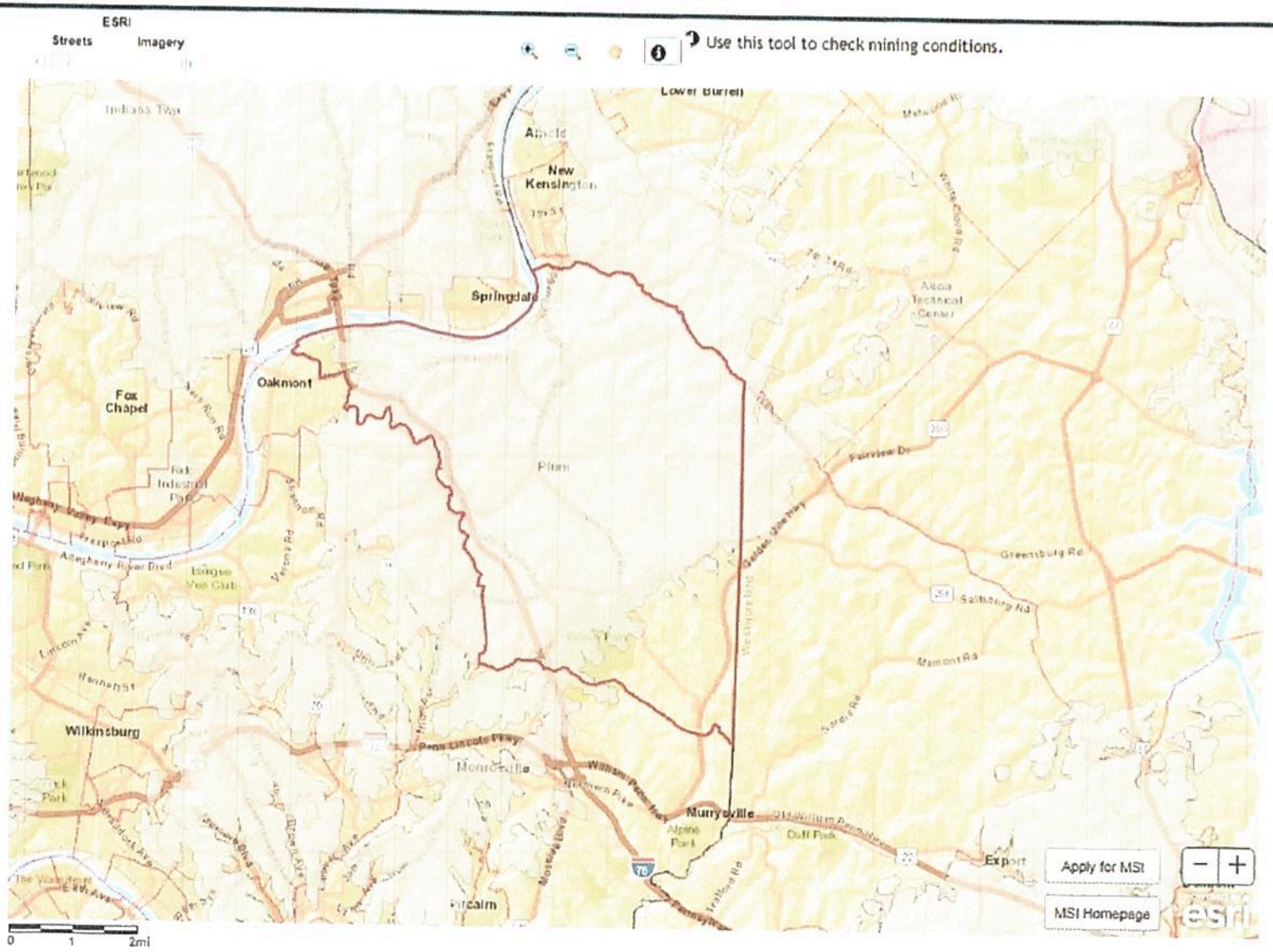
Municipality

If your site is located within a gray, "Underground Mining Area", your site is over or near a known mined area and you are at risk for mine subsidence or a mine water breakout. Mine Subsidence Insurance is recommended.

If your site is located within the pink, "Coal Exists - Possibly Mined" area, your site is over or near an area where mineable coal is known to exist, however DEP does not have a record as to whether it was mined. Mine Subsidence Insurance is available if desired.

The mining information on this website may be based on maps and plans obtained from various sources. The Department assumes no responsibility for the accuracy or completeness of this information.

Call 1 800 922 1678 for more information.

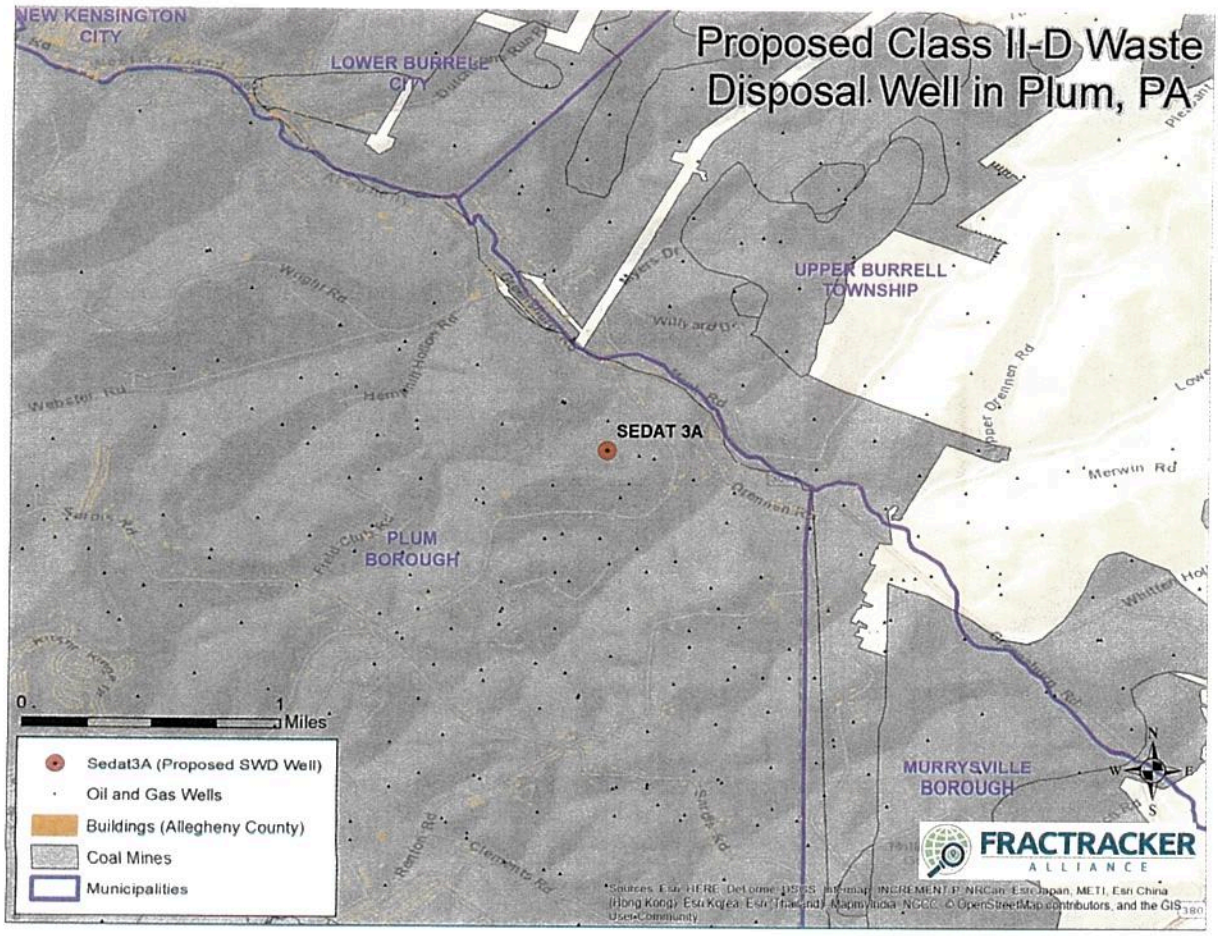


National Underground Injection Control Inventory-Federal Fiscal Year 2016

State and Tribal Summary

EPA Region	State	Class 1 Hazardous Wells	Other Class I	Class II Disposal Wells	Class II Recovery Wells	Class II Other	Class III Sites	Class III Wells	Class IV Sites	Class IV Wells	Class V Wells	Class VI Wells
1	CT	-	-	-	-	-	-	-	-	-	781	-
1	MA	-	-	-	-	-	-	-	-	-	4040	-
1	ME	-	-	-	-	-	-	-	-	-	1984	-
1	NH	-	-	-	-	-	-	-	-	-	11445	-
1	RI	-	-	-	-	-	-	-	-	-	1671	-
1	VT	-	-	-	-	-	-	-	-	-	1833	-
2	NJ	-	-	-	-	-	-	-	-	-	1432	-
2	NY	-	-	6	322	2	6	173	-	-	7938	-
2	PR	-	-	-	-	-	-	-	-	-	3341	-
2	VI	-	-	-	-	-	-	-	-	-	42	-
3	DC	-	-	-	-	-	-	-	-	-	147	-
3	DE	-	-	-	-	-	-	-	-	-	1775	-
3	MD	-	-	-	-	-	-	-	-	-	13475	-
3	PA	-	-	15	1764	-	-	-	-	-	15261	-
3	VA	-	-	13	3	-	17	17	-	-	11882	-
3	WV	-	-	67	606	-	2	20	-	-	4156	-
4	AL	-	-	94	164	-	1	4	-	-	953	-
4	FL	1	247	20	48	-	-	-	-	-	14259	-
4	GA	-	-	-	-	-	-	-	-	-	14966	-
4	KY	-	2	109	2885	-	-	-	-	-	14304	-
4	MS	4	6	578	740	163	-	-	-	-	7502	-
4	NC	-	-	-	-	-	-	-	2	-	10024	-
4	SC	-	-	-	-	-	-	-	-	-	12680	-
4	TN	-	-	2	24	-	-	-	-	-	6947	-
5	IL	3	8	1100	6964	-	-	-	-	-	28928	6
5	IN	4	16	215	999	-	-	-	-	-	11043	-
5	MI	7	25	812	701	-	5	53	-	-	6279	-
5	MN	-	-	-	-	-	-	-	1	1	3528	-
5	OH	10	-	2233	128	-	4	49	-	-	17356	-
5	WI	-	-	-	-	-	-	-	-	-	1799	-
6	AR	4	8	836	256	-	-	-	-	-	223	-
6	LA	20	17	3195	557	-	19	95	-	-	787	-
6	NM	-	5	951	3420	-	9	10	-	-	1804	-
6	OK	-	6	4400	6827	54	-	-	2	-	2641	-
6	TX	82	96	13418	40421	-	119	6085	6	-	44358	-
7	IA	-	-	7	-	-	-	-	-	-	3317	-
7	KS	5	64	5039	11724	-	4	157	-	-	7411	1
7	MO	-	-	10	442	-	-	-	-	-	6809	-
7	NE	-	9	154	498	-	3	4770	-	-	1345	-
8	CO	-	18	373	569	-	5	22	-	-	2573	-
8	FP	-	-	26	4	-	-	-	-	-	3	-
8	MT	-	-	261	977	-	-	-	-	-	6610	-
8	ND	-	7	591	762	-	-	-	-	-	857	-
8	SD	-	2	41	41	-	14	14	-	-	472	-
8	UT	-	-	87	709	-	4	56	2	19	3362	-
8	WY	-	84	479	4519	-	10	12997	-	-	2498	-
9	AS	-	-	-	-	-	-	-	-	-	-	-
9	AZ	-	-	-	-	-	2	11	-	-	35382	-
9	CA	-	46	1794	54102	-	1	136	-	-	20881	-
9	FM	-	-	-	-	-	-	-	-	-	-	-
9	GU	-	-	-	-	-	-	-	-	-	487	-
9	HI	-	-	-	-	-	-	-	-	-	6667	-
9	MP	-	-	-	-	-	-	-	-	-	18	-
9	Navajo	-	-	18	344	-	-	-	-	-	96	-
9	NV	-	-	12	5	-	-	-	-	-	1617	-
10	AK	-	22	49	1449	-	-	-	-	-	1868	-

EPA Region	State	Class 1 Hazardous Wells	Other Class I	Class II Disposal Wells	Class II Recovery Wells	Class II Other	Class III Sites	Class III Wells	Class IV Sites	Class IV Wells	Class V Wells	Class VI Wells
10	ID	-	-	-	-	-	-	-	-	-	17803	-
10	OR	-	-	-	-	-	-	-	-	-	42021	-
10	WA	-	-	1	-	-	-	-	-	-	51836	-
OTHER	TRIBES	-	4	1163	2733	-	-	-	-	-	2673	-
Grand Total		140	692	38169	145707	219	225	24669	13	20	498190	7


Proposed Class II-D Waste Disposal Well in Plum, PA
NEW KENSINGTON CITY
LOWER BURRELL CITY
UPPER BURRELL TOWNSHIP
PLUM BOROUGH
MURRYSVILLE BOROUGH
SEDAT 3A
Wright Rd
Webster Rd
Henry Hill Hollow Rd
Willyard Dr
Hyers Dr
Upper Drennen Rd
Merwin Rd
Drennen Rd
Fields Rd
Field Club Rd
Whitten Rd
Ridge Rd
Renton Rd
Clements Rd
0
1
Miles
Sedat3A (Proposed SWD Well)
Oil and Gas Wells
Buildings (Allegheny County)
Coal Mines
Municipalities
N
W
E
S
FRACTRACKER ALLIANCE
Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Oliver J. Drumheller, Ed.D., R.R.T.
200 Scott Drive
Monroeville, PA 15146
412.374.0870

Copy

Plum Injection Well EPA Hearing
26 July 2017

I strongly oppose this injection well for many reasons related to health problems, environmental degradation and quality of life issues.

Injection of wastewater and contents (high salt, radioactive materials) adversely affects drinking water sources downstream. Water is essential for life and must be protected

Safety testing and monitoring needs to be done by the EPA or other government agencies to ensure there is no bias due to corporate influence. Self testing and reporting must not be in place of public interests.

Injection wells near schools negatively affects children's health, their growth and welfare. As children are our future their welfare must be our priority.

Wastewater injection causes increased seismic activity. According to the United States Geologic Survey (Dept. of Interior) the area with the most active seismic activity is Texas and Oklahoma, not the U.S. West Coast! This is due to waste injection wells and has to be stopped.

Damage to infrastructure for delivery of this waste damages local roads and bridges; repairs are then left to government entities for resolution. This is an example of privatizing profit and then socializing the cost of risky behavior.

The proposed Plum injection well is also near Boyce Park (Allegheny County) that is used by citizens for recreation and enjoyment. Damage to the park would reduce quality of life for all citizens.

Please consider these points and do not approve this application. Thank you. OJD

7/26/17